Invariant Temporal Ordering Framework V26/F6: A Foundational Theory of Cosmic Onset, Common Cosmic Stages, Universal Physical Change, and Identity-Bounded Physical Histories

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Abstract

The Invariant Temporal Ordering Framework V26/F6 reconstructs temporal ontology from physical systems, their common cosmic stages, and their identity-bounded physical histories. The universe denotes the totality of all physical systems without exception and is not an additional bearer above that totality. Ontological membership is independent of present observability or experimental qualification, and every physical system has a nonempty identity domain.

Time denotes the fixed, irreversible, and uninterrupted succession and ordering of the common cosmic stages of change across all physical systems then existing at each stage; these stages together constitute one common cosmic extension. Formally, $T_{\mathrm{ITOF}} = (\mathcal{S}_C, \prec_C)$. The relation $\prec_C$ orders the stages in their fixed and irreversible succession. Here "uninterrupted" excludes cessation of physical realization, empty cosmic stages, or a gap between the continued realization of change and cosmic-stage succession; it does not by itself classify the order as discrete, dense, continuous, countable, or metric. Neither time, a stage, nor the ordering relation causes or transports physical change.

The reconstructed Cosmic Moment Axiom states both universal presence and bearer-specific physical realization:

$$\mathrm{CMA}: \quad \forall s \in \mathcal{S}_C \left[\mathcal{S}_{\mathrm{phys}}(s) \neq \varnothing \wedge \forall A \in \mathcal{S}_{\mathrm{phys}}(s) \big(\mathrm{Present_C}(A; s) \wedge \mathrm{PhysReal}^{+}_{A}(s) \big) \right].$$

Thus, at every common cosmic stage, all physical systems whose identities are then realized are present at that same stage, and each undergoes its own physically realized change there. The content, magnitude, mechanism, distribution, and observability of change remain bearer-specific.

Cosmic onset and bearer onset are independently classified. Every bearer identity originating after the initial common cosmic stage has a domain-warranted physical origin in the realized change of one or more directly contributing physical systems present at its onset stage. Each system begins its identity, physical history, and change immediately at its onset stage. Universal Change Continuity is derived universally from Physical-System Realization, CMA, and the

Identity Onset Postulate; the Identity-Domain Continuity Postulate independently excludes every internal gap in a bearer history. Each physical history is $\mathcal{H}_A = (I_A, \prec_C |_{I_A}, X_A)$. Identity may persist through extensive change; where ordinary identity ending occurs within the continuing universe, an identity-ending transformation produces one or more successor systems.

Observation compares physical records under declared models and protocols. Non-detection neither proves absence of change nor identifies an unspecified hidden mechanism. Noticeable effects may be cumulative, as in archaeological stone degradation and genetic differences detected only after progressive molecular or lineage change. Clocks are changing physical systems whose standardized outputs assist comparison, scheduling, coordination, and the organization of human life; they do not measure time itself. Restricted tests can support, pressure, or reject declared operational hypotheses without exhausting the universal scope of CMA or UCC. ITOF rejects relativistic temporal ontology while allowing model-bounded calculational use of successful formulas without transferring temporal identity to coordinates, metrics, proper-time functionals, spacetime geometry, or clock outputs.

Canonical definition of time

Time denotes the fixed, irreversible, and uninterrupted succession and ordering of the common cosmic stages of change across all physical systems then existing at each stage; these stages together constitute one common cosmic extension.

$$T_{\mathrm{ITOF}} = (\mathcal{S}_C, \prec_C).$$

Here $\mathcal{S}_C$ is the domain of the common cosmic stages, and $\prec_C$ orders their fixed, irreversible, and uninterrupted succession. The stages taken together constitute the one common cosmic extension. The extension is not an independently existing container, and neither time, a stage, nor the ordering relation causes physical change. No physical system possesses stages specific to itself; the content and nature of change remain bearer-specific.

Cosmic Moment Axiom

$$\boxed{\mathrm{CMA}: \quad \forall s \in \mathcal{S}_C \left[\mathcal{S}_{\mathrm{phys}}(s) \neq \varnothing \wedge \forall A \in \mathcal{S}_{\mathrm{phys}}(s)\big(\mathrm{Present_C}(A; s) \wedge \mathrm{PhysReal}^{+}_{A}(s)\big)\right]}.$$

At every common cosmic stage, all physical systems whose identities are then realized are present at that same stage, and each undergoes its own bearer-specific physically realized change there. The axiom neither equates the contents of different systems' changes nor assigns causal agency to time or to the stage. The full typed definitions and consequences are given in Axiom 5.1.

Contents

1. Foundational Position and Dependency Order

1.1 The point of departure

V26/F6 begins with physical systems rather than with a coordinate, metric, clock reading, or independently acting temporal entity. The universe denotes the totality of all physical systems without exception. Continuing bearer-specific physical change is realized across common cosmic stages; the fixed, irreversible, and uninterrupted succession and ordering of those stages together constitute one common cosmic extension, and time denotes that succession and ordering.

The following explanatory order is ontological rather than a strict derivation from notation alone:

$$
\begin{aligned}
&\text{physical systems, their factors, and their actual engagements}\\
&\quad\Longrightarrow \text{bearer-specific physical realization}\\
&\quad\Longrightarrow \begin{array}{l}\text{the fixed, irreversible, and uninterrupted succession}\\ \qquad\text{and ordering of common cosmic stages}\end{array}\\
&\quad\Longrightarrow \text{one common cosmic extension constituted by those stages}\\
&\quad\Longrightarrow \text{the meaning denoted by time.}
\end{aligned}
$$

At each later common cosmic stage, positive physical realization occurs across all then-existing systems: onset realization for identities newly originating there and continuation realization for identities already persisting there. The stage expresses this universal physical realization without acting as a cause, carrier, or material object: systems and their relations do not manufacture stage-objects, and stages do not generate change or one another.

1.2 Definition, postulate, axiom, and result

A definition fixes the meaning of a term or symbol. A postulate states an independent foundational commitment. An axiom gives a governing universal statement. A result follows from declared definitions, postulates, and axioms. These statuses are kept distinct:

- the time definition and the state/history definitions are definitions;
- physical-system realization is an independent ontological postulate;
- COP is an independent cosmological postulate;
- the Later Physical-Origin Postulate is an independent universal physical-origin postulate governing every non-initial bearer onset;
- IOC is an independent universal identity-onset postulate conditional on a nonempty identity domain;
- IDC is an independent universal identity-domain-continuity postulate;
- CMA is the universal axiom of common-stage presence and bearer-specific physical realization;

- the bearer-level existence–change statement is a consequence of CMA, while UCC is derived from Physical-System Realization, CMA, and IOC under their declared scope conditions;
- operational claims are model- and protocol-bounded evidential propositions.

1.3 Formal construction and type discipline

The principal ontological predicates are PhysicalSystem(A), ExistsAs(A, s), Present$_C(A; s)$, and the identity domain I_A. The predicate StudyQualified$_{P,M}(A)$ belongs to an epistemic or protocol-relative level and never limits the universal quantifiers of CMA.

The common cosmic-stage domain is $\mathcal{S}_C$, as represented in Equation (3). A stage variable s is an element of that domain; it is not a physical record, coordinate value, clock reading, state vector, or geometrical hypersurface. The order relation $\prec_C$ is assumed to be strict, transitive, total on distinct stages, fixed, and irreversible. V26/F6 does not additionally assume density, discreteness, continuity, gaplessness, or countability.

Stages are primitive ordered members of $\mathcal{S}_C$. Their numerical identity and ordered position distinguish them; no equality of bearer state, record, or clock output defines stage identity. A later stage remains later even when one or more bearer states recur under a declared criterion.

1.4 Definitions do not create physical facts

A definition of onset, ending, record, state, or stage does not physically cause the corresponding occurrence. The physical fact is realized by systems and their actual relations. Formal definitions classify those facts and preserve their dependency structure.

1.5 No circular dependence

The reconstruction does not claim that $\mathcal{S}_C$ can be formally derived from a formula that already quantifies over $s \in \mathcal{S}_C$. Instead, it distinguishes explanatory priority from formal representation. Physical systems and their realized changes have explanatory priority; $\mathcal{S}_C$ and $\prec_C$ formally represent the common stages and their fixed, irreversible, and uninterrupted succession and ordering, which together constitute the common cosmic extension. This clarification removes any claim of a strict non-circular mathematical construction that the notation itself does not supply.

1.6 Foundational clarification from V25/F5 to V26/F6

V25/F5 emphasized the universal ordering and succession of common cosmic stages in one common cosmic extension. V26/F6 retains that foundation but makes the dependency more explicit: continuing physical change is realized across common stages; their fixed, irreversible, and uninterrupted succession and ordering together constitute the common extension; and time denotes that succession and ordering. The revision does not make extension an additional entity and does not assign causal power to time or stages.

1.7 Governing commitments and derived results

The governing commitments are: the universe is the totality of actual physical systems; Physical-System Realization supplies a nonempty identity domain for every physical system; every cosmic stage is physically occupied; CMA includes the explicit presence of every extant physical system at that same stage together with its bearer-specific physical realization; COP governs the initial cosmic stage and the immediate onset of the first systems; IOC governs the unique onset within every nonempty physical-system identity domain; the Later Physical-Origin Postulate governs the direct physical origin of every non-initial bearer onset; IDC excludes every internal gap in an identity domain; and every identity ending within the continuing universe is closed through the unified transformation formalism. UCC is derived from Physical-System Realization, CMA, and IOC: Physical-System Realization supplies nonemptiness, IOC supplies the unique realized onset within that domain, and CMA supplies bearer-specific physical realization throughout the continuation domain. No endpoint follows from UCC alone.

2. The Universe as the Totality of All Physical Systems

2.1 Governing meaning

The universe denotes the totality of all actually realized physical systems without exception:

$$\text{Universe} := \text{TotalityOfAllPhysicalSystems}, \qquad \mathcal{U}_{\text{phys}} := \{A \mid \text{PhysicalSystem}(A)\}.$$

It is not a second-order bearer added above those systems and does not possess one independent bearer history of the form $\mathcal{H}_U$. References to the history of the universe mean the plurality of the physical histories of its systems within the one common cosmic succession, not one general history belonging to a separate cosmic object.

2.2 Physical-system status and study qualification

The ontological predicate is

$$\text{PhysicalSystem}(A).$$

A physical system is a physically realized bearer distinguished by its own identity and by the structural and organizational physical characteristics through which that identity is realized. It is not reducible merely to a physical factor, property, influence, condition, interaction, or mechanism.

Postulate 2.1 (Physical-System Realization)**.** Every physical system has a nonempty identity domain:

$$\boxed{\text{PSR}: \quad \forall A\,[\text{PhysicalSystem}(A) \Longrightarrow I_A \neq \varnothing]}. \tag{1}$$

The predicate applies independently of present observability, detectability, classification, or experimental access. By contrast,

$$\text{StudyQualified}_{P,M}(A)$$

is a protocol- and model-relative predicate indicating that bearer A satisfies the declared conditions of study under protocol P and model M. It may be false or unsettled even when PhysicalSystem(A) is true. Therefore no universal axiom is restricted to study-qualified systems.

2.3 All systems and local classifications

Subsystem, composite, organism, molecule, clock, planet, field configuration, and other classifications identify bearers under domain-specific criteria. Such classifications may overlap or be nested. They do not divide the common cosmic stage and do not create private temporal domains.

2.4 No temporal container

The phrase "systems exist in time" is avoided when it suggests a temporal container. The precise relation is that a system's identity is physically realized at members of the common cosmic-stage domain. The system, its state, and its change are physical; time denotes the fixed, irreversible, and uninterrupted succession and ordering of the common cosmic stages of change, which together constitute one common cosmic extension.

3. Necessary Bearer-Specific Change

3.1 Change as part of the Cosmic Moment Axiom

Bearer-specific physical realization is no longer governed by an axiom independent of CMA. It is included in the reconstructed Cosmic Moment Axiom. The bearer-level existence–change statement is the following consequence:

$$\mathrm{ECP}(A,s): \quad s \in \mathcal{S}_C \wedge A \in \mathcal{S}_{\mathrm{phys}}(s) \Longrightarrow \mathrm{Present}_{\mathrm{C}}(A;s) \wedge \mathrm{PhysReal}_A^{+}(s).$$

ECP is therefore a named consequence, not an additional principle. This avoids duplicating the same universal quantification in two foundational laws.

3.2 Why physically realized change may remain unobserved

A physically realized change may remain unresolved because it lies below instrument sensitivity, occurs outside the selected variables, is masked by compensating effects, remains within a declared stability tolerance, falls between sampling operations, is obscured by noise or uncertainty, is inaccessible through the available signal path, or becomes noticeable only through cumulative manifestation.

Non-detection and unspecified change content

$$\begin{aligned} &\neg\,\mathrm{Detected}_{P,M,\varepsilon}(A,s) \not\Rightarrow \neg\,\mathrm{PhysReal}_A^{+}(s),\\ &\neg\,\mathrm{Detected}_{P,M,\varepsilon}(A,s) \not\Rightarrow \mathrm{SpecifiedHiddenChange}_A(s). \end{aligned} \tag{2}$$

Equation (2) states both limits. The first non-entailment prevents absence of a record from being treated as absence of change. The second prevents non-detection from being used to invent a particular content, magnitude, or mechanism. CMA governs the occurrence of bearer-specific physical change; domain evidence governs what that change was and how it occurred.

Truth-valued realization predicates are not compared as if they were change contents. Let $\mathfrak{C}_A$ be the declared bearer-specific realization-content domain and define

$$\mathcal{C}_A : I_A \longrightarrow \mathfrak{C}_A, \qquad \mathcal{C}_A(s) := \mathrm{RealizationContent}_A(s).$$

For two systems at the same stage, both realization predicates may be true:

$$\mathrm{PhysReal}_A^+(s) \wedge \mathrm{PhysReal}_B^+(s).$$

Their change contents can be compared only after declared maps into a common comparison domain:

$$\Psi_A^{\mathcal{C}} : \mathfrak{C}_A \longrightarrow \mathfrak{C}_{AB}, \qquad \Psi_B^{\mathcal{C}} : \mathfrak{C}_B \longrightarrow \mathfrak{C}_{AB}.$$

A bearer-specific difference under a declared criterion may then be written

$$\Psi_A^{\mathcal{C}}(\mathcal{C}_A(s)) \not\equiv_{\Gamma_{AB}^{\mathcal{C}}} \Psi_B^{\mathcal{C}}(\mathcal{C}_B(s)) \,.$$

The displayed non-equivalence is not inferred merely from the truth of the two realization predicates. No cross-bearer comparison is assumed without a common codomain or explicit comparison maps.

3.3 Internal factors and actual physical engagements

For a bearer A, represent the declared physical ground of realization as the typed pair

$$\mathcal{G}_A(s) := (\mathcal{I}_A(s), \mathcal{E}_A(s)),$$

where $\mathcal{I}_A(s)$ denotes declared internal physical factors and $\mathcal{E}_A(s)$ denotes actual physical engagements with other systems, fields, exchanges, boundary conditions, and environments. The ordered pair prevents an unproved set-theoretic union of differently typed objects. The distinction is analytical and high-level, not a claim that every physical mechanism decomposes uniquely or exclusively into two independent classes.

For continuation realization at a later member of the same identity domain,

$$\mathrm{ContinuationReal}_A(s) \Longrightarrow \mathrm{GroundedIn}(\mathrm{ContinuationReal}_A(s), \mathcal{G}_A(s)) \,.$$

Time, the stage, and the succession relation are excluded from the causal ground.

3.4 No motion, materiality, or machinery of stages

A cosmic stage is not matter, energy, a field, a mechanism, a carrier, or a moving entity. It does not enter a bearer, transport it, or produce its change. Physical systems do not move from one stage-object to another. A later stage is the common stage at which later physical realization is actual.

3.5 Physical grounding, localized change, and bearer scale

A localized alteration may warrant change in the bearer to which it is validly attributed, but attribution must preserve bearer and scale. A molecular change does not automatically establish the ending of an organism; a cellular record does not automatically represent the complete state of the organism; and a change in a subsystem may coexist with persistence of the composite identity. Chemical, genetic, biological, and macroscopic applications therefore require explicit part–whole and identity criteria.

4. Cosmic Succession, Common Extension, and the Meaning of Time

4.1 Canonical definition

Canonical definition

Definition 4.1. Time denotes the fixed, irreversible, and uninterrupted succession and ordering of the common cosmic stages of change across all physical systems then existing at each stage; these stages together constitute one common cosmic extension.

$$T_{\mathrm{ITOF}} = (\mathcal{S}_C, \prec_C). \tag{3}$$

Here $\mathcal{S}_C$ denotes the domain of the common cosmic stages and $\prec_C$ orders their succession and ordering. The stages taken together constitute the common cosmic extension. Fixity is the invariance of that ordering and succession: once $s \prec_C t$, the relation does not reverse or become interchangeable. No motion or causal agency is assigned to the stages.

The common cosmic extension is constituted by the fixed, irreversible, and uninterrupted succession and ordering of the common cosmic stages. It is not an independently existing container, carrier, or additional physical bearer. The uninterrupted succession does not impose countability or a discrete immediate-successor relation.

4.2 Meaning and identity of cosmic stages

Every $s \in \mathcal{S}_C$ is a primitive member of the one common ordered domain. Its identity is not defined by a bearer state, chosen observable, coordinate value, record, or clock output. Under CMA, every stage is occupied by at least one physical system and expresses the presence and physical realization of every system then extant:

$$s \in \mathcal{S}_C \quad \overset{\text{expresses}}{\longmapsto} \quad \Big\{ (\mathrm{Present}_{\mathrm{C}}(A; s), \mathrm{PhysReal}_A^{+}(s)) \mid A \in \mathcal{S}_{\mathrm{phys}}(s) \Big\}.$$

The displayed arrow is expressive, not causal or productive.

4.3 The common domain, succession, and order type

For $r, s, u \in \mathcal{S}_C$, the adopted order is strict, transitive, and total on distinct members:

$$\neg(s \prec_C s), \qquad (r \prec_C s \wedge s \prec_C u) \Longrightarrow r \prec_C u,$$

$$r \neq s \Longrightarrow (r \prec_C s) \vee (s \prec_C r).$$

The order is irreversible. V26/F6 does not infer from these properties that the domain is dense, discrete, continuous, gapless, metric, or countable. Any such enrichment would require a separate postulate.

4.4 What the definition excludes

Time is not matter, energy, a field, a force, a coordinate, a metric interval, a proper-time functional, a clock output, or a causal participant in change. These exclusions identify type boundaries; separate arguments are required for any broader physical criticism of a model.

4.5 The extension is common

No system possesses a private domain of cosmic stages. A bearer's identity domain is a subset of the common domain:

$$I_A \subseteq \mathcal{S}_C.$$

Different onsets, endings, state paths, and records therefore constitute different physical histories within the same cosmic succession, not different times.

5. The Common Cosmic Stages and the Cosmic Moment Axiom

5.1 The common cosmic stages

At a common cosmic stage s, every physical system whose identity is then realized is present at that same stage. Spatial separation, signal delay, different state content, and unequal clock readings do not divide the stage. Presence does not mean instantaneous communication or equal physical conditions.

Define

$$\mathcal{S}_{\text{phys}}(s) := \{A \in \mathcal{U}_{\text{phys}} \mid \text{ExistsAs}(A, s)\} = \{A \in \mathcal{U}_{\text{phys}} \mid s \in I_A\},$$

and

$$\text{Present}_{\text{C}}(A; s) \Longleftrightarrow \text{PhysicalSystem}(A) \wedge s \in I_A.$$

Thus membership in $\mathcal{S}_{\text{phys}}(s)$ already entails $\text{Present}_{\text{C}}(A; s)$. The explicit occurrence of $\text{Present}_{\text{C}}$ in the full CMA formula is retained for semantic emphasis on universal common-stage presence;

it adds no independent condition beyond extant-system membership. A formally reduced but equivalent CMA formula may omit that conjunct.

5.2 Governing statement

Cosmic Moment Axiom

Axiom 5.1.

$$\boxed{\text{CMA}: \quad \forall s \in \mathcal{S}_C \left[\mathcal{S}_{\text{phys}}(s) \neq \varnothing \wedge \forall A \in \mathcal{S}_{\text{phys}}(s)\big(\text{Present}_{\text{C}}(A; s) \wedge \text{PhysReal}_A^{+}(s)\big)\right]}. \quad (4)$$

At every common cosmic stage, all physical systems in the universe whose identities are then realized are present at that same common cosmic stage, and each undergoes its own bearer-specific physically realized change at that same stage.

The non-emptiness clause prevents a formally empty cosmic stage. If no physical system is realized later than a final stage, there is no later member of $\mathcal{S}_C$, rather than empty formal stages after physical realization has ended. The formally reduced equivalent is

$$\forall s \in \mathcal{S}_C \left[\mathcal{S}_{\text{phys}}(s) \neq \varnothing \wedge \forall A \in \mathcal{S}_{\text{phys}}(s) \;\; \text{PhysReal}_A^{+}(s)\right],$$

because $A \in \mathcal{S}_{\text{phys}}(s) \implies \text{Present}_{\text{C}}(A; s)$ by definition. The full formula remains governing because it displays common-stage presence explicitly.

Pairwise co-presence is derived:

$$A, B \in \mathcal{S}_{\text{phys}}(s) \implies \text{CoPresent}_{\text{C}}(A, B; s),$$

where

$$\text{CoPresent}_{\text{C}}(A, B; s) \iff \text{Present}_{\text{C}}(A; s) \wedge \text{Present}_{\text{C}}(B; s).$$

The axiom is universal over all extant physical systems, not merely those accessible to a study. It does not include not-yet-originated or already-ended identities.

5.3 Bearer specificity and non-causation

CMA asserts occurrence and common-stage presence; it does not equate the content, magnitude, rate, mechanism, distribution, detectability, or observability of different systems' changes. The stage does not act on the systems, and time is not a causal participant. The causes and mechanisms of change remain properties of systems and their actual physical engagements.

5.4 Spatial separation

Distance affects interaction, propagation, received records, and access. It neither postpones the source system's realization to the reception stage nor divides the common stage. The common cosmic stage is not produced by synchronization, signal exchange, or causal propagation among spatially separated systems. It is the single ontological stage at which all then-existing physical systems are present and undergo their own bearer-specific physical change. Thus

$$\mathrm{CoPresent}_{\mathrm{C}}(A,B;s) \not\Rightarrow \mathrm{SignalExchange}(A,B;s),$$
$$\mathrm{CoPresent}_{\mathrm{C}}(A,B;s) \not\Rightarrow \mathrm{CausalInfluence}(A,B;s).$$

Spatial separation and finite signal propagation govern interactions, records, and epistemic access; they neither divide the common cosmic stage nor require an instantaneous influence to establish its unity. No signal creates common-stage presence, and CMA implies no instantaneous signal channel.

6. Cosmic Onset and the First Physical Systems

6.1 Cosmic origin

Cosmic onset is the physical origin of the first systems and the initial member of the common cosmic-stage domain; its independent status is stated in Postulate 6.1. The existence of an initial member is not derived from strict total order alone; it is adopted through the independent Cosmic Onset Postulate.

6.2 Cosmic Onset Postulate

The initial-stage predicate is defined by

$$\mathrm{Initial}_{\mathrm{C}}(s_0) \iff s_0 \in \mathcal{S}_C \wedge \neg\exists r \in \mathcal{S}_C\,(r \prec_C s_0). \tag{5}$$

Postulate 6.1 (Cosmic Onset Postulate)**.**

$$\begin{aligned}\mathrm{COP}:\quad \exists! s_0 \in \mathcal{S}_C\,\big[\,&\mathrm{Initial}_{\mathrm{C}}(s_0) \wedge \mathcal{S}_{\mathrm{phys}}(s_0) \neq \varnothing \\ &\wedge \forall A \in \mathcal{S}_{\mathrm{phys}}(s_0)\ \ \mathrm{OnsetReal}_A(s_0)\big].\end{aligned} \tag{6}$$

The universe is not an additional bearer distinct from its constituent systems. Its origin denotes the collective physical realization of the first systems. At s_0, the identities of every system then constituting the universe become physically realized and bearer-specific physical change begins immediately in every one of them. There is no dormant stage between system origin and the beginning of change; systems that originate later have their own unique later onset stages.

6.3 Systems originating later

For any physical system A, define onset by

$$\mathrm{Onset}_A(s) \iff s \in I_A \wedge \neg\exists r \in I_A\,(r \prec_C s).$$

Define the later-in-history predicate by

$$\mathrm{LaterInHistory}_A(s) \iff s \in I_A \wedge \exists r \in I_A\,(r \prec_C s).$$

Onset realization is defined without using $\mathrm{PhysReal}^{+}_{A}(s)$:

$$\mathrm{OnsetReal}_A(s) \iff \mathrm{Onset}_A(s) \wedge \mathrm{IdentityOriginRealized}_A(s) \wedge \mathrm{ChangeBegins}_A(s).$$

Thus onset is not alteration from a nonexistent earlier state of the same bearer. It is the physical realization of the new identity together with the immediate beginning of that bearer's change.

For a later-originating system, define the prior physical-origin relation by

$$\begin{aligned}\mathrm{OriginatesAt}(B,\mathcal{P},s) \iff\ & B \in \mathcal{U}_{\mathrm{phys}} \wedge s \in \mathcal{S}_C \wedge \varnothing \neq \mathcal{P} \subseteq \mathcal{U}_{\mathrm{phys}} \\ & \wedge \mathrm{OnsetReal}_B(s) \wedge \forall A \in \mathcal{P}\ \ [\mathrm{Present}_{\mathrm{C}}(A;s) \wedge \exists r \in I_A\,(r \prec_C s)] \\ & \wedge \mathrm{PhysicalOriginLink}(\mathcal{P},s,B).\end{aligned} \tag{7}$$

Here $\mathcal{P}$ is the set of direct physical contributors at the onset stage. Every member of $\mathcal{P}$ is present at s and has a physically realized history before s. The relation $\mathrm{PhysicalOriginLink}(\mathcal{P},s,B)$ states the domain-warranted physical contribution of their changes to the realization of the new identity B at s. A contributor may continue after s or end at s; the relation excludes an identity that ended before s from being listed as a direct contributor.

Postulate 6.2 (Later Physical-Origin Postulate)**.** Every physical-system identity beginning after the initial common cosmic stage has a direct physical origin in the change of one or more previously realized physical systems that are present at its onset stage:

$$\forall B\,\forall s\,[\mathrm{PhysicalSystem}(B) \wedge \mathrm{OnsetReal}_B(s) \wedge \neg\,\mathrm{Initial}_{\mathrm{C}}(s) \implies \exists \mathcal{P}\ \ \mathrm{OriginatesAt}(B,\mathcal{P},s)]\,. \tag{8}$$

Successor transformation is one important case of later physical origin. A later onset does not, however, require the termination of every directly contributing system; each direct contributor must be present at the onset stage and may either continue or end there.

6.4 Identity onset and identity-domain continuity

Postulate 6.3 (Identity Onset Postulate)**.** Every physical system with a nonempty identity domain has one and only one realized identity onset:

$$\boxed{\mathrm{IOC}: \quad \forall A\left[\mathrm{PhysicalSystem}(A) \wedge I_A \neq \varnothing \implies \exists! s^0_A \in I_A\ \ \mathrm{OnsetReal}_A(s^0_A)\right]}. \tag{9}$$

Postulate 2.1 supplies $I_A \neq \varnothing$, after which IOC supplies the unique realized onset within that nonempty domain. For systems originating with the universe, $s^0_A = s_0$; for later systems it is their own later origin stage. Once a bearer identity ends, that same identity does not begin again. Any later bearer, even one closely similar in composition, organization, function, or observable properties, possesses a distinct identity and physical history.

For $u, v \in I_A$, identity continuity is

$$\begin{aligned}\mathrm{IdCont}_A(u,v) \iff\ & u, v \in I_A \wedge u \preceq_C v \\ & \wedge \forall s \in \mathcal{S}_C\big[(u \preceq_C s \wedge s \preceq_C v) \implies s \in I_A\big].\end{aligned}$$

Postulate 6.4 (Identity-Domain Continuity)**.** Every physical-system identity domain is order-convex and contains no gap:

$$\boxed{\text{IDC}: \quad \forall A\, \forall r,s,u \in \mathcal{S}_C \left[\text{PhysicalSystem}(A) \wedge r,u \in I_A \wedge r \prec_C s \wedge s \prec_C u \Longrightarrow s \in I_A\right]}. \quad (10)$$

IDC prevents an identity from being physically realized, disappearing at an intermediate stage, and then returning as the same identity. Identity continuity permits extensive change and recurrence under a declared state criterion; it does not imply equality of states. When identity ends, its domain closes permanently, and any successor identity has its own distinct onset and history.

7. Physical Systems, Identity, State, and Physical Realization

7.1 Physical systems and study-qualified bearers

A bearer is included in the universal ontology by PhysicalSystem(A). Experimental eligibility is stated separately by $\text{StudyQualified}_{P,M}(A)$. The latter requires declared identity, attribution, model, and protocol conditions; it does not determine whether the bearer exists or is included in CMA. The governing bearer type is closed by

$$\mathsf{Bearer} := \mathcal{U}_{\text{phys}},$$

and study qualification selects only from that type:

$$\forall A \left[\text{StudyQualified}_{P,M}(A) \Longrightarrow \text{PhysicalSystem}(A)\right].$$

The primitive bearer-stage predicates therefore have signatures

$$\begin{aligned} \text{ExistsAs, IdentityOriginRealized, ChangeBegins}: \ \mathcal{U}_{\text{phys}} \times \mathcal{S}_C &\longrightarrow \{\top, \bot\}, \\ \text{AlterReal, IdentityEndingRealized}: \ \mathcal{U}_{\text{phys}} \times \mathcal{S}_C &\longrightarrow \{\top, \bot\}. \end{aligned}$$

7.2 Physical state

For each physical system A, let Ω_A be the codomain of its possible bearer states under the declared state description. The actual state map is

$$X_A : I_A \longrightarrow \Omega_A.$$

A selected component is

$$X_{A,k} = \pi_{A,k} \circ X_A.$$

Equality of a selected component does not entail equality of the complete state. Criterion-indexed equivalence is written

$$X_A(s) \equiv_{\Gamma_A} X_A(t),$$

and means equivalence only under the declared criterion Γ_A. It implies neither complete equality nor recurrence of the cosmic stage.

States of different systems may belong to different codomains. A cross-bearer comparison is defined only after a declared common representation or map, for example

$$\Psi_{A\to B} : \Omega_A \longrightarrow \Omega_B,$$

or maps from both codomains into a declared comparison space. No direct equality $X_A(s) = X_B(s)$ is presumed without that bridge.

7.3 Onset and continuation realization

Define continuation realization by

$$\mathrm{ContinuationReal}_A(s) \iff \mathrm{LaterInHistory}_A(s) \wedge \mathrm{AlterReal}_A(s),$$

where $\mathrm{AlterReal}_A(s)$ denotes actual bearer-specific alteration at a later member of the same identity domain. Total positive physical realization is

$$\mathrm{PhysReal}^{+}_A(s) \iff \mathrm{OnsetReal}_A(s) \oplus \mathrm{ContinuationReal}_A(s).$$

This definition is non-circular because $\mathrm{OnsetReal}_A$ and $\mathrm{ContinuationReal}_A$ are defined independently of $\mathrm{PhysReal}^{+}_A$. The exclusive alternative distinguishes identity origin from later alteration while preserving immediate change at onset.

7.4 Primitive predicates, signatures, and inferential status

The following table makes the non-circular basis explicit. Here $\mathsf{Bearer} := \mathcal{U}_{\mathrm{phys}}$, and, unless otherwise stated, bearer-stage predicates have signature $\mathcal{U}_{\mathrm{phys}} \times \mathcal{S}_C \to \{\top, \bot\}$. Primitive ontological predicates are not themselves observations or records; their empirical warrant, where available, is supplied through separate bearer-, model-, and protocol-relative evidence.

Predicate and signature	**Status**	**Ontological or inferential role**
$\mathrm{PhysicalSystem}(A)$	Primitive ontological	States that A is an actually realized physical bearer, not merely a factor, property, or possible model object.
$\mathrm{ExistsAs}(A, s)$	Primitive ontological	States that the identity of A is physically realized at s; it generates I_A.
$\mathrm{IdentityOriginRealized}_A(s)$	Primitive ontological	States that the distinct identity of A is physically realized for the first time at s.
$\mathrm{ChangeBegins}_A(s)$	Primitive ontological	States that bearer-specific physical change begins immediately with identity onset.
$\mathrm{AlterReal}_A(s)$	Primitive, domain-warranted	States actual alteration at a later member of the same identity domain; it is not defined by detection.
$\mathrm{IdentityEndingRealized}_A(s)$	Primitive ontological	States the terminal physical realization of the bearer identity at an attained last member of its domain.

Predicate and signature	Status	Ontological or inferential role
$\mathrm{TransformativeFailure}_A(s)$	Primitive physical-path predicate	Describes a physical transformation path that may ground identity ending; it is not definitionally identical with the ending result.
$\mathrm{TransformationLink}(\mathcal{P}, s, \mathcal{Q})$	Primitive, domain-warranted relation	Connects declared predecessor and successor sets through a physically warranted transformation at s.
$\mathrm{PhysicalOriginLink}(\mathcal{P}, s, B)$	Primitive, domain-warranted relation	Connects the changes of direct contributors present at s, each with a prior realized history, to the physical realization of a later-originating bearer without requiring every contributor to terminate.
$\mathrm{OnsetReal}_A(s)$, $\mathrm{ContinuationReal}_A(s)$, $\mathrm{PhysReal}^+_A(s)$, $\mathrm{OriginatesAt}(B, \mathcal{P}, s)$	Derived	Combine the primitive predicates and domain-warranted links under the declared onset, continuation, positive-realization, and later-origin definitions.

Both forms may be observable under a declared protocol or unresolved within its limits. Physical realization is not identical with observation or detection:

$$\mathrm{PhysReal}^+_A(s) \not\Rightarrow \mathrm{Detected}_{P,M,\varepsilon}(A, s), \qquad \neg\,\mathrm{Detected}_{P,M,\varepsilon}(A, s) \not\Rightarrow \neg\,\mathrm{PhysReal}^+_A(s).$$

7.5 Bearer specificity

State, realization content, change mechanism, and physical history belong to the bearer. A signal, instrument, record, or model may represent selected aspects but does not replace the bearer. Cross-system comparison requires declared mappings, variables, units, and protocols.

8. Identity Domains and Physical Histories

8.1 Identity domain

For a physical system A, its identity domain is:

$$I_A = \{s \in \mathcal{S}_C \mid \mathrm{ExistsAs}(A, s)\}.$$

Every member of I_A belongs to the common cosmic-stage domain:

$$I_A \subseteq \mathcal{S}_C.$$

The inclusion states participation in the common extension. It does not define a private time for A.

8.2 Physical history

The physical history of A is:

Definition 8.1.

$$\mathcal{H}_A = (I_A, \prec_C |_{I_A}, X_A). \tag{11}$$

The history includes the stages at which the identity is realized, the restriction of $\prec_C$ to those stages, and the bearer states realized there.

Histories may differ in onset, extent, ending, state content, recurrence, and observational record:

$$\mathcal{H}_A \neq \mathcal{H}_B.$$

This inequality does not imply different cosmic extensions. It records different physical histories within the same extension.

8.3 Same class and different histories

Two systems may belong to the same class while having different histories:

$$\mathrm{SameClass}(A, B) \not\Rightarrow \mathcal{H}_A = \mathcal{H}_B.$$

Manufacturing differences, environmental exposure, interactions, internal events, damage, repair, and measurement interventions may all separate their histories. Class membership supports comparison; it does not erase bearer individuality.

8.4 No private stage domain

The framework rejects the replacement of I_A by an independent domain of temporal stages belonging only to A. If A and B coexist at s, then $s \in I_A \cap I_B$, and the stage is the same stage for both. Their changes remain different.

8.5 Composite, Nested, Open, and Distributed Systems

Composite identity

A composite system has an identity that is not reducible to the independent persistence of every constituent. Constituents may be replaced, exchanged, or transformed while the composite identity continues. Conversely, many constituents may persist after the composite identity ends. The theory therefore separates constituent continuation from bearer continuation.

Nested bearers

When B is physically part of A, both may be physical bearers under different questions. Their histories satisfy

$$I_A \subseteq \mathcal{S}_C, \qquad I_B \subseteq \mathcal{S}_C,$$

but neither history is automatically identical to the other. A change of B may be part of the change of A, while the ending of B may or may not end A.

Open and exchanging systems

Exchange with an environment does not disqualify a bearer. Living systems, clocks, stars, planets, and laboratory apparatus are open to different degrees. The identity criterion must state which exchanges are compatible with persistence and which transformations terminate the identity.

Distributed systems

A distributed system may have spatially separated components. The separation does not create multiple cosmic stages. Records and control signals may propagate between components with delay, while all components then existing participate in the same common stage. The physical unity of the distributed bearer is an identity question, not a consequence of instantaneous communication.

9. Universal Change Continuity

9.1 Onset realization and the continuation domain

For a physical system A, define

$$I_A^{\mathrm{cont}} := \{ s \in I_A \mid \exists r \in I_A \, (r \prec_C s) \} .$$

Universal Change Continuity is the bearer-level proposition

Universal Change Continuity

$$\begin{aligned} \mathrm{UCC}(A) \iff\ & \mathrm{PhysicalSystem}(A) \wedge I_A \neq \varnothing \\ & \wedge \exists ! s_A^0 \in I_A \ \ \mathrm{OnsetReal}_A(s_A^0) \\ & \wedge \forall s \in I_A^{\mathrm{cont}} \ \ \mathrm{ContinuationReal}_A(s). \end{aligned} \tag{12}$$

It states that the bearer's identity and change begin together at its unique onset and that no later member of the continuing identity domain is without bearer-specific physical alteration.

Proposition 9.1 (Universal bearer derivation of UCC)**.**

$$\mathrm{PSR} \wedge \mathrm{CMA} \wedge \mathrm{IOC} \implies \forall A \, [\mathrm{PhysicalSystem}(A) \implies \mathrm{UCC}(A)]. \tag{13}$$

Proof. Fix an arbitrary physical system A. Postulate 2.1 gives $I_A \neq \varnothing$, and IOC supplies the unique onset member $s_A^0 \in I_A$ with $\mathrm{OnsetReal}_A(s_A^0)$. Let $s \in I_A^{\mathrm{cont}}$. Then $A \in \mathcal{S}_{\mathrm{phys}}(s)$, so CMA yields $\mathrm{Present}_C(A; s) \wedge \mathrm{PhysReal}_A^+(s)$. Because s has an earlier member in I_A, it satisfies $\mathrm{LaterInHistory}_A(s)$ and cannot satisfy the unique onset condition. By the non-circular exclusive realization definition, the positive realization at s is therefore $\mathrm{ContinuationReal}_A(s)$. Since s was arbitrary and A was arbitrary, continuation realization holds throughout every physical system's continuation domain, and the universal conclusion follows. IDC independently guarantees that no bearer identity domain contains an internal gap.

Equation (12) and the derivation above do not derive physical truth from logic alone; they display the dependency of UCC on Physical-System Realization for identity-domain nonemptiness, on IOC for unique realized onset within that domain, and on the universal physical-realization content of CMA for continuation.

9.2 Physical ground of uninterrupted continuation

For each $s \in I_A^{\mathrm{cont}}$, the continuing realization is attributed to the bearer through its typed physical ground:

$$\mathcal{G}_A(s) = (\mathcal{I}_A(s), \mathcal{E}_A(s)), \qquad \mathrm{GroundedIn}(\mathrm{ContinuationReal}_A(s), \mathcal{G}_A(s))\,.$$

No universal mechanism is imposed, and time or the stage is not included among the causes.

9.3 Uninterrupted change and stage succession

UCC is ontological and does not require that every stage be separately resolvable by an instrument. Stability, equilibrium, recurrence, or nondetection under selected variables does not establish complete stasis. A finite null result is evidentially bounded by the bearer, model, variables, sensitivity, sampling, and protocol.

9.4 Universality without identical change

The universality concerns the occurrence of bearer-specific realization throughout identity persistence. It does not imply a common magnitude, mechanism, rate, state, or observational manifestation. CMA supplies universal scope over extant physical systems; UCC expresses the complete-history consequence of immediate realized onset and uninterrupted later continuation for each individual history.

10. Stability, Recurrence, Localized Change, and Difficult Systems

10.1 Rest, stability, equilibrium, and recurrence

Relative rest

Kinematic rest is a relation between a system and a selected reference. If

$$\boldsymbol{v}_{A/R} = 0, \tag{14}$$

then the position of A does not change relative to R under the adopted description. This does not establish that the complete physical state is unchanged:

$$\boldsymbol{v}_{A/R} = 0 \not\Rightarrow X_A(s) \equiv_{\Gamma_A} X_A(t). \tag{15}$$

Microscopic motion, thermal redistribution, field interaction, chemical process, stress relaxation, radiation exchange, and other realizations can continue while the centre or visible boundary remains fixed relative to the reference.

Terrestrial rest is local and relative

A sample on a laboratory table may be at rest relative to the table, building, and local terrestrial coordinate system. The sample, instrument, researcher, laboratory, and building nevertheless share the rotation of Earth, Earth's orbital motion, and wider motion of the solar system. Hence

$$\boldsymbol{v}_{A/R_{\text{lab}}} = 0 \not\Rightarrow \boldsymbol{v}_{A/R_{\text{other}}} = 0. \tag{16}$$

This example establishes the relativity of the kinematic description. It is not the primary reason that physical realization continues. Even if A is treated as at rest in the chosen frame, its internal–external interweaving remains physically active.

Fixed position and selected quantities

A fixed position is one quantity among many:

$$\widehat{\boldsymbol{x}}_{A/R,P}(r_1) = \widehat{\boldsymbol{x}}_{A/R,P}(r_2) \not\Rightarrow X_A(s) \equiv_{\Gamma_A} X_A(t). \tag{17}$$

The same rule holds for temperature, mass, pressure, shape, intensity, or another selected output. An equality may be informative about that quantity while remaining silent about unmeasured components.

Stability

Stability means that a system remains within a specified regime, basin, tolerance, pattern, or response class under stated conditions. It does not mean complete stasis. A stable structure can undergo continuous molecular motion, exchange, repair, microscopic rearrangement, or slow degradation. A stable clock can continue cycling. A stable orbit is motion, not immobility.

The stability predicate must include the controlled variable and tolerance:

$$\text{Stable}_{Q,\epsilon,J}(A) \iff \forall \lambda \in J,\ Q_A(\lambda) \in \mathcal{N}_\epsilon(Q_*), \tag{18}$$

where λ is the declared model or operational parameter and $\mathcal{N}_\epsilon(Q_*)$ is a tolerated neighbourhood. This does not establish equivalence under a bearer-complete criterion.

Stability across later stages

In ITOF, stability across later common stages means persistence within a declared physical regime, pattern, or tolerance while bearer-specific change continues. It does not mean that the bearer has one frozen physical phase between two stages. A later phase may resemble an earlier one, or selected quantities may remain equal, without cancelling the intervening realizations or reversing the cosmic order:

$$\mathrm{Stable}_{Q,\epsilon,J}(A) \not\Rightarrow \mathrm{NoPhysicalChange}_A(J). \tag{19}$$

An archaeological stone provides a concrete cumulative case. During a limited observation window no macroscopic difference may be resolved, while thermal, mineral, chemical, microphysical, environmental, and stress-related alterations accumulate across many successive cosmic stages. A crack, colour change, loss of material, or surface erosion observed years or centuries later did not therefore arise wholly and at once when it became visible.

Cumulative manifestation in archaeological stone

$$\begin{aligned} &\forall i < n: \quad d_{P,D}(O_{A,P}(s_i), O_{A,P}(s_{i+1})) \leq \varepsilon_{P,D}, \\ &d_{P,D}(O_{A,P}(s_1), O_{A,P}(s_n)) > \varepsilon_{P,D} \not\Rightarrow \exists! s_k \ \mathrm{EntireAlterationOccurredAt}(A, s_k). \end{aligned} \tag{20}$$

Equation (20) formalizes why the later visible effect may be the cumulative manifestation of many small bearer-specific realizations. Prior non-detection does not establish cessation, while later noticeability does not compress the whole alteration into one stage.

Equilibrium and steady state

Equilibrium may express vanishing net flux, stationary probability distribution, balance of opposing processes, or extremization within a model. Dynamic equilibrium can involve continuous opposing exchanges whose net measured result is zero. Thus

$$\sum_i J_i = 0 \not\Rightarrow \forall i, \ J_i = 0, \tag{21}$$

and even $J_i = 0$ for selected macroscopic channels does not establish absence of every microscopic realization.

A steady state is similarly a condition on selected observables or distributions. The statement

$$\frac{dQ_A}{d\lambda} = 0 \tag{22}$$

uses model parameter λ and quantity Q_A. It does not state that the complete state is identical across the cosmic extension, and it does not define time.

Periodic return

If a system later realizes a condition equivalent to an earlier condition under a declared criterion, then

$$s \prec_C t \wedge X_A(s) \equiv_{\Gamma_A} X_A(t) \Longrightarrow s \neq t \wedge \neg(t \prec_C s). \tag{23}$$

A patient may be ill, recover, and later become ill again. The later illness may be equivalent to the earlier illness under a declared disease criterion, yet it remains a later physical state because the common cosmic stages have not reversed. Likewise, if a selected quantity returns after a cycle,

$$Q_A(\lambda + T) = Q_A(\lambda), \tag{24}$$

the cycle has not returned the system or the universe to an earlier cosmic stage. Intermediate realizations occurred, other bearer components may differ, and all extant systems continued to change. Even an idealized periodic solution represents recurrence in selected variables, not temporal repetition.

Adverse-scenario burden

Rest, stability, and equilibrium become relevant to the universal-change principle only if they support a domain-adequate adverse case. The burden is not to show a flat graph. It is to show that a physical system maintained identity over the investigated domain and realized no physical change in any physically relevant component, relation, property, or process. The distinction makes the principle testable without defining change as a binary transition.

> **Governing rest and stability rule.**
>
> Kinematic rest, stable appearance, equality of a selected quantity, periodic return, and equilibrium are descriptions of specified relations or observables. None is identical with complete physical stasis.

10.2 Localized, chemical, genetic, and biological change

Local physical difference as a sufficient witness

A system can realize physical change through a difference confined to one component, relation, boundary region, molecular site, cell, or substructure while its global organization and identity persist. Throughout V26/F6, $X_A(s)$ denotes the ontically complete physical state of bearer A at stage s, while $X_{A,k}(s)$ denotes only an attributable component or selected sub-description of that state. Then

$$\begin{aligned} \exists u, v \in I_A \; \exists k \; \Big[u \prec_C v \wedge \mathrm{RealDifference}(X_{A,k}(u), X_{A,k}(v)) \\ \wedge\, k \in K(\Gamma_A) \wedge \mathrm{ValidAttribution}_{A,P,M}(k; u, v) \wedge \mathrm{IdCont}_A(u, v) \Big] \\ \Longrightarrow \mathrm{Warrant}_{P,M}[X_A(u) \not\equiv_{\Gamma_A} X_A(v)] \,. \end{aligned} \tag{25}$$

The analytical index k marks the location or component relevant to the claim. It carries no assumption that the system is permanently decomposable into independent parts. One validly attributed local difference in a component selected by Γ_A warrants non-equivalence of the bearer states under that criterion because the component belongs to the complete physical state.

Magnitude, distribution, and threshold

The logical status of a physical difference is independent of its magnitude. A change can be macroscopic, microscopic, molecular, genetic, relational, or distributed across many small components. Let δQ_A denote a real difference in a selected quantity and $\epsilon_{D,P}$ the effective threshold of detector D under protocol P. The subthreshold condition is

$$0 < |\delta Q_A| < \epsilon_{D,P}. \tag{26}$$

This relation explains an expected non-resolution under the stated instrument model. Evidence for the actual difference comes from a physical model, an independent channel, accumulated manifestation, improved sensitivity, or another warranted route. The ontic claim and the detection claim therefore remain explicitly separated.

The spatial distribution also matters. A small difference spread across the entire system and a larger difference confined to one site may produce different records while both qualify as change. The test must report magnitude, location, sampling fraction, and the relation between sampled material and the declared bearer.

Chemical realization

Chemical change includes bond formation and breaking, oxidation, reduction, hydrolysis, diffusion, phase nucleation, compositional redistribution, polymer-chain scission, cross-linking, and surface reaction. Single-molecule studies also demonstrate directly resolved molecular dynamics in individual enzymatic systems [54]. The early alteration may occupy a microscopic region while dimensions, mass, colour, or mechanical response remain within tolerance. Later macroscopic degradation can manifest the accumulation and coupling of many earlier localized realizations.

A complete chemical inference chain has the form

$$\begin{aligned} &\text{chemical alteration in } A \longrightarrow \text{sample–instrument interaction} \\ &\qquad\qquad\qquad\qquad \longrightarrow \text{record } r_D \longrightarrow \text{model-based attribution to } A. \end{aligned}$$

Accelerated-weathering and mechanical-analysis standards provide operational methods for controlling radiation, humidity, temperature, loading, and sampling conditions [39, 40, 41, 37, 38, 42]. The acceleration comes from altered physical factors and reaction conditions. Extrapolation to service conditions therefore requires a declared kinetic or degradation model and an uncertainty statement.

Genetic bearer hierarchy

A genetic claim must identify its bearer before assigning change. At least six distinct levels occur:

(i) a DNA or RNA molecule;

(ii) a chromosome, plasmid, organelle genome, or other genomic structure;

(iii) a cell;

(iv) a tissue or cellular mosaic;

(v) an organism or continuing cell lineage;

(vi) a population, species sample, or evolutionary lineage.

A difference established at one level transfers to a higher level only through an explicit bearer relation. A validly attributed substitution in one molecule warrants molecular change. Attribution to a cell requires evidence that the molecule belongs to that cell. Attribution to an organism requires a sampling and organizational bridge. Attribution to a population requires frequency, sampling, and lineage analysis. This hierarchy prevents automatic transfer from one altered component to every containing or related bearer.

Canonical genetic-change condition

Let $G_{A,k}(s)$ denote a genomic sequence or genomic structural feature attributable to bearer level k, and let $E_{A,k}(s)$ denote an epigenomic or regulatory molecular feature. A genomic change witness is

$$\begin{aligned} &u, v \in I_A \wedge u \prec_C v \wedge G_{A,k}(u) \neq G_{A,k}(v) \wedge k \in K(\Gamma_A) \wedge \mathrm{IdCont}_A(u,v) \\ &\quad \wedge \mathrm{ValidGeneticAttribution}_{A,P,M}(k; u, v) \Longrightarrow \mathrm{Warrant}_{P,M}[X_A(u) \not\equiv_{\Gamma_A} X_A(v)]\,. \end{aligned} \tag{27}$$

An epigenomic or regulatory witness uses $E_{A,k}$ with its own attribution and persistence conditions. Sequence or structural genomic change and epigenomic regulation must not be conflated, even when both contribute to a broader hereditary or regulatory history.

Genetic realization and phenotypic manifestation

Genetic difference and phenotypic effect are separate physical claims. Write

$$\Delta G_A(u,v)$$

for a genetic difference and

$$\Delta \Phi_A(u,v)$$

for a phenotypic difference. The theory permits

$$\Delta G_A(u,v) \neq 0 \quad \wedge \quad \Delta \Phi_A(u,v) = 0 \tag{28}$$

within the resolution and domain of the phenotype test. Regulatory buffering, redundancy, tissue restriction, allele fraction, developmental timing, and environmental conditions may delay or suppress a detectable phenotypic manifestation. Conversely, a phenotypic difference can arise from non-genetic physical changes. The two evidential chains must therefore be reported independently.

Somatic mutation, mosaicism, and lineage

Somatic mutation provides a direct example of localized change within continuing biological identity. A variant may arise in one cell, propagate through a descendant clone, remain restricted to a tissue, or attain a measurable mosaic fraction. The organism retains its identity while a subset of its cells acquires a physically distinct genetic state. Studies of somatic mosaicism and accumulated mutation document these bearer-specific patterns [43, 44, 45, 46, 47, 48].

For a lineage L, the valid relation is

$$
\begin{aligned}
&u, v \in I_L \wedge u \prec_C v \wedge \mathrm{IdCont}_L(u, v) \\
&\quad \wedge \mathrm{LineageSupported}(L; u, v) \wedge k \in K(\Gamma_L) \wedge G_{L,k}(u) \neq G_{L,k}(v) \\
&\qquad \Longrightarrow X_L(u) \not\equiv_{\Gamma_L} X_L(v).
\end{aligned}
$$

Lineage evidence may include ancestry markers, clonal structure, spatial sampling, cell labels, or phylogenetic reconstruction. The inferred ancestral sequence remains a reconstruction with uncertainty; the extant molecular samples remain physical records.

Epigenetic and regulatory change

Epigenetic marking and chromatin organization are physical features of molecular and cellular systems. A methylation difference, histone modification, nucleosome relocation, or durable regulatory-state alteration qualifies when materially instantiated, correctly attributed, and relevant to the declared state description. Its persistence, reversibility, and functional effect are separate questions. The framework therefore recognises epigenetic change without equating every transient regulatory fluctuation with a stable hereditary alteration.

Genetic records and exact-stage limits

A sequencing output is a downstream detector record. Sample extraction, amplification, library preparation, sequencing, base calling, alignment, and variant inference occur after the molecular realization and add their own physical transformations. A valid record chain can warrant that the genetic difference existed within a bounded source history:

$$\mathrm{ValidatedGeneticRecord}_{P,M}(r_D) \Longrightarrow \mathrm{ConstrainsGeneticWindow}_{P,M}(A, W_G). \tag{29}$$

Here W_G is a sampling and reconstruction window in the evidential domain, not a subset of the cosmic-stage identity domain. It may be broad because sampling is sparse, molecular alteration is progressive, a variant begins in a small cellular fraction, the selected assay omits the affected locus, mosaic distribution separates tissues, or the signal remains below the method's detection threshold.

Genetic detection does not compress genetic history into one stage

$$
\begin{aligned}
&\mathrm{GeneticDifferenceDetected}_{P,M}(r_2) \not\Rightarrow \exists! s \in I_A \ \ \mathrm{EntireGeneticAlterationOccurredAt}(A, s), \\
&\neg\, \mathrm{GeneticDifferenceDetected}_{P,M}(r_1) \not\Rightarrow \neg\, \mathrm{PhysReal}_A^{+}(s).
\end{aligned} \tag{30}
$$

Equation (30) shows why a later positive test may record the accumulated or progressively distributed result of molecular and lineage changes across many stages. The validated records can warrant a physically attributable genetic difference at the proper bearer level, but they do not show that the entire alteration arose instantaneously at detection, and a prior negative test does not by itself prove either complete stasis or one specified undetected mutation.

Biological organization and continuing identity

Living systems maintain organization through metabolism, exchange, repair, signalling, replication, regulated turnover, immune activity, and environmental engagement. Homeostasis is a dynamically maintained regime. Phenotypic persistence can therefore coexist with continuous molecular, cellular, and relational change.

The identity criterion must match the bearer. Replacement of molecules may preserve cellular or organismal identity; replacement of cells may preserve tissue identity; lineage divergence may physically end one lineage identity while establishing successor lineages, with the boundary warranted through domain-valid criteria and evidence. The framework separates persistence of organization from identity of constituents and separates termination of a bearer from annihilation of its physical material.

Biological life history as a domain-valid model

A complete organismal life history can provide a domain-valid model of identity onset, immediate onset realization, ordered biological succession, criterion-relative function and failure, recovery or recurrence, and identity termination where it occurs. The model is not a separate biological time and does not enumerate common cosmic stages. Biological phases such as development, maturity, disease, recovery, ageing, and terminal decline are coarse-grained classifications of many realized states within one identity domain.

Biological life-history model

For a study-qualified organism A satisfying $\mathrm{StudyQualified}_{P,M}(A)$ and with $s_A^0 = \min I_A$,

$$\mathrm{AdequateBiologicalHistoryModel}_{P,M}(A) \Longrightarrow \mathrm{Warrant}_{P,M}\begin{bmatrix} \mathrm{OnsetReal}_A(s_A^0), \\ \forall s \in I_A \;\; \mathrm{PhysReal}_A^{+}(s), \\ \mathrm{OrderedBiologicalSuccession}(A) \end{bmatrix}. \tag{31}$$

Disease may constitute failure only relative to a declared biological, physiological, regulatory, or clinical criterion κ:

$$\begin{aligned} &\mathrm{Disease}_{A,\kappa}(s) \wedge \mathrm{FailureCriterionMet}_{A,\kappa}(s) \Longrightarrow \mathrm{FunctionalFailure}_{A,\kappa}(s), \\ &\mathrm{FunctionalFailure}_{A,\kappa}(s) \not\Rightarrow \mathrm{End}_A(s). \end{aligned} \tag{32}$$

A diagnosis that remains unchanged across a clinical interval does not establish complete biological stasis. Conversely, disease, recovery, remission, and recurrence are ordered physical changes within the continuing history while the organismal identity persists. The history ends when the organismal identity physically ceases; the biological criterion and protocol provide fallible grounds for judging that boundary, and no universal calendar age fixes it. A century-scale interval may be used in an illustrative human dataset, but no fixed numerical age is a governing identity-termination condition.

Biological scale discipline

Microscopic and macroscopic descriptions possess equal logical standing when they match the bearer and claim. A macroscopic witness can establish macroscopic change. A molecular or genetic witness can establish localized change. Transfer across scales requires a physical bridge specifying containment, causal influence, sampling, organisation, or aggregation. This discipline allows the theory to be universal without flattening the hierarchy of biological and material systems.

10.3 Difficult-system classes

Purpose of difficult-class analysis

Universal continuing change cannot be supported only by obviously active systems. The strongest tests involve systems described as stable, stationary, isolated, in equilibrium, in a ground state, periodic, or long-lived. Each description must be translated into its actual physical and mathematical claim before it is treated as a possible counterexample.

Classical fixed points

A fixed point of a dynamical model satisfies

$$\dot{\boldsymbol{x}} = \boldsymbol{f}(\boldsymbol{x}) = 0. \tag{33}$$

The equation concerns model variables $\boldsymbol{x}$ under specified dynamics. To become a physically adequate adverse scenario for universal physical realization, one must show that $\boldsymbol{x}$ is bearer-complete, physically instantiated, identity-preserving at a later common cosmic stage, and unaffected by omitted variables, fluctuations, coupling, or model limits. A formal fixed point alone is not sufficient.

Thermodynamic equilibrium

Thermodynamic equilibrium is characterized by macroscopic conditions and extremal or balance relations. Microscopic descriptions may still include motion or fluctuations. Even if an ideal equilibrium model assigns stationary macroscopic variables, the ontology of the actual system must be examined. The claim "the temperature is constant" is weaker than "the complete physical state is equivalent."

Open-system steady states

An open system can maintain a stationary distribution while exchanges and transitions continue. In a master-equation description,

$$\frac{d\rho}{d\lambda} = \mathcal{L}(\rho), \qquad \mathcal{L}(\rho_{\mathrm{ss}}) = 0, \tag{34}$$

where λ is the model parameter and ρ_{ss} a steady state. The equation states stationarity under the generator. It does not prove absence of quantum jumps, environmental exchange, correlations, or unrepresented physical realization. Open quantum systems provide especially clear examples of stationary statistical description with ongoing interaction [19, 22, 20].

Stationary quantum states

For a strictly isolated system represented by a time-independent Hamiltonian, an energy eigenstate satisfies

$$\hat{H}|\psi\rangle = E|\psi\rangle, \qquad |\psi(t)\rangle = e^{-iEt/\hbar}|\psi(0)\rangle. \tag{35}$$

Here t is the evolution parameter of the quantum model and is not identified with T_{ITOF}. For a selected observable $\hat{O}$, one may obtain

$$\frac{d}{dt}\langle\hat{O}\rangle = 0. \tag{36}$$

The strict-isolation qualification specifies the idealized domain of the unitary expression; it does not establish that any concrete physical bearer is completely isolated. These equations state stationarity within a declared representation and selected observable set. ITOF does not infer bearer-attributable physical change merely from a global phase when the adopted interpretation supplies no physical distinction. It also does not infer complete physical stasis from stationary expectation values. The analysis must distinguish the state vector, the actual bearer, fields and boundary conditions, environmental coupling, relational degrees of freedom, the completeness of the observable set, and the identity criterion.

A stationary-state candidate is therefore a stringent test rather than a case dismissed by definition. CMA continues to govern the bearer as a physical system, but the type, content, magnitude, and mechanism of its bearer-specific change remain open wherever domain evidence does not determine them. A domain application of the UCC theorem must identify an actual physical route to continuing realization or state the unresolved bearer-complete obligation explicitly. No unspecified "hidden change" may be introduced merely to protect universality. Precision spectroscopy, quantum-jump observation, and environmental-coupling studies provide domain-specific evidence, but no single experiment closes every interpretive and class-level question [21, 22, 27, 28, 29, 30].

Experimentally isolated atoms and energy exchange

An experimentally isolated atom remains a physical system with its own physically realized identity and bearer boundary. Isolation does not establish complete physical stasis or remove every physical condition and relation; it places the atom within a newly defined experimental arrangement:

$$\mathrm{ExperimentallyIsolated}_P(A) \not\Rightarrow \mathrm{CompletePhysicalStasis}(A).$$

Whenever the atom emits or absorbs energy, undergoes an electronic or nuclear transition, ionizes, recombines, decays, or participates in an interaction, it undergoes actual physical change. For a later member of its identity history,

$$\begin{aligned} s \in I_A^{\mathrm{cont}} \wedge \Big[&\mathrm{EnergyEmission}_A(s) \vee \mathrm{EnergyAbsorption}_A(s) \vee \mathrm{ElectronicTransition}_A(s) \\ &\vee \mathrm{NuclearTransition}_A(s) \vee \mathrm{Ionization}_A(s) \vee \mathrm{Recombination}_A(s) \\ &\vee \mathrm{Decay}_A(s) \vee \mathrm{PhysicalInteraction}_A(s)\Big] \Longrightarrow \mathrm{AlterReal}_A(s). \end{aligned} \tag{37}$$

Such observations provide direct evidence of change under the stated conditions. They do not by themselves determine the complete change content of the atom at every common cosmic stage or prove unrestricted CMA or UCC from one experiment.

Casimir configuration as a boundary-conditioned quantum case

A Casimir configuration is useful because it separates a quantum-field calculation from temporal ontology. For ideal parallel plates of area A and separation a, the standard model gives

$$E_{\mathrm{Cas}} = -\frac{\pi^2 \hbar c}{720\, a^3} A, \qquad P_{\mathrm{Cas}} = -\frac{\pi^2 \hbar c}{240\, a^4}. \tag{38}$$

The calculated energy difference and pressure belong to the field–boundary system, its geometry, and the approximations of the model [18]. Variation of a, plate properties, temperature, or material response changes the physical configuration and predicted force. None of these quantities denotes a deformation, acceleration, or multiplication of time.

The case also disciplines universal-change reasoning. A stationary idealized Casimir model does not by itself establish complete stasis of the real field–boundary bearer, while the existence of a non-zero calculated pressure does not by itself prove continuing change in every component. The required analysis remains bearer-complete and distinguishes model stationarity, boundary-conditioned energy, material response, measurement interaction, and actual physical realization.

Ground states and vacuum descriptions

A ground state is lowest with respect to a Hamiltonian under specified boundary conditions. A vacuum state is defined within a field-theoretic representation. Neither phrase automatically denotes a physical system in complete stasis. Interactions, fluctuations, detector response, boundary changes, and representation dependence must be analysed. At the same time, V26/F6 must not use the words “vacuum fluctuation” as a universal placeholder that immunizes the principle. A claimed route must be physically specified and evidentially supported.

Stable particles and long-lived systems

Stability may mean no observed decay within a bound or exact stability under a theory. A stable particle can still participate in interactions, propagation, field relations, or composite systems. If the candidate is an exactly isolated stable particle in an unchanging state, the burden becomes sharply defined: does the complete physical bearer undergo any actual physical alteration while identity persists? The answer cannot be assumed from terminology alone.

Periodic and recurrent systems

Exact recurrence in model variables does not repeat the cosmic stage. A periodic oscillator undergoes successive physical states even when a coordinate repeats. Poincaré recurrence, where applicable, concerns return arbitrarily close to an earlier region of state space under restrictive conditions; it does not imply reversal of cosmic order or identity of the entire universe at two stages.

Geometrically stationary relativistic models

A stationary spacetime admits a timelike Killing structure in an appropriate region. This geometrical symmetry does not establish that all physical systems represented in the model are changeless, nor that the cosmic extension stops. The word “stationary” belongs to the metric symmetry and must not be transferred without analysis to temporal ontology.

Difficult-class conclusion

No difficult class is dismissed by definition. Each receives an explicit bearer, state, identity, model, evidence, and adverse-scenario analysis. This approach keeps restricted hypotheses operationally testable and the unrestricted universal claim scientifically accountable, while avoiding two errors: treating every stationary equation as proof of stasis, or invoking unspecified hidden processes whenever evidence is absent.

11. Ending of a System, Transformative Failure, and Successor Systems

11.1 Functional failure and identity ending

Functional failure alone does not necessarily end a system:

$$\mathrm{FunctionalFailure}_A(s) \not\Rightarrow \mathrm{End}_A(s).$$

Identity ends only when the physical conditions by which A remains that bearer cease to be realized. The relevant judgment is governed by the declared identity criterion and the bearer’s physical history. $\mathrm{IdentityEndingRealized}_A(e)$ names the ontological result that the identity ends; $\mathrm{TransformativeFailure}_A(e)$ names a physical path or mechanism that may ground that result. Neither is definitionally reducible to the other.

11.2 History-grounded endpoint

For a system whose identity actually ends, the ending stage is an attained last member of its identity domain:

$$\begin{aligned}\mathrm{End}_A(e_A) \iff e_A \in I_A \wedge \neg\exists u \in I_A\,(e_A \prec_C u)\\ \wedge\, \mathrm{IdentityEndingRealized}_A(e_A).\end{aligned} \tag{39}$$

Equation (39) makes the last-member condition an explicit bearer-ending commitment, not a theorem of arbitrary ordered subsets. V26/F6 does not assert that every bearer ends. Conditional uniqueness is

$$(\exists e_A \in I_A\ \ \mathrm{End}_A(e_A)) \Longrightarrow \exists! e_A \in I_A\ \ \mathrm{End}_A(e_A).$$

UCC neither requires nor causes an endpoint:

$$\mathrm{UCC}(A) \not\Rightarrow \exists e_A \in I_A\ \ \mathrm{End}_A(e_A).$$

11.3 Physical causes of transformative failure

Represent the high-level analytical factor description as the typed triple

$$\mathcal{F}_A(e_A) := (\mathcal{F}_A^{\text{int}}(e_A), \mathcal{F}_A^{\text{ext}}(e_A), \mathcal{F}_A^{\text{joint}}(e_A)).$$

The triple is not claimed to be a unique microphysical decomposition. It records internal, external, and inseparably coupled factors declared by the domain model. Where ordinary ending occurs,

$$\text{OrdinaryEnd}_A(e_A) \implies \text{FailureGround}(\text{End}_A(e_A), \mathcal{H}_A, \mathcal{F}_A(e_A))\,.$$

11.4 Successor systems and unified transformation formalism

Define

$$\text{Succ}(A, e_A) := \{B \mid \text{PhysicalSystem}(B) \wedge B \neq A \wedge \text{SuccessorOf}(B, A) \wedge \text{OnsetReal}_B(e_A)\}\,.$$

A general transformation is defined by

$$\begin{aligned}\text{TransformAt}(\mathcal{P}, e, \mathcal{Q}) \iff\ & e \in \mathcal{S}_C \wedge \varnothing \neq \mathcal{P} \subseteq \mathcal{U}_{\text{phys}} \wedge \varnothing \neq \mathcal{Q} \subseteq \mathcal{U}_{\text{phys}} \\ & \wedge \forall A \in \mathcal{P}\ \ \text{End}_A(e) \wedge \forall B \in \mathcal{Q}\ \ \text{OnsetReal}_B(e) \\ & \wedge \forall A \in \mathcal{P}\ \forall B \in \mathcal{Q}\ (A \neq B) \\ & \wedge \text{TransformationLink}(\mathcal{P}, e, \mathcal{Q}) \\ & \wedge \forall B \in \mathcal{Q}\ \ \text{PhysicalOriginLink}(\mathcal{P}, e, B).\end{aligned} \tag{40}$$

Here $\mathcal{P}$ is the predecessor set, $\mathcal{Q}$ is the successor set, and TransformationLink$(\mathcal{P}, e, \mathcal{Q})$ asserts the domain-warranted physical transformation relation connecting their ending and onset realizations. The accompanying PhysicalOriginLink clauses close the direct physical-origin relation from the predecessor set to every successor. This covers fragmentation, merger, one-to-one replacement, one-to-many branching, many-to-one formation, and many-to-many reorganization.

Ordinary ending with one predecessor is the special case of the same transformation formalism:

$$\text{OrdinaryEnd}_A(e_A) \iff \text{TransformativeFailure}_A(e_A) \wedge \text{TransformAt}(\{A\}, e_A, \text{Succ}(A, e_A))\,. \tag{41}$$

Equation (41) therefore entails $\text{End}_A(e_A)$, a nonempty successor set, a warranted transformation link, and $\text{OnsetReal}_B(e_A)$ for every successor $B \in \text{Succ}(A, e_A)$. It does not create a second ending route parallel to general transformation.

Principle 11.1 (In-universe ending closure)**.** Every physically realized identity ending within a continuing universe belongs to a warranted transformation event:

$$\begin{aligned}&\text{End}_A(e) \wedge \neg\,\text{UniverseEnd}(e) \\ &\qquad \implies \exists \mathcal{P}, \mathcal{Q}\ \ [A \in \mathcal{P} \wedge \text{TransformAt}(\mathcal{P}, e, \mathcal{Q})]\,.\end{aligned} \tag{42}$$

The principle excludes a bearer identity ending without transformation while the universe continues. The exceptional absolute universe-ending condition remains governed separately and concisely by Equation (43).

For every ordinary successor $B \in \mathrm{Succ}(A, e_A)$, identity origin, physical-history onset, and change begin immediately at e_A. The convention is explicitly stage-overlapping:

$$e_A \in I_A \cap I_B, \qquad A \neq B.$$

The stage is the last stage of the predecessor identity and the first stage of the successor identity. The commonality concerns only the cosmic stage: the predecessor identity ends and one or more new successor identities begin there. They do not share an identity or one physical history. In bearer-indexed form,

$$\widetilde{I}_A := \{(A, s) \mid s \in I_A\}, \qquad \widetilde{I}_B := \{(B, s) \mid s \in I_B\}, \qquad A \neq B \Longrightarrow \widetilde{I}_A \cap \widetilde{I}_B = \varnothing.$$

Even close similarity in composition, organization, function, or observable properties does not restore the predecessor identity:

$$\mathrm{Similarity}_\Gamma(A, B) \not\Rightarrow A = B.$$

There is no intervening empty stage, but there is also no reopening or continuation of the ended predecessor identity inside the successor.

When every declared predecessor has a physically realized history before a non-initial transformation stage, general transformation entails direct physical origin for each successor:

$$\begin{aligned} &\mathrm{TransformAt}(\mathcal{P}, e, \mathcal{Q}) \wedge \neg\, \mathrm{Initial}_C(e) \wedge \forall A \in \mathcal{P}\; \exists r \in I_A\, (r \prec_C e) \\ &\quad \Longrightarrow \forall B \in \mathcal{Q}\; \mathrm{OriginatesAt}(B, \mathcal{P}, e). \end{aligned}$$

The presence requirement in OriginatesAt is satisfied because every predecessor ends at e and therefore belongs to its identity domain at that stage. The common stage e is the attained ending member of each predecessor history and the onset member of each successor history; stage overlap does not merge bearer identities. The origin relation does not impose an artificial binary SuccessorOf relation between every successor and every predecessor in a many-bearer transformation.

At one common cosmic stage, any physically allowed number of distinct transformation events may occur. Millions of predecessor identities may end, millions of new identities may begin, and other systems may continue within their existing identities at that same stage. No equality of cardinalities is required:

$$|\mathcal{S}_{\mathrm{terminal}}(s)| \;\text{ need not equal }\; |\mathcal{S}_{\mathrm{onset}}(s)|\,.$$

For bookkeeping, define the role subsets

$$\mathcal{S}_{\mathrm{onset}}(s) := \{A \in \mathcal{S}_{\mathrm{phys}}(s) \mid \mathrm{OnsetReal}_A(s)\}, \qquad \mathcal{S}_{\mathrm{terminal}}(s) := \{A \in \mathcal{S}_{\mathrm{phys}}(s) \mid \mathrm{End}_A(s)\},$$

$$\mathcal{S}_{\mathrm{continuing}}(s) := \{A \in \mathcal{S}_{\mathrm{phys}}(s) \mid \mathrm{LaterInHistory}_A(s) \wedge \neg\, \mathrm{End}_A(s)\}.$$

These subsets classify bearer roles at s; common-stage membership neither merges distinct transformation events nor creates a shared bearer history. The theory does not infer a one-to-one balance between ending and originating identities.

11.5 Approximate prediction of ending

A declared physical model may predict an operational ending window:

$$\mathrm{PredictedEndWindow}_{P,M}(A, W_A).$$

Such a prediction is approximate and protocol-bounded. It does not identify one exact cosmic stage:

$$\mathrm{PredictedEndWindow}_{P,M}(A, W_A) \not\Rightarrow \exists! s \in \mathcal{S}_C \;\; \mathrm{ExactEndStage}_A(s).$$

11.6 Exceptional ending of the universe

The exceptional ending of the universe would be absolute cessation of all systems extant at a final stage, with no successors and no later cosmic stage:

$$\begin{aligned}
\mathrm{UniverseEnd}(s_*) \iff\; & s_* \in \mathcal{S}_C \wedge \mathcal{S}_{\mathrm{phys}}(s_*) \neq \varnothing \\
& \wedge \forall A \in \mathcal{S}_{\mathrm{phys}}(s_*) \;\; \mathrm{End}_A(s_*) \\
& \wedge \forall A \in \mathcal{S}_{\mathrm{phys}}(s_*) \;\; \mathrm{Succ}(A, s_*) = \varnothing \\
& \wedge \neg\exists \mathcal{P}, \mathcal{Q} \;\; \mathrm{TransformAt}(\mathcal{P}, s_*, \mathcal{Q}) \\
& \wedge \neg\exists B, \mathcal{P} \;\; \big[\mathrm{OnsetReal}_B(s_*) \wedge \mathrm{OriginatesAt}(B, \mathcal{P}, s_*)\big] \\
& \wedge \neg\exists u \in \mathcal{S}_C \; (s_* \prec_C u).
\end{aligned} \tag{43}$$

Because CMA excludes empty stages, the final clause excludes later empty formal stages as well as later physical systems. The two preceding clauses exclude both general successor transformation and any non-transformative later-system onset at the final stage. The universe is not an additional bearer: this exceptional condition states the collective ending of every system then constituting it. ITOF does not otherwise model or elaborate the condition.

12. Observation, Measurement, Records, and Stage Restraint

12.1 Ontic occurrence and observational access

Physical realization and access to it are different propositions:

$$\mathrm{Occurrence}_A(s) \not\equiv_{\mathrm{type}} \mathrm{AccessToOccurrence}_{P,M}(A, r).$$

A bearer may undergo physical change without producing an accessible record under the chosen protocol. Nondetection does not establish absence of realization.

12.2 The measurement chain

A valid evidential chain requires a physical occurrence, interaction with an access channel, realization of a record carrier, extraction of a reading, and a validated inference. Each arrow is a declared physical or inferential relation rather than identity:

$$\text{Occurrence} \rightsquigarrow_{\text{phys}} \text{RecordRealization} \rightsquigarrow_{\text{phys}} \text{Reading} \rightsquigarrow_{\text{inf}} \text{Claim}\,.$$

The observer, instrument, laboratory, storage carrier, and environment are physical systems included in CMA whenever their identities are realized at the stage concerned. This fact is an internal consequence of CMA and is not used as independent evidence proving the axiom.

12.3 Records, stages, and typed realization

A physical record r and a cosmic stage s have different types:

$$\text{Type}(r) = \mathsf{PhysicalRecord}, \qquad \text{Type}(s) = \mathsf{CommonCosmicStage}, \qquad r \not\equiv_{\text{type}} s.$$

Nevertheless, a record may be physically realized in a declared record bearer or device D at a stage:

$$\text{RecordRealizedAt}_D(r, s).$$

Here D identifies the physical bearer in which the record state r is realized. This relation does not turn the record into the stage or make record order identical with cosmic-stage order.

12.4 Operational manifestations and candidate-stage inference

Examination observes noticeable manifestations and compares physical records. ITOF supplies no canonical, identity-preserving, or uniquely determining map from records to cosmic stages. A declared physical model may nevertheless provide a fallible candidate-stage inference:

$$\text{CandidateStages}^{A,\chi}_{P,M}(r) \subseteq \mathcal{S}_C.$$

Here A is the bearer or system to which the reconstruction is attributed, and χ is the target occurrence being reconstructed, such as source realization, emission, arrival, threshold manifestation, identity onset, or identity ending. Such a set may be empty, broad, or non-unique under the available evidence. It remains model- and protocol-dependent and does not identify r with any member of the set.

For a same-bearer comparison,

$$\begin{aligned}&\text{PositiveWitness}^{\Gamma}_{A,k,P,M,D}(r_1, r_2)\\ &\quad\Longrightarrow \text{ChangeWarrant}_{P,M}\Big[\text{NoticeablePhysicalDifference}^{\Gamma}_{A,k}(r_1, r_2)\Big]\,.\end{aligned}$$

A positive witness requires valid bearer attribution, a declared comparison criterion, and a difference exceeding accepted measurement uncertainty and operational variation.

12.5 Exact-stage restraint

The ontic existence of an onset, endpoint, or threshold-crossing stage is distinct from warranted knowledge of it. A finite record comparison does not justify a unique stage assignment:

$$\mathrm{ValidDifferenceWitness}_{A,P,M}(r_1, r_2) \nRightarrow \mathrm{WarrantedUniqueStageAssignment}_{P,M}(A, r_1, r_2).$$

This is an epistemic limit. It does not assert that no unique ontic threshold stage could exist under any physical model. It states that the finite protocol does not establish that stage exactly.

12.6 Past reconstruction and uncertainty

Past reconstruction may use propagation models, provenance, calibration, decay, stratigraphy, genetic inheritance, or other physical relations. The output is a model-conditioned candidate history or stage set with declared uncertainty. Reconstruction never converts a record into the past occurrence itself and never gives a record the type of a cosmic stage.

13. Clocks, Operational Intervals, Rates, and Comparisons

13.1 Clocks as changing physical systems

Clock bearer and process

A clock is a physical system selected because some repeatable or modelled process can be converted into standardized records and numerical readings. The bearer may be an atomic transition, oscillator, resonator, rotating body, decay process, electronic circuit, or composite apparatus. The clock does not measure time itself. It realizes physical changes and produces records whose ordering and calibration provide standardized operational measurements. These measurements are valuable to human beings for comparing physical processes, coordinating activities, scheduling events, navigation, communication, and organizing individual and social life.

Let C denote the clock system, $\mathcal{X}_C$ its admissible physical-state domain, and $\Theta_{C,P}$ the relevant physical and protocol conditions, including environment, control fields, velocity, gravitational setting, coupling, device state, and record convention. Record production is typed by

$$\mathcal{R}_{C,P} : \mathcal{X}_C \times \Theta_{C,P} \longrightarrow \mathfrak{R}_{C,P}, \qquad r_C = \mathcal{R}_{C,P}(X_C, \Theta_{C,P})\,, \tag{44}$$

where $\mathfrak{R}_{C,P}$ is the clock-record domain. The expression is functional shorthand for a physical production process, not a claim that one isolated instantaneous state mechanically determines every record without dynamics.

Reading and calibration

Under protocol P, a clock record is mapped to a numerical codomain:

$$N_{C,P} : \mathfrak{R}_{C,P} \longrightarrow \mathbb{R}_P, \qquad n_C = N_{C,P}(r_C), \tag{45}$$

where $N_{C,P}$ includes counting, scale, unit, interpolation, correction, and reporting rules. Therefore

Clock outputs are operational measures, not time

$$n_C \not\equiv_{\text{type}} T_{\text{ITOF}}, \qquad r_C \not\equiv_{\text{type}} s, \qquad n_C \in \mathbb{R}_P. \tag{46}$$

Clock outputs support standardized measurement and the organization of human life; they do not measure time in itself or count cosmic stages.

Equal readings establish equality only within the declared reading protocol, while unequal readings quantify different physical clock outcomes within the common cosmic extension. The readings warrant protocol-relative numerical comparison and an operational window, while ontic stage identity remains distinct from that warrant.

Clock counts and cosmic-stage order

The succession of cosmic stages is not assumed discrete, countable, equally spaced, or instrumentally isolable. A clock counts selected physical cycles or transforms a continuous signal into a standardized output. It does not count the common cosmic stages. If one oscillator completes more cycles than another under different physical conditions, the result concerns the systems and their processes.

Drift, failure, and missing readings

Clock drift is a deviation of the physical system or its record mapping from the adopted standard. Malfunction, environmental sensitivity, decoherence, ageing, power interruption, or readout failure belongs to the clock and its conditions, not to time. The diagnostic chain is

$$\text{ClockDiscrepancy} \longrightarrow \text{ClockAssessment}(C, \Theta_{C,P}, P, r_C), \tag{47}$$

not a claim that the cosmic extension accelerated, slowed, or became discontinuous.

Ideal and real clocks

An ideal clock is a modelling limit in which the clock output tracks a defined theoretical quantity with stipulated accuracy. A real clock may deviate because of physical conditions. The distinction will be essential in the relativistic sections: proper time is a metric functional, while a real clock is a material system whose output is modelled as approximately or ideally related to that functional. Dynamical analyses of rods and clocks illustrate why material behaviour and metric representation must not be collapsed into one ontological category [9, 10]; ITOF nevertheless rejects their use to establish a relativistic identity of time.

13.2 Operational intervals, rates, and cross-system comparison

Operational order

Records can be ordered by a protocol without being cosmic stages. Let

$$r_1 \lhd_P r_2 \tag{48}$$

mean that protocol P places record r_1 before record r_2. The grounds may be detector architecture, causal chain, storage order, signal sequence, or another validated rule. The relation is epistemic-operational and must not be confused with the foundational cosmic relation $\prec_C$, although a valid physical argument may support consistency between them in a specific case.

Operational interval

For clock C and two clock records $r_{C,1} \lhd_P r_{C,2}$, define

$$\Delta N_{C,P} := N_{C,P}(r_{C,2}) - N_{C,P}(r_{C,1}). \tag{49}$$

This is a numerical interval in the clock's reporting scale. It is not an amount of cosmic extension. It can be compared, transformed, calibrated, and used in laws because the protocol gives it operational meaning.

Rates

Let $\widehat{Q}_{A,P} : \mathfrak{R}_{A,P} \to \mathbb{R}_{Q,P}$ be a protocol-defined measurement or estimation map from sample records to numerical values. For a valid protocol pairing of two sample records with two clock records, define

$$\Delta_P Q_A := \widehat{Q}_{A,P}(r_{A,2}) - \widehat{Q}_{A,P}(r_{A,1}), \tag{50}$$

$$\Delta_P N_C := N_{C,P}(r_{C,2}) - N_{C,P}(r_{C,1}), \tag{51}$$

$$\overline{v}^{\,P}_{Q_A|C} := \frac{\Delta_P Q_A}{\Delta_P N_C}, \qquad \Delta_P N_C \neq 0. \tag{52}$$

The construction operates only on numerical outputs in declared codomains. It neither subtracts complete physical states nor divides by time itself.

Cross-system comparison

Two clocks may use different native readings and units. A comparison protocol P_{12} maps them into a common numerical codomain $\mathbb{R}_{P_{12}}$:

$$\Gamma_{i,P_{12}} : \mathrm{Range}(N_{C_i,P_i}) \longrightarrow \mathbb{R}_{P_{12}}, \qquad i \in \{1,2\}. \tag{53}$$

The differential output is

$$\Delta N^{(P_{12})}_{C_1C_2} := \Gamma_{1,P_{12}}(n_{C_1}) - \Gamma_{2,P_{12}}(n_{C_2})\,. \tag{54}$$

A non-zero value can reflect differing worldlines, environments, mechanisms, calibration, or device behaviour. It does not entail two cosmic extensions:

$$\Delta N_{C_1C_2}^{(P_{12})} \neq 0 \nRightarrow \text{MultipleCosmicExtensions}\,. \tag{55}$$

13.3 Atomic-clock differential outputs and the temporal-attribution boundary

High-precision atomic-clock comparisons instantiate this type boundary directly [23, 24, 25, 26]. A comparison produces two physical clock outputs and one protocol-defined numerical difference:

$$n_{C_1} = N_{C_1,P_1}(r_{C_1}), \qquad n_{C_2} = N_{C_2,P_2}(r_{C_2}), \qquad \Delta N_{C_1C_2}^{(P_{12})} = \Gamma_{1,P_{12}}(n_{C_1}) - \Gamma_{2,P_{12}}(n_{C_2}). \tag{56}$$

These are, respectively, outputs of two independently realized clock histories and the result of a declared comparison map. The experiment does not additionally deliver an independently observed object called time.

Atomic-clock outputs do not acquire temporal identity

$$n_{C_1} \not\equiv_{\text{type}} T_{\text{ITOF}}, \qquad n_{C_2} \not\equiv_{\text{type}} T_{\text{ITOF}}, \qquad \Delta N_{C_1C_2}^{(P_{12})} \not\equiv_{\text{type}} T_{\text{ITOF}}. \tag{57}$$

When $\Delta N_{C_1C_2}^{(P_{12})} \neq 0$, the directly warranted conclusion is that the two clock systems produced different physical outcomes under the stated bearer conditions, trajectories, interactions, calibrations, and protocols. The measurement itself supplies no non-arbitrary rule by which one output becomes "time" while the other becomes a deviation from time. Treating both outputs as distinct times would replace the fixed, irreversible, and uninterrupted succession and ordering of the common cosmic stages with device-indexed temporal identities, a conclusion neither measured nor licensed by the comparison.

A relativistic or other quantitative model may predict the difference and may attain model-bounded calculational adequacy for the selected records. Such agreement remains a relation among a model, two material clock systems, and their records. It does not transfer the type of time to either output, does not make the difference a physical alteration of time, and does not determine the common cosmic stage. The general ruling on predictive utility is stated in Subsection 17.5, and the detailed clock-experiment reclassification is developed in Subsection F.1.

Operational comparison and common cosmic-stage participation

V26/F6 compares clock records and numerical readings under a declared protocol. Signal exchange and coordinate conventions organise the comparison and delimit operational windows. Common-stage unity belongs to the already defined cosmic domain and order. CMA states that all physical systems whose identities are then realized are present at that same common stage and each realizes its own bearer-specific change there. Finite clock and signal records remain limited to operational windows and do not, by themselves, warrant a unique common cosmic stage of noticeability.

14. Light, Distance, and Remote Physical Records

14.1 Light as a physical factor and carrier

In the present analysis light is treated as a physical factor and carrier of records rather than as a clock or a temporal substance. A luminous source is a structured physical system. Its physical realizations alter emission properties; radiation propagates; a detector undergoes interaction and produces records. The chain is

$$\begin{aligned} \mathrm{PhysReal}_S^{+}(s) &\rightsquigarrow_{\mathrm{phys}} \mathrm{Emission}_S \rightsquigarrow_{\mathrm{phys}} \mathrm{Propagation}_L \\ &\rightsquigarrow_{\mathrm{phys}} \mathrm{Detection}_D \rightsquigarrow_{\mathrm{phys}} \mathrm{RecordState}_D(r_D). \end{aligned} \tag{58}$$

Each arrow represents a physical relation requiring a domain model. The emitted radiation is not the source change itself, and the detector record is not the original source state.

14.2 Continuous flux and successive records

Astronomical sources generally supply continuing flux rather than one isolated "light" followed by another as separate substances. Successive portions of that flux carry information about successive physical conditions of the source. The detector samples and integrates the arriving flux according to its response. The source can therefore be observed to change over days, months, or longer after radiation from it becomes available to the detector. Successive variability is governed by the emission spacing together with the differential propagation term between records; propagation contributions common to both records cancel in the difference.

Under protocol P,

$$\Delta t_{\mathrm{arr}}^{(P)} = \Delta t_{\mathrm{emit}}^{(P)} + \Delta\Pi^{(P)}. \tag{59}$$

If successive records follow effectively the same path through sufficiently stable conditions, then

$$\Delta\Pi^{(P)} \approx 0, \qquad \Delta t_{\mathrm{arr}}^{(P)} \approx \Delta t_{\mathrm{emit}}^{(P)}. \tag{60}$$

The approximation is physical and protocol-specific. Lensing, moving media, dispersion, path changes, scattering, and detector processing may make $\Delta\Pi^{(P)}$ non-negligible.

14.3 Remote records and the common stage

The arrival of a record does not bring the source's earlier cosmic stage into the detector. The source system realized its bearer-specific change at the common cosmic stage of emission; the detector realizes its own change at a later common stage when the signal is recorded. The record physically preserves information through propagation, but it does not preserve the stage as an object.

Accordingly, a remote record supports a model-bounded reconstruction window:

$$\mathrm{RemoteRecordOf}(r, S) \wedge \mathrm{ValidPropagationModel}_P \Longrightarrow \mathrm{ConstrainsSourceWindow}_P(r, W_{S,P}). \tag{61}$$

The reconstruction estimates emission coordinates or source history with stated uncertainties and yields a model-bounded source window in the model's coordinate or reconstruction domain. A declared physical bridge may additionally return a non-unique candidate set of cosmic stages, but no such set is canonical and no record becomes a stage. The represented history is connected to the model by $\mathcal{M}_{\mathrm{rel},A}$, while the source's bearer-specific realization at a common cosmic stage remains ontically distinct from the record. A unique exact-stage assignment requires an additional validated uniqueness warrant that the record alone does not supply.

14.4 Distance and the Cosmic Moment Axiom

Distance has no role in whether extant systems are present at the same common cosmic stage or whether each realizes its bearer-specific change under CMA. It governs whether, when, and how another system receives information about that change. Finite signal speed therefore constrains evidence and physical influence. No signal transmits, creates, or causes common-stage presence or the physical change realized by the source.

14.5 Astrophysical variability and identity transformation

Modern surveys and observatories record variable stars, transients, oscillations, stellar activity, and other changing sources across repeated observations [34, 35, 36, 53]. These data strongly demonstrate continuing physical change in remote systems and the usefulness of successive records. They do not enumerate every realization or directly identify cosmic stages. Their role in ITOF is evidential: they show that distance and long propagation do not imply that only one immutable source state can ever be observed.

Stellar evolution supplies a domain-valid identity history. Some massive stars undergo terminal collapse or explosive transformation, with the former stellar identity giving way to one or more successor systems such as a compact remnant and expanding ejecta; the detailed outcome is bearer- and model-dependent [32]. Galactic systems require a different identity criterion. Galaxies do not generally "explode" as single bearers; close interaction, tidal disruption, material redistribution, and merger may preserve, divide, or terminate prior galactic identities and establish successor organizations [33]. In both cases, constituent persistence does not imply persistence of the predecessor identity.

Astrophysical history and successor systems

For a stellar or galactic bearer A under an explicit astrophysical identity criterion, the astrophysical model is distinct from the biological model because its bearer criteria and realization mechanisms are different. Its common ITOF consequences are

$$\begin{gathered}\mathrm{AdequateAstrophysicalHistoryModel}_{P,M}(A)\\ \Longrightarrow \mathrm{Warrant}_{P,M}\begin{bmatrix}\mathrm{OnsetReal}_A(s_A^0),\\ \forall s\in I_A\ \ \mathrm{PhysReal}_A^+(s)\end{bmatrix}.\end{gathered} \tag{62}$$

When a terminal transformation is warranted, the ontic relation is

$$\begin{gathered}\mathrm{TerminalTransformation}_A(e_A)\\ \mathrm{End}_A(e_A)\wedge \mathrm{Succ}(A,e_A)\neq\varnothing,\\ \Longrightarrow \forall B\in \mathrm{Succ}(A,e_A),\quad \mathrm{OnsetReal}_B(e_A),\\ \mathcal{H}_B\neq\mathcal{H}_A.\end{gathered} \tag{63}$$

This proposition does not require every stellar or galactic change to terminate identity. Variability, oscillation, mass loss, activity, or morphological evolution may occur while the bearer identity physically persists under the declared evidential judgment. Identity termination is asserted only when the bearer identity is warranted to have physically ceased.

14.6 Source, propagation, and reception differences

For two records emitted by a remote source and received by a detector, the operational difference obeys the accounting relation

$$\Delta_{\mathrm{rec}}=\Delta_{\mathrm{src}}+\Delta_{\mathrm{prop}}. \tag{64}$$

When the propagation contribution is common or independently corrected, the large shared travel interval cancels from the comparison and the residual record separation estimates the source-event separation under the declared model. Light remains a physical carrier of records. It does not carry time or the common cosmic stage, and delayed access to a remote history does not place the remote bearer in a private time.

15. Predictive Use of Individual Physical History

15.1 Ontic history prefix and predictive reconstruction

For an ontic stage $s\in I_A$, define the identity-domain prefix

$$I_A^{\leq s}:=\{r\in I_A \mid r=s\ \vee\ r\prec_C s\}, \tag{65}$$

and the corresponding physical-history prefix

$$\mathcal{H}_A^{\leq s}:=\left(I_A^{\leq s},\ \prec_C|_{I_A^{\leq s}},\ X_A|_{I_A^{\leq s}}\right). \tag{66}$$

This is an ontic part of the bearer's actual physical history, not a detector record or an evidential reconstruction.

Prediction ordinarily lacks direct access to that complete prefix. Let u be a declared operational data cutoff in protocol P, and let

$$\widehat{\mathcal{H}}^{\leq u}_{A,P,M} \tag{67}$$

denote the protocol- and model-conditioned reconstruction warranted by records available no later than u. Likewise, $\widehat{\mathcal{G}}_{A,P,M}(u)$ denotes the available reconstruction of the bearer's state, constitution, and actual engagements at that cutoff. Their types remain distinct:

$$\mathrm{Type}\Big(\mathcal{H}^{\leq s}_{A}\Big) = \mathsf{OnticPhysicalHistoryPrefix}, \tag{68}$$

$$\mathrm{Type}\Big(\widehat{\mathcal{H}}^{\leq u}_{A,P,M}\Big) = \mathsf{ProtocolModelHistoryReconstruction}, \tag{69}$$

so that

$$\widehat{\mathcal{H}}^{\leq u}_{A,P,M} \not\equiv_{\text{type}} \mathcal{H}^{\leq s}_{A}. \tag{70}$$

The cutoff u and the reconstructed prefix need not assign a unique common cosmic stage. They belong to the evidential layer and are connected to ontic claims only through declared inference bridges.

15.2 Prediction origin, future target window, and outcome variables

At the ontic formulation level, let $s_\star \in I_A$ be a prediction-origin stage and let

$$J^{+}_{A}(s_\star) \subseteq \{v \in \mathcal{S}_{\mathrm{C}} \mid s_\star \prec_C v\} \tag{71}$$

be a predeclared future target window. At the ontic formulation level, define the distinct binary targets

$$Y^{J^+}_{\text{fail}}(A) := \mathbf{1}\Big[\exists v \in J^{+}_{A}(s_\star) \cap I_A \ \ \mathrm{FunctionalFailure}_A(v)\Big], \tag{72}$$

$$Y^{J^+}_{\text{end}}(A) := \mathbf{1}\Big[\exists v \in J^{+}_{A}(s_\star) \ \ \mathrm{End}_A(v)\Big]. \tag{73}$$

Failure and identity cessation are therefore separate predictive outcomes. When cessation is warranted only at an unresolved upper cut rather than at a represented stage, the experimental target must be formulated as a protocol-defined boundary-window outcome and must not claim exact stage resolution.

In an operational implementation, the cutoff u and the future evaluation window are fixed in the protocol's native order. Every predictor, reconstruction, calibration choice, and model-selection operation must use information available at or before u; no record from the future target window may enter model construction, tuning, or preprocessing.

15.3 Class-only and history-informed models

Let the common baseline information be

$$\mathcal{Z}_{A,P,M}(u) := \Big(\mathcal{C}_A, \widehat{\mathcal{G}}_{A,P,M}(u), D_A\Big), \tag{74}$$

where $\mathcal{C}_A$ is class information and D_A contains the declared data, calibration, uncertainty, and admissibility conditions. The two comparison models are

$$M_{\text{class}} := \mathfrak{M}_0(\mathcal{Z}_{A,P,M}(u); D_{\text{train}}), \tag{75}$$

$$M_{\text{hist}} := \mathfrak{M}_1\Big(\mathcal{Z}_{A,P,M}(u), \widehat{\mathcal{H}}^{\leq u}_{A,P,M}; D_{\text{train}}\Big), \tag{76}$$

$$M_{\text{abl}} := \mathfrak{M}_1\Big(\mathcal{Z}_{A,P,M}(u), \mathcal{A}\Big(\widehat{\mathcal{H}}^{\leq u}_{A,P,M}\Big); D_{\text{train}}\Big). \tag{77}$$

Here $\mathcal{A}$ is a preregistered control that removes, order-disrupts, or replaces historical input while preserving the history-capable architecture, tuning budget, cutoff, and evaluation protocol. The class-only model supplies an external benchmark; the ablation comparison tests the incremental contribution of historical information.

For a predeclared higher-is-better score, define the external benchmark difference and the architecture-controlled history contribution by

$$\Delta_{\text{pred}} := \text{Score}(M_{\text{hist}}; D_{\text{test}}) - \text{Score}(M_{\text{class}}; D_{\text{test}}), \tag{78}$$

$$\Delta_{\text{hist}} := \text{Score}(M_{\text{hist}}; D_{\text{test}}) - \text{Score}(M_{\text{abl}}; D_{\text{test}}). \tag{79}$$

A specific contribution from historical information is accepted only under a predeclared decision rule, for example

$$\Delta_{\text{hist}} > \delta_{\text{hist}}, \qquad \delta_{\text{hist}} \geq 0, \tag{80}$$

with an uncertainty analysis appropriate to the declared score and sampling design. Model-selection and uncertainty procedures must be stated rather than chosen after inspection [17, 16].

The class-only comparison tests the history-informed configuration against a nonhistorical benchmark; the ablation comparison isolates the declared historical input under a fixed architecture. Neither result proves ontological independence, establishes CMA exclusively, or determines an ontic endpoint. Prediction remains conditional on data quality, reconstruction validity, model adequacy, and the target window.

16. Empirical Access, Restricted Testability, and Evidential Architecture

16.1 Test-status discipline

Under the following test-status discipline, CMA and UCC have universal ontological scope, whereas direct experimental decisions concern declared restricted hypotheses or restricted empirical consequences of UCC. No finite protocol can inspect every physical system at every common cosmic stage, prove universal stage presence, or exhaust every bearer variable. The empirical architecture therefore keeps five layers formally distinct.

1. Preregistered restricted operational hypothesis.

The hypothesis is specified before evidence inspection and does not contain the later decision. Its functional form preregisters the protocol, model, variables, threshold, bearer, window, and valid-comparison rule. For the accepted evidence supplied at layer 3, define

$$\mathcal{C}_{A;P,M,V,J} := \left\{(r_i, r_j) \in \mathcal{E}^2_{A,P,M,V,J} \mid r_i \neq r_j \wedge \mathrm{ValidComparison}_{A,P,M,V,J}(r_i, r_j)\right\}. \quad (81)$$

Operational stasis means only that the declared protocol contains at least one valid comparison and that every such accepted comparison remains at or below the declared resolution threshold:

$$\begin{aligned} \mathrm{OperationalStasis}_{A;P,M,V,\varepsilon,J} \iff & \mathcal{C}_{A;P,M,V,J} \neq \varnothing \\ & \wedge \forall (r_i, r_j) \in \mathcal{C}_{A;P,M,V,J},\ d_{M,V}(O(r_i), O(r_j)) \leq \varepsilon. \end{aligned} \quad (82)$$

The preregistered restricted operational no-stasis hypothesis is therefore

$$H^{\mathrm{OpNS}}_{A;P,M,V,\varepsilon,J} \iff \exists (r_i, r_j) \in \mathcal{C}_{A;P,M,V,J}\left[d_{M,V}(O(r_i), O(r_j)) > \varepsilon\right]. \quad (83)$$

It is an operational hypothesis defined over distinct accepted record comparisons under the declared protocol, model, variables, threshold, bearer, and window. It is not a bearer-state proposition independent of evidence, and it is not an indexed ontological UCC. In particular,

$$\mathrm{OperationalStasis}_{A;P,M,V,\varepsilon,J} \not\Rightarrow \mathrm{CompletePhysicalStasis}(A).$$

If no valid comparison exists, neither operational stasis nor the operational no-stasis hypothesis is established. The mandatory decision constraint is stated at the decision-rule layer below.

2. Study admissibility.

The qualifications required for the study are a separate proposition:

$$\begin{aligned} \mathrm{AdmissibleStudy}_{A,J,P,M} \iff & \mathrm{StudyQualified}_{P,M}(A) \\ & \wedge \mathrm{IdentityWarrant}_{A,P,M}(J) \\ & \wedge \mathrm{ProtocolAdequacy}_{P}(A, J) \\ & \wedge \mathrm{ModelScopeDeclared}_{M}(A, J) \\ & \wedge \mathrm{SensitivityAdequate}_{P,M}(A, J) \\ & \wedge \mathrm{ConfoundersControlled}_{P,M}(A, J). \end{aligned} \quad (84)$$

Admissibility neither asserts the hypothesis nor predetermines the outcome.

3. Observed evidence.

Let

$$\mathcal{E}_{A,P,M,V,J} := \{r \in \mathcal{R}_D \mid \mathrm{AcceptedRecord}_{A,P,M,V,J}(r)\}. \quad (85)$$

Here $\mathcal{R}_D$ is the record space of the declared record bearer or device D, and AcceptedRecord applies the preregistered provenance and quality conditions. The records and extracted observables are evidence objects, not decisions and not cosmic stages.

4. Declared decision rule.

A rule fixed before outcome interpretation maps the evidence to one of three restricted statuses:

$$\delta_{P,M,\varepsilon}(\mathcal{E}_{A,P,M,V,J}) \in \{\mathsf{support}, \mathsf{adverse}, \mathsf{inconclusive}\}. \quad (86)$$

The absence of a valid comparison requires an inconclusive restricted decision:

$$\mathcal{C}_{A;P,M,V,J} = \varnothing \Longrightarrow \delta_{P,M,\varepsilon}(\mathcal{E}_{A,P,M,V,J}) = \textsf{inconclusive}. \tag{87}$$

5. Restricted conclusion.

The study conclusion is the output of that declared rule under an admissible study:

$$\text{AdmissibleStudy}_{A,J,P,M} \Longrightarrow \text{StudyConclusion}_{A,P,M,V,\varepsilon,J} = \delta_{P,M,\varepsilon}(\mathcal{E}_{A,P,M,V,J}) \,. \tag{88}$$

The conclusion remains restricted to the bearer, identity warrant, variables, model, sensitivity, sampling, window, uncertainty, and protocol. A negative or inconclusive result does not entail $\neg\,\text{PhysReal}^{+}_{A}$, and a supportive result does not deductively prove CMA or unrestricted UCC.

16.2 New V26/F6 test programmes

The principal programmes are: (i) class-only versus history-informed prediction; (ii) multi-channel examination of apparently stable systems; (iii) onset observation testing whether identity realization and detectable change begin within the same protocol resolution; (iv) separation of functional failure from identity termination; (v) part–whole and nested-system attribution; (vi) remote-record reconstruction with explicit propagation corrections; and (vii) cross-domain synthesis of physical-system histories with declared class coverage, model dependence, and counterexample obligations.

For every programme, the protocol must state in advance the bearer, identity criterion, variables, model, sensitivity, sampling, uncertainty, adverse result, and allowed model revision. Adding an unconstrained variable only after a negative outcome does not count as confirmation.

16.3 Four levels of empirical claim

The empirical programme distinguishes:

(i) one physical change in one identified bearer;

(ii) continuing change in that bearer across a declared domain;

(iii) continuing change across a defined physical class;

(iv) universal change continuity across all physical systems.

Each level carries its own burden. A genetic variant warrants change in a molecule, cell, organism, or lineage only at the level supported by attribution. A class-level synthesis requires heterogeneous cases. Universal support requires a cumulative programme across classes and explicit treatment of difficult candidates.

16.4 Pre-registration of bearer, identity, domain, and adverse outcome

A strong test fixes before interpretation:

(1) the physical bearer A;

(2) the identity domain I_A and the domain-valid identity criterion used to evaluate IdCont_A;

(3) the ordered comparison domain J;

(4) the state components and quantities relevant to the claim;

(5) the access variables and detector model;

(6) the protocol P and inference model M;

(7) the uncertainty budget and decision rule;

(8) the outcome that would count against the claim.

The objects used in this test architecture have distinct types:

$$\begin{aligned}
\mathrm{Type}(H^{\mathrm{OpNS}}_{A;P,M,V,\varepsilon,J}) &= \textsf{PreregisteredRestrictedOperationalHypothesis}, && (89)\\
\mathrm{Type}(\mathcal{C}_{A;P,M,V,J}) &= \textsf{AcceptedComparisonSet}, && (90)\\
\mathrm{Type}(\mathrm{OperationalStasis}_{A;P,M,V,\varepsilon,J}) &= \textsf{ProtocolRelativeOperationalProposition}, && (91)\\
\mathrm{Type}(\mathrm{AdmissibleStudy}_{A,J,P,M}) &= \textsf{ProtocolRelativeAdmissibilityProposition}, && (92)\\
\mathrm{Type}(\mathrm{AdverseAdmissible}_{A,J,P,M}) &= \textsf{StrengthenedAdmissibilityProposition}, && (93)\\
\mathrm{Type}(\mathcal{E}_{A,P,M,V,J}) &= \textsf{PhysicalEvidenceSet}, && (94)\\
\mathrm{Type}(\delta_{P,M,\varepsilon}) &= \textsf{DeclaredDecisionRule}, && (95)\\
\mathrm{Type}(\mathrm{StudyConclusion}_{A,P,M,V,\varepsilon,J}) &= \textsf{RestrictedEvidentialConclusion}. && (96)
\end{aligned}$$

None creates ontic identity, constitutes physical stasis, or changes the universal scope of CMA and UCC.

Bearer-coverage adequacy.

For a preregistered restricted claim, $\mathrm{BearerCoverageAdequate}_{P,M}(A,J)$ is a protocol-relative evidential proposition asserting that the component, spatial, temporal, mechanism, identity, and attribution coverage required by that claim has been satisfied within the declared model, sensitivity, sampling, and uncertainty limits. Its acceptance criteria must be registered before outcome interpretation and remain specific to the bearer and claim; it does not assert metaphysically exhaustive access to the complete bearer state. Thus

$$\mathrm{Type}(\mathrm{BearerCoverageAdequate}_{P,M}(A,J)) = \textsf{ProtocolRelativeEvidentialProposition}. \quad (97)$$

Admissibility for an adverse conclusion is a strengthening of, not an alternative to, the general study-admissibility proposition:

$$\begin{aligned}
\mathrm{AdverseAdmissible}_{A,J,P,M} \iff{} & \mathrm{AdmissibleStudy}_{A,J,P,M}\\
& \wedge \mathrm{IdentityPersists}(A,J)\\
& \wedge \mathrm{BearerCoverageAdequate}_{P,M}(A,J)\\
& \wedge \mathrm{InferenceValidated}_{P,M}(A,J).
\end{aligned} \quad (98)$$

These are test qualifications rather than the adverse conclusion itself. Sensitivity and confounder control are inherited from AdmissibleStudy and are not duplicated in an independent system.

The decision rule must remain minimally compatible with the operational propositions while retaining an inconclusive option for unresolved uncertainty:

$$
\begin{aligned}
&H^{\mathrm{OpNS}}_{A;P,M,V,\varepsilon,J} \\
&\quad \Longrightarrow \delta_{P,M,\varepsilon}(\mathcal{E}_{A,P,M,V,J}) \in \{\mathsf{support}, \mathsf{inconclusive}\}, \\
&\mathrm{OperationalStasis}_{A;P,M,V,\varepsilon,J} \wedge \mathrm{AdverseAdmissible}_{A,J,P,M} \\
&\quad \Longrightarrow \delta_{P,M,\varepsilon}(\mathcal{E}_{A,P,M,V,J}) \in \{\mathsf{adverse}, \mathsf{inconclusive}\}.
\end{aligned}
\tag{99}
$$

For a preregistered restricted operational no-stasis hypothesis, an adverse conclusion may be stated as

$$
\begin{aligned}
&\mathrm{AdverseAdmissible}_{A,J,P,M} \wedge \delta_{P,M,\varepsilon}(\mathcal{E}_{A,P,M,V,J}) = \mathsf{adverse} \\
&\quad \Longrightarrow \mathrm{StudyConclusion}_{A,P,M,V,\varepsilon,J} = \mathsf{adverse}.
\end{aligned}
\tag{100}
$$

This conclusion is adverse to the declared restricted hypothesis, not by itself a proof that unrestricted physical change ceased. An empirical adverse scenario for unrestricted UCC would require warranted identity-preserving complete physical stasis, whereas a finite null record establishes only non-detection within its model, variables, sensitivity, sampling, and window.

Repeated adverse results from independent admissible protocols, broader bearer coverage, higher sensitivity, and different variable sets nevertheless impose cumulative empirical pressure. They narrow the defensible empirical scope of the universal claim and may require revision of auxiliary models or of the foundational claim if a warranted bearer-complete stasis case is established. The framework may not neutralize every adverse result by introducing unspecified hidden change. Thus non-detection does not prove stasis, but it remains scientifically consequential evidence within its declared limits.

16.5 Positive witnesses

A positive witness is a physically attributable record-level difference under a declared comparison criterion. For a record channel or bearer component k, define

$$
\begin{aligned}
&\mathrm{PositiveWitness}^{\Gamma}_{A,k,P,M,D}(r_1,r_2) \Longleftrightarrow \mathrm{SameBearerRecords}_{A,P,M}(r_1,r_2) \\
&\quad \wedge \mathrm{DeclaredCriterion}(\Gamma_{A,k},P,D) \wedge \mathrm{ValidAttribution}_{A,P,M}(r_1,r_2;k) \\
&\quad \wedge d_{P,D_k}(O_{A,k,P}(r_1), O_{A,k,P}(r_2)) > \varepsilon_{A,k,P,D_k}.
\end{aligned}
\tag{101}
$$

Here d_{P,D_k} is the declared comparison rule and ε_{A,k,P,D_k} includes the accepted measurement uncertainty and operational variation for that channel. The witness therefore does not reduce to an arbitrary numerical difference. It requires the same bearer, valid attribution, a declared criterion, and a difference beyond the accepted uncertainty and operational variation.

The warranted conclusion is

$$
\begin{aligned}
&\mathrm{PositiveWitness}^{\Gamma}_{A,k,P,M,D}(r_1,r_2) \\
&\quad \Longrightarrow \mathrm{ChangeWarrant}_{P,M}\Big[\mathrm{NoticeablePhysicalDifference}_{A,k,P,M}(r_1,r_2)\Big].
\end{aligned}
\tag{102}
$$

If $k \in K(\Gamma_A)$, one such validated difference is sufficient to defeat equivalence under Γ_A for the bearer conditions represented by the compared records. This conclusion does not assign either record to a cosmic stage and does not identify the exact stage at which the change first became noticeable. Equivalence under a declared criterion requires equivalence across every component selected by that criterion; a single valid criterion-relevant difference defeats it.

16.6 Coverage and bearer completeness

Coverage has at least four dimensions:

(a) *component coverage*: which parts, fields, relations, and scales are accessed;

(b) *temporal coverage*: which operational windows and sampling gaps are included;

(c) *spatial coverage*: which regions, cells, tissues, surfaces, or remote source areas are sampled;

(d) *mechanism coverage*: which plausible physical routes could generate a difference outside the measured channels.

A claim of equivalence under the bearer-complete criterion Γ_A^{all} must justify all four dimensions relative to the bearer and declared domain. A null result in one channel supports a bounded statement about that channel.

16.7 Physical variables and access variables

Physical variables belong to the bearer: composition, structure, field values, spatial relations, molecular sequences, energy distributions, correlations, and processes. Access variables belong to the measurement chain: sensitivity, integration duration, calibration, sampling, propagation, alignment, reconstruction priors, selection rules, and model assumptions. Their separation prevents an access limitation from being reported as a bearer property.

16.8 Independent evidential channels

Convergent evidence is strongest when channels depend on different physical aspects and different failure modes. Material tests may combine spectroscopy, microscopy, mass change, mechanical response, chemical products, and surface analysis. Genetic tests may combine sequencing technologies, allele-specific assays, lineage reconstruction, imaging, and functional measurements. Astronomical tests may combine photometry, spectroscopy, timing, polarization, and independent instruments.

Independence is physical and methodological, not merely statistical. Shared sample preparation, calibration, model priors, or propagation assumptions can correlate nominally different records and must be reported.

16.9 Outcome classes

Every test reports one of four principal outcomes:

(a) *validated difference*: one or more witnesses establish bearer-specific non-equivalence;

(b) *bounded equivalence*: selected variables remain equivalent within declared sensitivity and coverage;

(c) *unresolved outcome*: data, attribution, identity, or coverage remain insufficient for either conclusion;

(d) *adverse restricted result*: an admissible null or contrary result defeats a preregistered operational hypothesis relative to its fixed model, variables, sensitivity, sampling, interval, and decision rule.

The fourth outcome challenges the restricted operational hypothesis within its validated scope. It does not convert a bounded null into proof of complete physical stasis. The second and third outcomes delimit present knowledge and guide stronger tests.

16.10 Operational ordering and stage restraint in experiments

Experiments may order records within a declared protocol and compare the noticeable outputs represented by those records. They do not order cosmic stages by measurement and do not identify records with cosmic stages; any candidate-stage inference is model-bounded and non-unique:

$$\begin{aligned} &\mathrm{OperationallyOrdered}_P(r_1, r_2) \wedge \mathrm{ValidatedDifference}_{A,P,M}(r_1, r_2) \\ &\implies \mathrm{Warrant}_{P,M}\Big[\mathrm{NoticeablePhysicalDifference}_{A,P,M}(r_1, r_2)\Big]. \end{aligned} \tag{103}$$

The validated comparison warrants a noticeable, physically attributable difference within the declared protocol and model. A time stamp, exposure interval, sequencing date, clock reading, or arrival coordinate belongs to the operational ordering of records; it does not identify a unique common cosmic stage at which the continuously developing change became noticeable.

16.11 Class-level synthesis

A class synthesis states:

(1) the class definition and bearer criteria;

(2) the tested subclasses and sampling limits;

(3) the physically distinct realization routes;

(4) the strongest supporting evidence;

(5) the difficult and unresolved candidates;

(6) the adverse result capable of revising the class claim.

The synthesis gains force through diversity of mechanisms and independent methods rather than through repetition of similar examples.

Cross-domain coverage predicate.

For the class-level synthesis below, define

$$\mathrm{CrossDomainCoverageAdequate}(\mathfrak{D}_{\mathrm{cov}}, \boldsymbol{\Pi}_{\mathrm{cov}})$$

as a protocol-relative evidential proposition requiring declared domain and subclass boundaries, bearer-selection and sampling rules, model assumptions, unresolved candidates, admissible adverse outcomes, and limits of generalization. Formally,

$$\mathrm{Type}(\mathrm{CrossDomainCoverageAdequate}(\mathfrak{D}_{\mathrm{cov}}, \boldsymbol{\Pi}_{\mathrm{cov}})) = \mathsf{ProtocolRelativeEvidentialProposition}. \tag{104}$$

It neither asserts exhaustive coverage of nature nor converts one exemplar per class into a universal class theorem. Each protocol instantiating this predicate must preregister its domain-selection rule, nonredundancy criterion, bearer-class coverage, instrument and model validation, treatment of null and unresolved outcomes, and a stopping or sufficiency rule. No universal adequacy threshold is supplied by the predicate name itself.

16.12 Cross-domain convergence among physical-system histories

The reconstructed evidence concerning the physical histories of systems across the universe is not an archive of one immutable condition. Under explicit observational and model assumptions, cosmic-background measurements, cosmological reconstruction, stellar populations and evolution, galactic interaction, planetary and geophysical records, material transformation, genetic succession, and organismal life histories disclose compared and physically attributable differences across bearer classes and scales [31, 32, 33, 34, 35, 52, 50, 43, 44]. These records are evidential reconstructions, not common cosmic stages, and their model dependence grants no metric, coordinate, or relativistic quantity temporal authority.

The evidential force lies in convergence among physically and methodologically distinct channels. The covered classes exhibit both identity-preserving alteration and, in warranted cases, identity-ending transformation into successor systems. The latter is not imposed on every change: a bearer may undergo extensive physical alteration while its bearer identity physically persists, as warranted under the declared evidential comparison and attribution criteria.

Cross-domain convergence warrant for physical-system histories

Let $\mathfrak{D}_{\mathrm{cov}}$ be the explicitly covered bearer classes and let

$$\boldsymbol{\Pi}_{\mathrm{cov}} := (\Pi_{\mathrm{sample}}, \Pi_{\mathrm{model}})$$

collect the declared sampling and model protocols. Define $\mathcal{W}_{\mathrm{CD}}$ as a coverage-qualified cross-domain warrant concerning physical-system histories combining independent channels, declared bearer identities, CrossDomainCoverageAdequate, and compared noticeable physical differences in the covered classes.

$$\begin{aligned}\mathcal{W}_D(P, M) \iff &\exists A_D \in D\ \exists k_D\ \exists \rho_{D,1}, \rho_{D,2} \\ &\wedge \mathrm{PositiveWitness}^{\Gamma}_{A_D,k_D,P,M,D}(\rho_{D,1}, \rho_{D,2}).\end{aligned} \tag{105}$$

$$\begin{aligned}\mathcal{W}_{\mathrm{CD}}(\mathfrak{D}_{\mathrm{cov}}; \boldsymbol{\Pi}_{\mathrm{cov}}) \iff\ &\mathrm{IndependentChannels}(\mathfrak{D}_{\mathrm{cov}}) \\ &\wedge \mathrm{CrossDomainCoverageAdequate}(\mathfrak{D}_{\mathrm{cov}}, \boldsymbol{\Pi}_{\mathrm{cov}}) \\ &\wedge \forall D \in \mathfrak{D}_{\mathrm{cov}}\ \mathcal{W}_D(P, M).\end{aligned} \tag{106}$$

Without this coverage qualification, one bearer per class yields only a diversity-based exemplar warrant, not class-level coverage.

Identity-ending transformation and successor claims require a declared bearer, an identity-ending criterion, physical evidence for transformation, and evidence for the onset of each proposed successor. Ontically, an ordinary predecessor ending and the onset of its successor system or successor systems occur at the same common cosmic stage. Evidentially, compared records may support transformation and successor-onset claims under declared identity and attribution criteria, but they do not identify the exact stage of the predecessor–successor boundary. Cross-domain convergence may therefore warrant successor histories without converting a sampled, recorded, or reconstructed difference into an exact stage assignment.

Let $\mathcal{W}^{\mathrm{emp}}_{\mathrm{succ}}$ denote cumulative empirical warrant for identity-ending transformation and successor histories under these restrictions. This warrant remains protocol-, model-, and bearer-bounded and does not establish an exact cosmic-stage boundary.

The UCC warrant does not deductively exhaust the unrestricted universal claim:

$$\begin{aligned}\mathcal{W}^{\mathrm{emp}}_{\mathrm{UCC,covered}}(\mathfrak{D}_{\mathrm{cov}}) \not\Rightarrow \forall A \Big[&\mathrm{PhysicalSystem}(A) \wedge I_A \neq \varnothing \\ &\Rightarrow \mathrm{UCC}(A)\Big].\end{aligned} \tag{107}$$

The box states two evidential consequences, not new cosmic axioms and not independent derivations of UCC. Continuing-change warrant does not require an identity-ending transformation witness, and transformation evidence is not imposed on every bearer history. Their force increases with class diversity, independent access routes, explicit identity criteria, adequate sampling and model coverage, and successful treatment of difficult candidates. A proposed exception must identify a physical bearer, preserve its identity across an extended history, and warrant complete physical invariance rather than constancy or non-detection in selected variables. Failure to validate such an exception does not by itself prove UCC; it leaves the positive cross-domain convergence unrebutted within the examined coverage.

16.13 Empirical limits on universal CMA and UCC claims

CMA states the presence and bearer-specific physical realization of every extant physical system at every common cosmic stage; the explicit presence conjunct is semantically emphatic and definitionally entailed by extant-system membership. UCC is the universal bearer-level consequence of Physical-System Realization together with CMA and IOC: nonemptiness permits IOC to supply the unique realized onset, after which CMA supplies physical realization at every later member of the bearer identity domain under the onset/continuation definitions; IDC separately excludes any internal identity gap. No bounded protocol can directly inspect the complete physical totality at every stage. Experimental work therefore tests restricted system-, class-, variable-, and model-bounded consequences.

A finite positive result supplies local or cumulative support; it does not prove the universal quantifier. A finite null result rejects only the declared restricted operational no-stasis hypothesis when its preregistered adequacy conditions are met. Broader pressure requires warranted identity persistence, exceptional bearer coverage, validated sensitivity, controlled confounding, and a physically adequate account of why no unmeasured or subthreshold realization remains. Even then, the evidential conclusion and the ontological claim retain different logical types.

Universal claims remain accountable to internal inconsistency, incompatible physical evidence, and adequately specified adverse physical scenarios. They are not insulated by an unconstrained appeal to hidden change. Difficult systems therefore remain an open research obligation rather than automatic confirmation.

16.14 Present-claim adequacy

V26/F6 states a universal foundational claim and supplies a systematic research programme for cumulative empirical assessment. The theory identifies positive witnesses, restricted operational hypotheses, difficult classes, exact-stage limits, cross-domain convergence, and relativistic boundaries. Reconstructed records from independent physical domains provide cumulative empirical warrant across the covered classes, while unrestricted UCC retains a clear adverse condition—warranted identity-preserving complete cessation of physical change. No finite historical archive exhausts the universal quantifier, and no finite null record can exclude every subthreshold, unmodelled, or unsampled difference. This architecture makes evidence cumulative and comparable while preserving the distinction between operational test failure, evidential convergence, and ontological non-occurrence.

17. Direct Ontological Confrontation with Relativity

17.1 Scope of the type-separation result

Within the canonical ITOF definitions and type system, relativistic coordinates, proper-time functionals, metric intervals, clock outputs, Lorentz transformations, and spacetime geometries are categorically distinct from T_{ITOF}. Numerical agreement, conventional use, or predictive fit cannot transfer temporal identity to those objects. The confrontation rejects compatibility, reconciliation, synthesis, ontological coexistence, and every claim of relativistic authority over the meaning or physical nature of time.

17.2 The exact object of confrontation

V26/F6 declares no compatibility with special relativity or general relativity and grants neither their geometry nor their equations confirmed authority over the physical nature of time or the universe. The formalisms examined originate in the foundational works of special and general relativity and in their standard geometrical development [4, 5, 8]; those sources identify the mathematical objects under criticism and are not invoked as authorities over ITOF. Broader philosophical treatments of space and time and the debate between geometrical and dynamical interpretations are cited only to locate the positions under examination [11, 12, 13]. The confrontation addresses both the ontological identity assigned to relativistic quantities and the unwarranted promotion of model-dependent calculations into claims about time itself.

ITOF recognizes the extensive scientific effort embodied in special and general relativity and the practical value of their mathematical formalisms in organizing and predicting declared relations among physical systems, particularly in studies of motion, gravitation, clock comparison, signal propagation, navigation, and astronomical observation. This recognition is confined to the historical, mathematical, and model-bounded operational contributions of relativity. It does not establish that coordinates, metric intervals, proper-time functionals, or spacetime geometry constitute time, and it implies no compatibility, reconciliation, synthesis, or ontological coexistence with the relativistic conception of time.

17.3 Relativistic formalisms under temporal-ontological exclusion

Relativistic equations are examined solely because they assign temporal meaning to coordinates, metric intervals, worldline functionals, clock outputs, and spacetime geometry. Their inclusion grants no physical authority to that temporal ontology. ITOF rejects the conversion of any coordinate assignment, metric relation, proper-time functional, clock reading, or geometrical construction into the definition or physical nature of time. Time is not a coordinate, proper time, a spacetime dimension, or a geometrically deformable entity. The cited sources identify the mathematical objects under criticism; they do not provide premises for compatibility, reconciliation, or ontological concession.

Relativistic formalisms introduce a family of model-defined mathematical, geometrical, and operational objects:

$$\mathcal{Q}_{\mathrm{rel}} = \{x^{\mu}, \Delta x^{\mu}, \tau[\gamma, g], g_{\mu\nu}, R^{\rho}{}_{\sigma\mu\nu}, G_{\mu\nu}, N_{C,P}, \nu, z, \dots\}. \tag{108}$$

Their types include coordinate components, interval constructions, worldline functionals, geometric fields, curvature tensors, clock-reading maps and outputs, and signal-frequency relations.

ITOF assigns the formal representation of time to a different type:

$$T_{\mathrm{ITOF}} \in \mathcal{T}_{\mathrm{ITOF}}, \qquad q \in \mathcal{Q}_{\mathrm{rel}} \Longrightarrow q \not\equiv_{\mathrm{type}} T_{\mathrm{ITOF}}, \tag{109}$$

where $\mathcal{T}_{\mathrm{ITOF}}$ is the type assigned to the fixed, irreversible, and uninterrupted succession and ordering of the common cosmic stages of change, which together constitute one common cosmic extension. This type boundary is a governing result of the confrontation; its scope is fixed in Subsection 17.1. A numerical fit, calculational use, or conventional acceptance of a relativistic quantity does not validate its temporal ontology or establish that its geometry corresponds to the physical nature of time. Relativistic formalisms define coordinate, metric, geometric, causal, signal, worldline, and clock relations inside their models; ITOF instead applies the canonical time definition in Section 4 (Definition 4.1), with $\prec_C$ separately ordering the fixed, irreversible, and uninterrupted succession and ordering of the common stages. Under the canonical ITOF type assignments, the definitions exclude a type-preserving identity between these domains:

$$\forall q \in \mathcal{Q}_{\mathrm{rel}}, \qquad \neg\exists\, \mathcal{B}_{\mathrm{id}} \ \ \mathrm{TypePreservingIdentityBridge}(q, T_{\mathrm{ITOF}}; \mathcal{B}_{\mathrm{id}}). \tag{110}$$

Coordinate transformations, proper-time functionals, metric curvature, and clock comparisons remain claims or calculations internal to the models that define them. Within V26/F6 they cannot acquire the identity of T_{ITOF} by notation, numerical fit, geometrical unification, convention, or dimensional extension.

17.4 Model fit, observation, and temporal identity

For a relativistic model M_{rel}, protocol P, and data D,

$$\mathrm{ApproximateFit}(M_{\mathrm{rel}}, P, D) \Longrightarrow \mathrm{ModelBoundedCalculationalAdequacy}_{P,D}(q; M_{\mathrm{rel}}), \tag{111}$$

where the conclusion is restricted to model-bounded calculational adequacy for the declared calculation and dataset. The fit is approximate and protocol-bounded. It neither identifies the complete physical cause of the output nor attributes change to time. No temporal ontology follows from it, and it establishes neither the physical completeness of the model nor the truth of its geometry nor any authority to define time. V26/F6 rejects the identity claim

$$q \equiv T_{\mathrm{ITOF}}$$

because the canonical definitions assign q and T_{ITOF} different objects, domains, relations, and predicates. Increased numerical precision can strengthen only the bounded fit of a declared calculation to a declared dataset; it does not confirm relativistic temporal ontology and cannot weaken this ontological exclusion.

17.5 Predictive utility and bearer-specific physical change

The predictive success of a relativistic formula must be attributed to the objects that are actually calculated and observed. Let $O^{\mathrm{obs}}_{A,P}$ denote a protocol-defined physical output of a physical bearer A, and let $\widehat{O}^{M_{\mathrm{rel}}}_{A,P}$ denote the corresponding output generated by a relativistic model from declared physical-history data, kinematic relations, gravitational assumptions, instrumental conditions, environmental parameters, and protocol rules. For a declared dataset and output type D, let $d_{P,D}$ be the predeclared comparison rule appropriate to scalar values, vectors, distributions, trajectories, classifications, or other admitted outputs, and let $\varepsilon_{P,D}$ be its acceptance bound.

The empirical comparison has the form

$$d_{P,D}\Big(O^{\rm obs}_{A,P}, \widehat{O}^{M_{\rm rel}}_{A,P}\Big) \le \varepsilon_{P,D} \Longrightarrow \text{ApproximateFit}(M_{\rm rel}, P, D). \tag{112}$$

The conclusion is substantial but bounded: the model has achieved an approximate, protocol-bounded fit for selected bearer outputs under the stated conditions, calibration, uncertainty, and domain. It does not by itself establish the complete physical cause or mechanism of those outputs, validate an unrestricted ontological interpretation, or attribute physical change to time. Time is not a causal participant in change. The causes, mechanisms, magnitudes, and physical contents of change remain properties of physical systems and their actual engagements.

Within ITOF, the observed output is a protocol-bounded record of a bearer condition. Let $W^{\rm obs}_P \subseteq \mathcal{O}_P$ be the operational observation-and-comparison window relevant to protocol P. The type boundary is

$$\text{Type}\Big(W^{\rm obs}_P\Big) = \mathsf{OperationalProtocolWindow}, \qquad \text{Type}(I_A) = \mathsf{CosmicStageIdentityDomain},$$

so that

$$W^{\rm obs}_P \not\equiv_{\rm type} I_A.$$

Its modelling may depend on the available records $\mathcal{R}_{A,P}$, a declared reconstruction of the bearer's physical history and grounding conditions, and declared conditions $\Theta_{A,P}$:

$$\widehat{O}^{M_{\rm rel}}_{A,P} = F_{M_{\rm rel},P}\Big(\mathcal{R}_{A,P}, \widehat{\mathcal{H}}_{A,P,M}, \widehat{\mathcal{G}}_{A,P,M}, \Theta_{A,P}\Big). \tag{113}$$

Equation (113) is a schematic predictive map from records, reconstruction, and declared conditions, not an ITOF dynamical law and not a stage-identification map. The detailed functional form, parameters, causal interpretation, and empirical warrant remain responsibilities of the domain model. Kinematic quantities such as velocity are relational descriptors of motion or history, not independent external forces. Gravitational fields, potentials, accelerations, trajectories, boundary conditions, and other engagements may enter a model only with their declared physical roles and attribution bridges.

Accordingly, successful prediction of clock, frequency, trajectory, decay, or signal outputs supplies positive empirical support for the bearer-level proposition that physical systems realize condition-sensitive outcomes through their distinct histories and actual engagements. This is the level at which ITOF locates physical change. The same success does not identify the output, the predictive quantity, or the difference between outputs with time:

$$O^{\rm obs}_{A,P} \not\equiv_{\rm type} T_{\rm ITOF}, \qquad \widehat{O}^{M_{\rm rel}}_{A,P} \not\equiv_{\rm type} T_{\rm ITOF}. \tag{114}$$

Nor does model adequacy make metric-deformation operations applicable to time:

$$\text{ApproximateFit}(M_{\rm rel}, P, D) \not\Rightarrow \Big[T_{\rm ITOF} \in \text{Dom}(\text{Dilation}) \vee T_{\rm ITOF} \in \text{Dom}(\text{Curvature})\Big]. \tag{115}$$

Any numerical use of a relativistic formula remains confined to the declared model, physical systems, records, and protocol. Navigation, synchronization, clock correction, trajectory calculation, and frequency prediction may employ empirically successful formulas only as model-bounded calculations of physical-system outputs. No such use transfers temporal identity to coordinates, metrics, worldline functionals, spacetime geometry, or clock readings, and no such use constitutes compatibility, reconciliation, synthesis, or ontological coexistence with relativistic temporal ontology.

The resulting evidential claim must remain proportionate. Relativistic experiments can support the bearer-specific and condition-sensitive character of physical outcomes emphasized by ITOF, but a finite successful calculation does not independently derive the common cosmic-stage domain, the fixed order, COP, CMA, or the unrestricted UCC theorem. Those foundational commitments retain their own definitions, dependencies, and test architecture.

Predictive success establishes calculational control over bearer-specific physical outputs under declared conditions. It does not establish that time or spacetime is the changing bearer. ITOF permits the operational use of successful calculations while rejecting every transfer of their numerical success into a relativistic identity or deformation of time.

17.6 Physical realization and relativistic representation

A relativistic model maps selected physical histories into a representational scheme:

$$\mathcal{R}_{\mathrm{rel}} : \mathcal{H}_{\mathrm{phys}} \longrightarrow \mathcal{M}_{\mathrm{rel}}, \tag{116}$$

where $\mathcal{M}_{\mathrm{rel}}$ may include coordinates, a Lorentzian metric, causal relations, worldlines, fields, and prediction rules. The map is a model-dependent mathematical proposal for organizing and calculating selected relations. It neither establishes the physical completeness of the model nor acquires authority over temporal identity. The common cosmic stage belongs to the ITOF foundation, while coordinate assignment remains a chart-dependent operation.

Declared input and model-defined output	**What the output does not establish in ITOF**
Localized occurrence or selected history data $\mapsto$ coordinate tuple x^μ or coordinate difference Δx^μ	A coordinate is not a common cosmic stage and does not define time.
Declared path γ and metric $g \mapsto$ proper-time functional $\tau[\gamma, g]$	A metric worldline functional is not time and does not demonstrate literal time dilation.
Metric and connection assumptions $\mapsto$ curvature objects such as $R^{\rho}{}_{\sigma\mu\nu}$	Geometric curvature does not become curvature of time.
Clock records, device assumptions, and a comparison protocol $\mapsto$ predicted or compared numerical clock outputs	Numerical agreement or divergence does not measure cosmic stages or confer temporal identity.

The table is a critical representation audit, not a bridge of compatibility. Each output remains confined to the assumptions, domain, and type of the model that produces it.

For an event or localized occurrence e represented in a relativistic model, let $\mathrm{Bearer}(e) = A$. The theory distinguishes

$$e \in \mathcal{O}_{\mathrm{phys}}, \qquad \mathcal{R}_{\mathrm{rel}}(e) = x^{\mu}(e), \qquad \mathrm{OccursFor}(e, A), \qquad A \in \mathcal{S}_{\mathrm{phys}}(s).$$

The coordinate image locates the represented occurrence within a chart. ITOF assigns the bearer A, rather than the event variable, to the extant-system domain of the common stage and requires bearer-specific change there.

17.7 The ontological force of the Cosmic Moment Axiom

CMA remains one universal cosmic axiom. It quantifies over every common cosmic stage and all physical systems whose identities are realized there; it is not replaced or abbreviated by a stage-local or bearer-local axiom. A particular presence-and-realization statement is obtained only by instantiating CMA for a declared $s \in \mathcal{S}_C$ and a declared bearer in $\mathcal{S}_{\mathrm{phys}}(s)$. Pairwise co-presence is then derived for any two members of that same extant-system set. CMA assigns no private stage to any bearer. ECP names the bearer-level instance of the same axiom; Physical-System Realization supplies nonempty bearer identity domains, IOC expresses unique immediate onset realization within them, and UCC expresses the derived complete-history consequence of onset and uninterrupted later continuation under CMA. That continuation is grounded in each bearer's internal factors and actual physical engagements; time and the cosmic stages neither cause nor mechanize it.

The central non-entailment is

$$\mathrm{RelativityOfCoordinateSimultaneity} \not\Rightarrow \neg\,\mathrm{CMA}\,. \tag{117}$$

Coordinate simultaneity is a relation defined inside a frame and synchronization convention. CMA concerns both the presence and bearer-specific physical realization of extant systems at the same common cosmic stage. A frame-dependent coordinate relation cannot negate or replace that ontological axiom.

17.8 Categorical ITOF ruling on temporal deformation

Under the canonical time definition in Section 4 (Definition 4.1), predicates whose definitions require a metric, connection, manifold dimension, coordinate transformation, path integral, or material clock cannot be transferred to time by a type-preserving identity. Separately, as the independent governing commitment stated in Subsection 17.8, V26/F6 categorically rejects the literal claims that time itself curves, dilates, contracts, warps, stretches, slows, accelerates, fragments, or acquires additional dimensions.

Let (M_D, g_{AB}) denote a declared higher-dimensional geometric model before its use in the type boundary; historical higher-dimensional constructions include the Kaluza–Klein proposals [6, 7].

The governing type judgment is

$$
\begin{aligned}
\mathrm{Type}(T_{\mathrm{ITOF}}) &= \mathsf{ITOFTemporalOrdering}, \\
\mathrm{Type}(g_{\mu\nu}) &= \mathsf{LorentzianMetric}, \\
\mathrm{Type}(R^{\rho}{}_{\sigma\mu\nu}) &= \mathsf{CurvatureTensor}, \\
\mathrm{Type}(\tau) &= \mathsf{MetricWorldlineFunctional}, \\
\mathrm{Type}(x^{\mu}) &= \mathsf{CoordinateAssignment}, \\
\mathrm{Type}(N_{C,P}) &= \mathsf{ClockReadingMap}, \\
\mathrm{Type}(M_D, g_{AB}) &= \mathsf{HigherDimensionalGeometricModel}.
\end{aligned}
\tag{118}
$$

Here $\mathsf{ITOFTemporalOrdering}$ names the fixed, irreversible, and uninterrupted ordering and succession of common cosmic stages in one common cosmic extension; it does not impose countability, discreteness, density, metricity, or immediate successors. Hence

$$
\mathrm{IllTyped}\Big(\mathrm{Curved}, \mathrm{Dilated}, \mathrm{Contracted}, \mathrm{Warped}, \mathrm{Deformed}, \mathrm{DimensionallyMultiplied}; T_{\mathrm{ITOF}}\Big). \tag{119}
$$

The rejected transfer must be replaced by the exact bearer of the relevant predicate:

$$
\mathrm{Curved}(g_{\mu\nu}, R^{\rho}{}_{\sigma\mu\nu}) \quad \text{for metric and connection geometry,} \tag{120}
$$

$$
\Delta\tau[\gamma_1, \gamma_2; g] \quad \text{for unequal metric worldline accumulation,} \tag{121}
$$

$$
\Delta N^{(P_{12})}_{C_1 C_2} \quad \text{for differential clock output,} \tag{122}
$$

$$
\mathrm{Warped}(M_D, g_{AB}) \quad \text{for a higher-dimensional geometrical model.} \tag{123}
$$

These objects may vary, curve, accumulate unequally, or possess additional dimensions within their declared models. None thereby acquires temporal identity. The common cosmic stages remain universal, and time denotes their fixed, irreversible, and uninterrupted succession and ordering, which together constitute one common cosmic extension.

ITOF rejects the relativistic deformation of time as a categorical distortion of temporal identity. Relativistic and higher-dimensional models assign curvature, unequal proper-time values, clock divergence, warping, compactification, or multiple coordinate-time components to their own mathematical objects. ITOF does not affirm the physical truth of those geometries and grants none of their predicates access to time. Time neither curves, dilates, contracts, warps, fragments, nor multiplies.

17.9 Strong theoretical boundary

V26/F6 establishes the following direct conclusions:

1. Lorentz transformations act on coordinate representations, not on T_{ITOF}.
2. Proper time is a metric functional of a declared worldline and metric, not a private or deformed time possessed by the system.

3. Differential clock readings are material-system outputs, not unequal quantities of time.
4. Curvature belongs to the metric and connection, not to time.
5. Empirically successful relativistic formulas may be used as model-bounded predictive maps for physical-system outputs; their operational utility does not validate relativistic temporal ontology or establish compatibility with it.
6. Four-dimensional and higher-dimensional manifolds enlarge geometrical representation or dynamics; they neither create additional times nor turn time into a dimension that can be warped or compactified.
7. Under the canonical time definition in Section 4 (Definition 4.1), the cosmic extension is common to all physical systems and its stages follow the fixed, irreversible, and uninterrupted succession and ordering represented by $\prec_C$. CMA states common-stage presence together with bearer-specific physical realization in every physical system whose identity is realized there.

As an independent governing commitment of V26/F6, the boundary is decisive. Relativistic calculations remain objects of examination within the models that formulate them; model-bounded numerical success may be acknowledged without treating the model as the physical ontology of time. ITOF neither adopts relativistic temporal ontology as a physical foundation nor treats operational success as confirmation of that ontology. Every transfer of geometric or operational deformation to time is rejected by the canonical ITOF type system.

17.10 Coordinates, Lorentz Transformations, and Synchronization

The transformations

For standard inertial coordinates in one spatial dimension,

$$t' = \gamma_v \left(t - \frac{vx}{c^2} \right), \qquad x' = \gamma_v (x - vt), \qquad \gamma_v = \frac{1}{\sqrt{1 - v^2/c^2}}. \tag{124}$$

These equations state the coordinate relation postulated between two inertial charts under the assumptions of special relativity. The symbols t and t' are coordinate components. Their transformation with x expresses the form of the chosen model and its asserted Minkowski invariants; it neither establishes the physical truth of that model nor describes a transformation of time as defined by ITOF.

The transformed pair belongs to a coordinate domain:

$$(x, t) \in \mathbb{R}^2_F, \qquad (x', t') \in \mathbb{R}^2_{F'} . \tag{125}$$

The ITOF object T_{ITOF} does not belong to either coordinate codomain. It is therefore incorrect even as a type statement to write a Lorentz transformation of time as defined by ITOF.

What transforms

The transformation changes coordinate descriptions of events. It may change coordinate differences, coordinate simultaneity, and decompositions into spatial and temporal components.

It does not change the physical occurrence already attributed to the systems, and it does not produce a second cosmic extension. A valid formulation is

$$\Lambda : x^{\mu}_{F}(e) \longmapsto x^{\mu}_{F'}(e), \tag{126}$$

where the same represented event e receives different coordinate components. The type boundary is instead

$$T_{\mathrm{ITOF}} \notin \mathrm{Dom}(\Lambda), \tag{127}$$

because the ITOF temporal meaning is not an element of the coordinate transformation's domain.

Coordinate relativity and cosmic order

Lorentz transformations act on coordinate descriptions, whereas $A \in \mathcal{S}_{\mathrm{phys}}(s)$ places the bearer at the common stage, CMA states its presence with every other extant bearer there and its bearer-specific physical realization. Frame-dependent coordinate differences therefore do not alter the integrated CMA claim of common-stage presence and bearer-specific realization. The stage is not obtained by setting a coordinate component equal across distant events, and coordinate values do not yield exact cosmic-stage assignment. The two claims are distinct:

(a) Lorentz transformations assign coordinate relations within the special-relativistic model and preserve the invariants postulated by that model.

(b) The common cosmic domain supplies common-stage unity independently of coordinate synchronization; CMA states universal presence and bearer-specific realization there.

Neither claim is a mathematical derivation of the other. V26/F6 does not derive Lorentz transformations from the axioms of ITOF. Such a derivation would require an additional physical model of moving systems, signal propagation, clocks, interactions, and measurement protocols. Explaining the bounded calculational success of Lorentz relations from such material models remains a later research problem rather than a completed result of this version. This limitation neither transfers temporal identity to relativistic coordinates nor constitutes compatibility, reconciliation, synthesis, or ontological coexistence with relativistic temporal ontology.

Relativity of coordinate simultaneity

In a chosen inertial chart, coordinate simultaneity is expressed by

$$t_F(e_1) = t_F(e_2). \tag{128}$$

Under a Lorentz transformation, this equality need not persist for spatially separated events. What follows is the frame dependence of that coordinate relation. The common cosmic stage is defined independently of equality of t_F. CMA states presence and bearer-specific change at that stage; neither supplies a coordinate-equality prediction in any chart. Relativistic events may be represented through the bridge $\mathcal{M}_{\mathrm{rel},A}$; operational evidence then compares records and may constrain coordinate or reconstruction ranges within the declared model. That coordinate model and physical record alone do not warrant one unique exact cosmic-stage assignment; any stronger assignment requires additional validated premises that establish uniqueness.

Invariant interval

The Minkowski-model interval

$$ds^2 = -c^2 dt^2 + dx^2 + dy^2 + dz^2 \tag{129}$$

is invariant under Lorentz transformations by construction of the Minkowski model. ITOF treats this as a metric relation internal to that model, not as proof that Minkowski geometry is the physical nature of time or of the universe. It does not convert ds^2 into the non-metric cosmic extension. The distinction is

$$\text{LorentzInvariant}(ds^2) \not\Rightarrow ds^2 \equiv T_{\text{ITOF}}. \tag{130}$$

Coordinate law and ontological boundary

Equation (124) states the coordinate transformation postulated within the special-relativistic model. V26/F6 does not certify that model as the physical nature of the universe and rejects the inference that a coordinate transformation defines or transforms time. The coordinate formula remains a model-defined relation; the common cosmic stage and the definition of time remain independent ITOF commitments.

Coordinate synchronization

Within an inertial frame F, a synchronization convention defines a coordinate relation among spatially separated events. Write

$$e_1 \sim_F e_2 \iff t_F(e_1) = t_F(e_2). \tag{131}$$

A Lorentz transformation generally maps this relation to a different coordinate assignment in another frame. This is the frame-dependent coordinate reassignment conventionally called the relativity of simultaneity.

Common-stage participation

ITOF begins from the primitive relation

$$A \in \mathcal{S}_{\text{phys}}(s),$$

where s is a common cosmic stage. For two systems,

$$\text{CoStage}(A, B; s) \iff A \in \mathcal{S}_{\text{phys}}(s) \wedge B \in \mathcal{S}_{\text{phys}}(s).$$

The pairwise relation is derived from membership in the same extant-system domain at the same common stage. It provides no construction of the stage from clocks, signals, frames, or coordinate equality. Common-stage unity is therefore not an ontological synchronization process: no initially separate temporal series are aligned, and no signal or influence establishes the stage.

The type distinction is

$$\sim_F \in \mathcal{T}_{\text{coordinate synchronization}}, \qquad \text{CoStage} \in \mathcal{T}_{\text{ontological participation}}.$$

Consequently, variation of $\sim_F$ across frames leaves the integrated CMA claim of common-stage presence and bearer-specific realization untouched.

Coordinate neutrality and empirical content

The direct formal output of the Cosmic Moment Axiom is the presence of all extant physical systems at the same common cosmic stage together with bearer-specific physical realization in each. Coordinate values, chart choices, clock settings, signal propagation laws, and frame-dependent corrections belong to their respective physical models. Accordingly, the axiom by itself has the following non-entailments:

$$\text{CMA} \not\Rightarrow \text{Determines}\Big(\Delta x^{\mu}, \Delta N_C^{(P)}(W_1, W_2), \Delta\nu, \Delta\tau\Big)\,. \tag{132}$$

Here $\Delta N_C^{(P)}(W_1, W_2)$ denotes a one-clock output difference across two declared protocol windows; the two-clock comparison remains $\Delta N_{C_1C_2}^{(P_{12})}$. Relativistic observables remain quantities defined by their declared models. Their calculated values neither validate the models' temporal ontology nor alter the independent ITOF commitment to common cosmic-stage unity.

Cosmological coordinates

Cosmological models may introduce a coordinate time adapted to a class of observers or to symmetries of a spacetime solution. Such a coordinate is a model object with an assigned metric role. The integrated CMA claim of common-stage presence and bearer-specific realization remains independent of the convenience, conventional use, or numerical fit of a cosmological chart.

17.11 Proper Time, Worldlines, Clock Outcomes, and Frequency Shifts

Proper time as a metric functional

For a timelike worldline γ in a Lorentzian metric $g_{\mu\nu}$, proper time is

$$\tau[\gamma, g] = \frac{1}{c}\int_{\gamma} \sqrt{-g_{\mu\nu}\, dx^{\mu} dx^{\nu}}. \tag{133}$$

The sign convention is stated by the displayed formula. Within relativity, proper time is defined as a scalar functional of a timelike path and metric and assigns a metric length to the worldline. ITOF records this model definition without accepting it as time or as an indispensable description of physical temporal reality. It fixes the model-defined type:

$$\tau[\gamma, g] \not\equiv_{\text{type}} T_{\text{ITOF}}. \tag{134}$$

A path functional is neither the fixed, irreversible, and uninterrupted succession and ordering of the common cosmic stages nor the formal ordering relation $\prec_C$; it is a model-defined functional of a declared path and metric.

Worldline dependence

If two systems follow different worldlines,

$$\tau[\gamma_1, g] \neq \tau[\gamma_2, g] \tag{135}$$

may hold. This difference concerns metric accumulation along the paths. It does not imply that the systems inhabited different cosmic extensions or owned different times. They remained within the common cosmic extension while their physical paths and conditions differed.

Twin-paradox case study: the common cosmic extension and unequal histories

Consider two physical systems A and B that separate, follow distinct timelike worldlines, and later reunite. Relativity assigns

$$\tau_A = \frac{1}{c}\int_{\gamma_A} \sqrt{-g_{\mu\nu}\, dx^\mu dx^\nu}, \qquad \tau_B = \frac{1}{c}\int_{\gamma_B} \sqrt{-g_{\mu\nu}\, dx^\mu dx^\nu}, \tag{136}$$

and generally

$$\tau_A \neq \tau_B. \tag{137}$$

The inequality is a metric relation postulated between different worldlines. Clock readings, physiological states, accumulated damage, chemical histories, and other bearer-specific outcomes may differ as physical records. ITOF accepts the observed bearer-specific differences when independently warranted, but it does not thereby accept the relativistic metric explanation or its temporal interpretation.

The temporal conclusion is nevertheless singular:

$$\mathcal{H}_A \neq \mathcal{H}_B \not\Rightarrow \text{DistinctTemporalExtensions}(A, B). \tag{138}$$

Both bearer orders are restrictions of the same fixed, irreversible, and uninterrupted succession and ordering $\prec_C$ to their respective identity domains I_A and I_B; no additional order relation or private temporal domain is introduced. The reunion comparison may establish unequal clock outputs and unequal physical histories within the common cosmic extension. Relativity represents the difference through unequal proper-time integrals, but ITOF does not treat that representation as proof that metric worldline accumulation is time. The result establishes neither two temporal extensions nor literal dilation of time itself. The so-called paradox is rejected ontologically by distinguishing physical bearer outcomes and model-defined path functionals from the common cosmic extension.

Rejection of literal time dilation

The conventional phrase "time dilation" is admissible only as shorthand whose exact referent is stated. Depending on context, the calculated object is a coordinate-duration relation, a difference between proper-time functionals, or a difference between clock outputs. V26/F6 rejects the literal interpretation that time itself has dilated.

The complete boundary is

$$\left(\Delta t_F \neq 0 \ \vee \ \Delta\tau[\gamma_1,\gamma_2;g] \neq 0 \ \vee \ \Delta N^{(P_{12})}_{C_1C_2} \neq 0\right) \not\Rightarrow T_{\mathrm{ITOF}} \in \mathrm{Dom(Dilation)}, \tag{139}$$

with

$$T_{\mathrm{ITOF}} \notin \mathrm{Dom(Dilation)}. \tag{140}$$

The exact statement must name the bearer: coordinate intervals transform, proper-time functionals differ, or physical clocks accumulate unequal readings. The common cosmic extension and the succession of its stages remain undistorted.

Ideal clock hypothesis

Relativistic clock theory postulates a connection between an ideal clock's output and proper time. In an affine reporting convention,

$$n^{\mathrm{ideal}}_{C,P} = \alpha_P \tau[\gamma, g] + \beta_P. \tag{141}$$

The constants encode scale and origin. Equation (141) is a relation between a modelled clock reading and a metric functional. It does not equate either with T_{ITOF}.

Real clocks

A real clock is sensitive to its own physical process and to the conditions under which that process is produced, recorded, and interpreted. Let $\Xi_{C,P}$ denote the declared protocol-relevant clock-process description, including the selected states, transitions, phases, frequencies, control operations, and record-production dynamics. A general prediction map is

$$n^{\mathrm{pred}}_{C,P} = \mathcal{K}_{C,P}(\Xi_{C,P}, \theta_{C,P}, \mathcal{M}_C, P)\,, \qquad \theta_{C,P} \in \Theta_{C,P}, \tag{142}$$

where $\Theta_{C,P}$ is the admissible condition space, $\theta_{C,P}$ is the realized condition tuple, and $\mathcal{M}_C$ is the device model. This general form does not require a relativistic quantity as a universal clock input. If a particular relativistic model is being examined, a model-specific specialization may instead be written

$$n^{\mathrm{pred,rel}}_{C,P} = \mathcal{K}^{\mathrm{rel}}_{C,P}(\tau[\gamma, g], \theta_{C,P}, \mathcal{M}_C, P)\,, \tag{143}$$

but $\tau[\gamma, g]$ then remains an input internal to that declared model rather than a definition of the clock, cosmic stages, or time. Either map may include systematic shifts, environmental corrections, device effects, and readout conventions. Agreement between calculated and recorded outputs provides only model-bounded evidence about the declared clock calculation; it does not validate relativistic temporal ontology and does not establish an identity between proper time and time.

Clock hypothesis and limitations

The relativistic clock hypothesis states that an idealized clock output follows proper time along its worldline independently of acceleration history beyond the path itself. Real clocks may violate ideal assumptions through acceleration sensitivity, field coupling, temperature, deformation, or internal dynamics. These are physical-system questions. V26/F6 interprets the phrase "measures proper time" operationally: the clock output tracks the functional within a stated model and uncertainty.

Metric accumulation and cosmic extension

The cosmic extension is common and non-metric. Proper-time accumulation can differ. Therefore

$$\tau[\gamma_1, g] \neq \tau[\gamma_2, g] \not\Rightarrow T_{\mathrm{ITOF}} \in \mathrm{Dom}(\mathrm{Dilation}), \tag{144}$$

and

$$\tau[\gamma, g] \text{ increases along } \gamma \not\Rightarrow \text{cosmic stages are counted by } \tau. \tag{145}$$

The worldline functional quantifies a path; it does not enumerate the stage succession.

Physical divergence of clock systems

When two clocks reunite after different trajectories or remain under different physical conditions, their readings can differ. The direct empirical quantity is a protocol-defined difference such as Equation (54). Relativity calculates such differences through proper-time and device models. V26/F6 accepts only the physically recorded divergence when warranted; it does not certify the relativistic calculation as the complete physical explanation and rejects its interpretation as unequal or dilated time.

The ontological interpretation is

$$\Delta N^{(P_{12})}_{C_1 C_2} \neq 0 \Longrightarrow \mathrm{DifferentClockOutcomes}_{P_{12}}, \tag{146}$$

and the differential output does not entail multiple cosmic extensions:

$$\Delta N^{(P_{12})}_{C_1 C_2} \neq 0 \not\Rightarrow \mathrm{MultipleCosmicExtensions}\,. \tag{147}$$

The non-implication follows because V26/F6 has the common cosmic extension and no indexed system times.

Relative motion and path asymmetry

In relativistic twin-type models, acceleration, turnaround, or differing inertial segments distinguish the represented paths. The model assigns a proper-time difference to those paths. ITOF does not endorse the geometry as the complete physical explanation and does not propose that time differed between the systems. It identifies the systems as changing physical bearers and treats unequal readings as differential physical outcomes within the common cosmic extension.

Rates belong to physical systems and protocols

The phrase "time runs at different rates for the clocks" can conceal three different statements:

(i) coordinate rates differ under a chart;

(ii) proper-time functionals accumulate differently along paths;

(iii) physical clock outputs differ under conditions and protocol.

Each is a distinct coordinate, model, or physical-output claim requiring its own warrant. None establishes that the non-metric cosmic extension has a system-specific rate. V26/F6 therefore replaces the undifferentiated phrase with the quantity actually calculated or measured.

Common stage with unequal readings

All existing clocks are present at the same common cosmic stage and realize their bearer-specific physical changes under CMA while producing potentially unequal readings. CMA supplies no zero-difference condition for their protocol-defined outputs:

$$\mathrm{CMA} \wedge C_1, C_2 \in \mathcal{S}_{\mathrm{phys}}(s) \not\Rightarrow \Delta N^{(P_{12})}_{C_1 C_2} = 0. \tag{148}$$

Common-stage co-presence together with bearer-specific change is not equality of physical state, change content, or output. This point corrects the older temptation to express cosmic unity as one-to-one correspondence among system-stage domains. In V26/F6 there are no such domains; there are changing clocks in the common cosmic stage.

Experimental precision

High-precision atomic-clock experiments provide precise records of frequency and reading differences [23, 24, 25, 26]. Relativistic models are commonly fitted to those records, but agreement does not prove that the model geometry is the physical nature of the universe or that time dilates. V26/F6 treats the records as evidence about changing physical clock systems and their conditions, while the adequacy and completeness of any relativistic explanation remain open to independent scrutiny.

Emitter–signal–receiver chain

A frequency comparison requires at least an emitter E, a propagating physical signal L, and a receiver R. The measured ratio is produced by the combined physical chain, not by a disembodied temporal quantity:

$$E \longrightarrow L \longrightarrow R \longrightarrow r_R \longrightarrow \nu_R. \tag{149}$$

Each component has state, interaction, uncertainty, and modelling conditions.

Redshift parameter

The redshift parameter is commonly defined by

$$1 + z = \frac{\nu_{\mathrm{emit}}}{\nu_{\mathrm{receive}}}. \tag{150}$$

This is a frequency ratio. It can encode relative motion, gravitational setting, cosmological model, or combinations of effects. Its type is not temporal ontology:

$$z \not\equiv_{\mathrm{type}} T_{\mathrm{ITOF}}. \tag{151}$$

Special-relativistic Doppler relation

Within the stated special-relativistic assumptions for collinear inertial motion, the Doppler factor is written

$$\frac{\nu_{\text{receive}}}{\nu_{\text{emit}}} = \sqrt{\frac{1-\beta}{1+\beta}}, \qquad \beta = \frac{v}{c}, \tag{152}$$

for recession in the chosen convention. The equation calculates a relation among emitted and received frequencies within the special-relativistic model. Agreement with a frequency record does not establish the model's temporal ontology, and the equation does not state that time itself has changed frequency.

Gravitational comparison

For static observers in a static spacetime, under the stated signature and normalization conventions, the standard comparison may be written

$$\frac{\nu_{\text{receive}}}{\nu_{\text{emit}}} = \sqrt{\frac{-g_{00}(x_{\text{emit}})}{-g_{00}(x_{\text{receive}})}}. \tag{153}$$

Outside those assumptions, the invariant measured-frequency relation $\nu = -k_a u^a$ and the relevant observer and propagation conditions must be used. The calculation concerns emitter, signal, receiver, observer states, and a geometric model. It does not identify the numerical ratio or metric component with T_{ITOF}.

Local clock systems

Atomic transitions, optical cavities, and electronic readouts respond through physical mechanisms. Relativistic models may be used to calculate selected comparisons after device corrections, but the adequacy and interpretation of those calculations require independent physical assessment. ITOF attributes the outcome to the material mechanisms and rejects every attribution of causal agency, slowing, or deformation to time.

17.12 Metric Geometry, Curvature, Field Equations, and Spacetime

Metric type

In general relativity the metric field $g_{\mu\nu}$ defines interval, causal, and geometrical relations. The line element is

$$ds^2 = g_{\mu\nu}\, dx^\mu dx^\nu. \tag{154}$$

Within general relativity, the metric is defined as a rank-two geometrical and dynamical field on a differentiable manifold. Clocks and stars are material bearers, while the metric remains a model-defined geometric-field object and the cosmic extension occupies the temporal-order type.

Curvature

The Riemann tensor used in general relativity

$$R^{\rho}{}_{\sigma\mu\nu} \tag{155}$$

and contractions derived from it characterize curvature inside the connection and metric geometry of the model. General relativity interprets geodesic deviation, lensing, redshift, and other records through that curvature. ITOF does not accept those interpretations as confirmation that the universe or time is geometrically curved. Within the relativistic notation, "spacetime is curved" means that the Lorentzian metric and connection are assigned non-zero curvature; the statement "time is curved" is rejected because time is neither the metric nor a metric subobject.

The governing boundary is stronger than a mere absence of implication:

$$\mathrm{Curved}(g_{\mu\nu}, R^{\rho}{}_{\sigma\mu\nu}) \quad \wedge \quad T_{\mathrm{ITOF}} \notin \mathrm{Dom}(\mathrm{Curvature}). \tag{156}$$

Thus curvature belongs exclusively to the declared metric and connection relations. The cosmic extension is common to all physical systems, and its stages follow the fixed, irreversible, and uninterrupted succession and ordering represented by $\prec_C$; it is not a metric, connection, sectional curvature, Ricci curvature, or scalar curvature. Under its independent governing commitment concerning relativistic temporal ontology, V26/F6 therefore rejects every literal attribution of curvature or geometrical distortion to time; this broader rejection is not inferred from type non-identity alone.

Einstein field equation

The field equation is

$$G_{\mu\nu} + \Lambda_{\mathrm{cosm}} g_{\mu\nu} = \frac{8\pi G}{c^4} T_{\mu\nu}. \tag{157}$$

Within general relativity, the equation postulates a relation between spacetime geometry and stress–energy. V26/F6 cites it as an object of analysis and neither adopts it as a confirmed account of physical nature nor modifies it into an ITOF law. The equation does not contain T_{ITOF}, s, or CMA as dynamical variables; inserting them would violate the non-causal and non-material definition.

Matter–geometry relation and physical realization

General relativity represents physical systems through field and matter equations on a spacetime model. ITOF does not accept that representation as confirmation that spacetime geometry is the physical nature of the universe or of time. A coordinate labelled temporal cannot convert the geometry into the common cosmic extension. The disagreement is foundational: general relativity geometrizes temporal description, whereas ITOF adopts the non-metric canonical definition in Definition 4.1 in Section 4. The common extension and the fixed, irreversible, and uninterrupted succession and ordering of its stages are stated independently of relativistic geometry.

Einstein-equation status under ITOF critique

Equation (157) remains the equation defined by general relativity, not an equation endorsed or derived by ITOF. Its geometrical interpretation, physical adequacy, and empirical scope remain open to independent scrutiny. The Cosmic Moment Axiom supplies no gravitational dynamics, and any gravitational proposal requires its own equations, evidence, and consistency tests without importing a distorted definition of time.

Lorentzian manifold

A relativistic spacetime model is represented by a manifold M equipped with a Lorentzian metric g and additional fields. Events are assigned to points, coordinates to charts, and physical histories to curves or field configurations. These are mathematical choices of the relativistic formalism. V26/F6 does not certify them as the physical nature of the universe and classifies them as geometry and representation rather than temporal ontology.

The governing type distinction is

$$(M, g) \not\equiv_{\text{type}} T_{\text{ITOF}}. \tag{158}$$

A manifold with metric has dimensional, topological, differentiable, and geometrical properties. The canonical definition and type system in Sections 4 and 1.3 exclude its identity with time. Any mathematical map, embedding, foliation, or isomorphism remains a relation between mathematical representations and cannot convert the manifold into time or time into a spacetime component.

Dimensionality

Dimensionality is defined for mathematical or physical model objects whose type admits that operation. The formal representation $T_{\text{ITOF}} = (\mathcal{S}_{\text{C}}, \prec_C)$ is not in the domain of geometric operations such as dimension assignment, curvature, warping, compactification, or metric deformation:

$$T_{\text{ITOF}} \notin \text{Dom}(\text{Dimension}), \qquad T_{\text{ITOF}} \notin \text{Dom}(\text{Curve}), \tag{159}$$

$$T_{\text{ITOF}} \notin \text{Dom}(\text{Warp}), \qquad T_{\text{ITOF}} \notin \text{Dom}(\text{Compactify}). \tag{160}$$

Higher-dimensional manifolds and metrics may be defined within their own models, but their dimensions do not become dimensions of time in ITOF.

Events and physical occurrences

A manifold event is a formal point in the model. A physical occurrence is a realization in a system. A declared map $\mathcal{M}_{\text{rel},A}$ can associate an attributed occurrence or history with model events, curves, fields, and relations, but the map remains a modelling proposal and the distinction is categorical:

$$e \not\equiv_{\text{type}} \text{PhysReal}^{+}_{A}(s). \tag{161}$$

This distinction prevents the model's point-set arrangement from becoming the ontology of stages.

Cosmic-stage type and hypersurface type

A spacelike hypersurface, foliation leaf, or constant-coordinate slice is a geometrical object defined by a spacetime model and additional choices. A common cosmic stage is the one stage shared by every system extant there; CMA states their presence and bearer-specific physical realization at that stage, while the derived UCC theorem combines immediate realized onset with uninterrupted later continuation across each bearer history. Their types are therefore distinct:

$$\text{Type}(s) = \mathsf{CommonCosmicStage}, \qquad \text{Type}(\Sigma_t) = \mathsf{GeometricHypersurface}, \qquad s \not\equiv_{\text{type}} \Sigma_t. \tag{162}$$

A foliation can organize a relativistic representation, but it neither defines the common stage nor supplies universal bearer-specific change; it does not assign the exact cosmic stage of distant physical occurrences. Identifying the two is rejected because it would replace the common cosmic stage with a model-dependent geometrical slice.

Representation without ontological capture

Relativistic theory represents selected relations through coordinates, causal classifications, worldlines, and geometry. V26/F6 treats these as model-defined objects and rejects their capture of temporal ontology. Any inferential link from a representation to a physical claim must be stated and tested independently; no such link can convert the representation into time or into the common cosmic stage.

17.13 Causal Classification, Covariance, and the Final Relativistic Boundary

Causal classification in relativistic models

Relativistic models classify relations as timelike, null, or spacelike through their metric and light-cone definitions. ITOF does not adopt those classifications as a definition of time and does not declare compatibility with the relativistic ontology from which they arise. Physical causal direction must be warranted by the actual processes, interactions, and records under study; the common stage and universal occurrence of change supply neither a signal mechanism nor a relativistic causal postulate.

Type distinction between cosmic order and causal order

The cosmic relation $\prec_C$ orders common cosmic stages. A relativistic causal relation orders events or occurrences connected by admissible influence. These relations have distinct domains. The representation bridge preserves independently established causal direction while operational evidence does not assign an exact cosmic stage:

Constraint 17.1. Any relativistic representation used in a calculation must be checked against independently warranted physical causal direction. Extant-bearer membership is stated by $A \in \mathcal{S}_{\text{phys}}(s)$, CMA states presence and bearer-specific physical realization there; observational records constrain windows and do not convert causal event order into exact cosmic-stage assignment.

Propagation delay

A signal emitted after a source realization arrives later at a detector. The arrival record belongs to the detector's later realization, not to the original source stage. Propagation delay affects access and comparison, not the source's original physical realization at the common cosmic stage.

For two successive source records under a declared protocol,

$$\Delta t_{\text{arr}}^{(P)} = \Delta t_{\text{emit}}^{(P)} + \Delta\Pi^{(P)}, \tag{163}$$

where $\Delta\Pi^{(P)}$ is the difference between propagation durations. The quantities are coordinate or operational intervals under protocol P:

$$\Delta t^{(P)} \not\equiv_{\text{type}} T_{\text{ITOF}}. \tag{164}$$

Arrival order and emission order

If paths and media differ, arrival order need not transparently reproduce source order without modelling. The detector records what arrives, and inference reconstructs emission under assumptions. In equal or sufficiently controlled propagation conditions, common contributions can cancel in differences, allowing arrival spacing to approximate emission spacing. This is a property of the signal geometry and protocol, not direct observation of cosmic stages.

Distance, records, and universal change at a common stage

The common cosmic domain establishes stage unity independently of signal exchange, and CMA states the presence and bearer-specific physical realization of all extant systems at that common stage. Distance and propagation determine when a detector receives records of the distant system. Neither principle entails an instantaneous communication channel. Signal propagation requires an independently specified physical model, and no relativistic signal model is granted authority to define the common cosmic stage or time.

Covariance

General covariance concerns the form assigned to equations under changes of coordinates. Lorentz and Poincaré symmetries are formal properties of special-relativistic equations and Minkowski models. ITOF does not accept these symmetries as evidence for the physical nature of time, and it does not treat covariance as confirmation of relativistic temporal ontology.

The correct non-implication is

$$\text{Covariant}(\mathcal{E}) \not\Rightarrow \text{TemporalOntology}(\mathcal{E}). \tag{165}$$

Covariance can be satisfied by equations formulated with different ontological commitments.

ITOF invariance

The invariance claimed by ITOF concerns the ordered irreversible succession itself: a later cosmic stage does not become earlier than its predecessor, and all physical systems existing there realize bearer-specific change at the common cosmic stage. This is not presented as a Lorentz scalar field, tensor equation, or symmetry generator. Confusing the two senses of invariance would create a category error.

Coordinate-chart neutrality

The present axiom is independent of coordinate charts and is not formulated by adding a four-velocity field, foliation variable, lapse, shift, or correction term to relativistic equations. This independence is not compatibility with, preservation of, or validation of those equations. ITOF neither derives its cosmic definition from relativistic formalisms nor certifies their geometry as the physical nature of the universe. Any attempt to map common-stage participation into a geometrical field would be a separate proposal with its own physical, causal, and evidential burden; it would not alter the canonical meaning of time or the Cosmic Moment Axiom.

Theoretical boundary

ITOF rejects any synthesis, reconciliation, or declaration of compatibility with the relativistic ontology of time. Relativistic formalisms assign coordinate, metric, causal, field, signal, worldline, and clock meanings within their own mathematical schemes; ITOF does not accept those schemes as confirmed descriptions of the physical nature of time or of the universe. Under the canonical time definition in Section 4 (Definition 4.1), the common cosmic extension includes all physical systems whose identities are realized within its stages; no relativistic coordinate or geometrical construction acquires its temporal identity. Every attribution of curvature, dilation, contraction, warping, fragmentation, or dimensional multiplication to time is rejected as a distortion of temporal identity.

Final boundary

Relativistic quantities remain coordinate, metric, geometric, causal-classification, or prediction objects. None is identical in type with T_{ITOF}, $\mathcal{S}_{\mathrm{C}}$, or $\prec_C$. V26/F6 asserts no compatibility, reconciliation, synthesis, or ontological coexistence with relativistic time.

18. Scope, Limits, and Conclusion

18.1 What V26/F6 establishes

V26/F6 establishes the following connected position:

(1) The universe denotes the totality of all physical systems without exception.

(2) At every common cosmic stage, every physical system whose identity is then realized is present there and undergoes its own bearer-specific physically realized change, as stated by Axiom 5.1 and Equation (4).

(3) The canonical time definition in Section 4 (Definition 4.1) governs the entire formulation.

(4) Every physical-system history is realized within the one common cosmic extension under Definition 8.1 and Equation (11); no system possesses private temporal stages.

(5) At each common cosmic stage, all then-existing physical systems share that same stage, while the content, magnitude, rate, mechanism, and observability of their changes remain bearer-specific.

(6) Cosmic onset is the origin of the first systems, and change begins immediately with each system's origin.

(7) Every bearer identity beginning after the initial common cosmic stage has a domain-warranted direct physical origin in one or more contributing systems present at its onset stage and possessing prior realized histories.

(8) Every system has an identity-bounded physical history within the common domain.

(9) Physical realization is independent of detection under Equation (2); the principal non-detection cases are set out in Subsection 3.2, and noticeable change does not identify the exact stage at which change occurred or began; see Subsection 12.5.

(10) Identity ending does not follow from UCC; every identity ending within the continuing universe is closed through the unified transformation formalism, while the exceptional universe-ending condition remains separate and concise. System endings may be predicted approximately under declared models.

(11) Clock outputs satisfy the type boundary in Equation (46); coordinates, proper-time functionals, metric intervals, and spacetime geometries are likewise not time.

18.2 Epistemic limits

The theory does not assign an exact number of cosmic stages, equal stage spacing, or a metric duration to the cosmic extension. It does not claim that every bearer change is directly measurable. Its unrestricted commitments are approached through restricted, cumulative, and bearer-specific empirical programs.

18.3 Final statement

The common cosmic stages include all physical systems whose identities are realized within them. At each such stage, all then-existing physical systems are present at that same stage, while their physical changes and identity-bounded histories remain bearer-specific. Time denotes the fixed, irreversible, and uninterrupted succession and ordering of the common cosmic stages of change across all physical systems then existing at each stage; these stages together constitute one common cosmic extension. The extension is not an independent container, and time does not cause the changes realized by systems. Noticeable effects may be cumulative and need not have occurred wholly at the stage of detection. The origin of the universe is addressed through the origin of physical systems.

A. Canonical Definitions, Equations, and Status

Item	Status	Dependency
Universe statement	Governing ontological commitment	The universe denotes the totality of all physical systems without exception.
Physical-system predicate	Ontological predicate	PhysicalSystem(A) is independent of present observability or experimental eligibility.

Item	Status	Dependency
Study qualification	Protocol-relative evidential predicate	$\text{StudyQualified}_{P,M}(A)$ qualifies a bearer for a declared investigation and does not restrict CMA.
Time definition	Canonical definition	The governing definition is stated in Definition 4.1 in Section 4 and in the opening canonical box.
$T_{\text{ITOF}} = (\mathcal{S}_C, \prec_C)$	Formal representation	Common stage domain; $\prec_C$ orders its fixed, irreversible, and uninterrupted succession and ordering.
Physical-system realization	Independent ontological postulate	Every physical system has a nonempty identity domain.
COP	Independent cosmological postulate	Initial stage, first systems, and immediate onset realization at cosmic origin.
IOC	Independent universal identity-onset postulate	Unique onset realization within every nonempty physical-system identity domain.
Later Physical-Origin Postulate	Independent universal physical-origin postulate	Every non-initial bearer onset has direct contributors present at the onset stage, each with a prior realized history and a domain-warranted physical-origin relation.
CMA	Governing universal cosmic axiom	Every cosmic stage is nonempty; all extant physical systems are present there and each realizes its own bearer-specific change.
ECP	Derived bearer-level consequence	Membership in $\mathcal{S}_{\text{phys}}(s)$ entails presence and physical realization at s.
UCC	Derived universal bearer proposition	Physical-System Realization supplies nonemptiness, IOC supplies unique realized onset within the nonempty domain, and CMA supplies positive realization across every later member; IDC separately excludes internal identity gaps.
IDC	Independent universal identity-continuity postulate	Every physical-system identity domain is order-convex and contains no internal gap.
Identity history	Canonical definition	I_A, restricted cosmic succession, and bearer state map.

Item	Status	Dependency
System ending	Conditional physical and identity proposition	Ending is an attained last identity-domain member with physically realized identity cessation; every ending within the continuing universe is closed through a warranted transformation, while UCC does not require an endpoint.
Record and stage	Typed distinction with a physical relation	A record is not a stage, although a record carrier may be physically realized at a stage.
Restricted test claim	Protocol-relative evidential proposition	May be supported or rejected within declared variables, model, sensitivity, sampling, and window.
Relativistic formula	Model-bounded representation	Type non-identity with time is distinct from additional physical criticism of the model.

Claim–Warrant Matrix

Claim	Required warrant	Invalid shortcut
Bearer changed	Physical witness or adequate bearer model	Treating clock passage or time as the cause.
Bearer remained the same system	Identity criterion and continuity evidence	Assuming that the same label guarantees the same identity.
Bearer ended within the universe	Attained endpoint, identity-ending realization, and transformation evidence	Functional failure alone.
Successor originated	New identity criterion and onset realization at the transformation stage	Calling every changed state a new system.
Many-bearer transformation occurred	Declared predecessor and successor sets with transformation evidence at one stage	Forcing every merger or fragmentation into a one-predecessor schema.
Noticeability assigned to one exact stage	A model-specific uniqueness warrant beyond finite record comparison	Identifying the first resolved record, clock value, or coordinate with the ontic stage.
Candidate-stage set inferred	Declared physical model, provenance, uncertainty, and non-identity restraint	Treating a model candidate set as a canonical ITOF map.

Claim	Required warrant	Invalid shortcut
System ending predicted	Declared model, data, window, and uncertainty	Exact cosmic-stage assertion from an operational window.
Remote source state inferred	Source, propagation, reception, and reconstruction model	Treating a received signal as the present source state.
Clock difference attributed	Complete comparison protocol	Calling the difference a deformation of time.
Relativistic formula ontologically interpreted	Independent identity and physical arguments	Inferring ontology from numerical fit or type notation alone.

Sequential Historical-Critical Review and Construction Inheritance Boundary

V26/F6 is governed by sequential historical-critical review. Earlier versions remain respected, cited, and documented stages in the development of ITOF [3, 2, 1], but they are historical sources rather than automatic authorities for the present formulation. For every candidate element q,

$$\mathrm{Inherited}_{V_n \to V26}(q) \Longrightarrow \mathrm{Revalidated}_{V26}(q).$$

The revised CMA supersedes every earlier formulation that separated common-stage presence from universal bearer-specific realization. The present formulation also supersedes the circular onset-realization definition and the classification of ECP as an independent axiom.

Material may enter V26/F6 only after it satisfies all of the following:

(i) it agrees with the canonical meaning of time and $T_{\mathrm{ITOF}} = (\mathcal{S}_C, \prec_C)$;

(ii) it preserves the statuses of physical-system realization, COP, IOC, the Later Physical-Origin Postulate, CMA, ECP, IDC, and UCC stated in this appendix;

(iii) it uses PhysicalSystem for ontology and StudyQualified only for protocol-relative qualification;

(iv) it states CMA through universal common-stage presence and bearer-specific physical realization, with no empty cosmic stages;

(v) it assigns the content and causes of change to bearers and their actual physical engagements, not to time or the stage;

(vi) it defines onset and continuation independently before defining total positive physical realization;

(vii) it preserves one common cosmic-stage domain and no private bearer-stage domain;

(viii) it treats physical-system realization, COP, IOC, the Later Physical-Origin Postulate, and IDC as independent postulates rather than consequences of strict order alone;

(ix) it treats UCC as a bearer-level consequence of Physical-System Realization, CMA, and IOC under the onset/continuation definitions;

(x) it does not infer an endpoint from UCC and does not assume that every bearer ends;

(xi) it unifies ordinary ending, successor onset, stage overlap, and many-predecessor/many-successor transformations, and excludes untransformed bearer ending within the continuing universe;

(xii) it preserves the type distinctions among stages, states, records, readings, coordinates, and model outputs;

(xiii) it allows model-bounded candidate-stage inference while denying a canonical or uniquely determining record–stage identity map;

(xiv) it states exact-stage limits epistemically, as limits of warrant from finite records;

(xv) it separates restricted empirical decisions from universal ontological quantifiers;

(xvi) it separates relativistic type non-identity from any additional physical criticism of relativistic geometry;

(xvii) it contains no compatibility, reconciliation, synthesis, or ontological-coexistence claim with relativistic time;

(xviii) its equations, symbols, examples, and citations preserve bearer and type throughout;

(xix) the word "structure" is excluded from the definitions and direct governing explanations of time, CMA, and the cosmic stages.

Canonical Definitions and Equations

Item	**Canonical statement**
Universe	Universe := TotalityOfAllPhysicalSystems, with $\mathcal{U}_{\text{phys}} := \{A \mid \text{PhysicalSystem}(A)\}$.
Physical system	PhysicalSystem(A) denotes an actually realized bearer with distinguishing structural and organizational characteristics; $\text{PhysicalSystem}(A) \implies I_A \neq \varnothing$.
Study qualification	$\text{StudyQualified}_{P,M}(A)$ is protocol- and model-relative and implies PhysicalSystem(A); $\mathsf{Bearer} := \mathcal{U}_{\text{phys}}$.
Time	Time denotes the fixed, irreversible, and uninterrupted succession and ordering of the common cosmic stages of change across all physical systems then existing at each stage; these stages together constitute one common cosmic extension.
Formal time representation	$T_{\text{ITOF}} = (\mathcal{S}_C, \prec_C)$.
Stage membership and presence	$\mathcal{S}_{\text{phys}}(s) := \{A \in \mathcal{U}_{\text{phys}} \mid s \in I_A\}$, and $\text{Present}_C(A; s) \iff \text{PhysicalSystem}(A) \wedge s \in I_A$.

Item	Canonical statement
CMA	$\mathrm{CMA} : \forall s \in \mathcal{S}_C[\mathcal{S}_{\mathrm{phys}}(s) \neq \varnothing \wedge \forall A \in \mathcal{S}_{\mathrm{phys}}(s)(\mathrm{Present}_{\mathrm{C}}(A; s) \wedge \mathrm{PhysReal}^{+}_{A}(s))]$.
ECP	$\mathrm{ECP}(A, s) : [s \in \mathcal{S}_C \wedge A \in \mathcal{S}_{\mathrm{phys}}(s)] \implies \mathrm{Present}_{\mathrm{C}}(A; s) \wedge \mathrm{PhysReal}^{+}_{A}(s)$, derived from CMA.
Identity domain	$I_A = \{s \in \mathcal{S}_C \mid \mathrm{ExistsAs}(A, s)\}$.
Physical history	$\mathcal{H}_A = (I_A, \prec_C \mid_{I_A}, X_A)$.
State map	$X_A : I_A \to \Omega_A$, with $X_{A,k} = \pi_{A,k} \circ X_A$.
Cross-bearer state comparison	Requires a declared common codomain or maps such as $\Psi_A : \Omega_A \to \Omega_{AB}$ and $\Psi_B : \Omega_B \to \Omega_{AB}$.
Onset	$\mathrm{Onset}_A(s) \iff s \in I_A \wedge \neg\exists r \in I_A(r \prec_C s)$.
Later-in-history	$\mathrm{LaterInHistory}_A(s) \iff s \in I_A \wedge \exists r \in I_A(r \prec_C s)$.
Onset realization	$\mathrm{OnsetReal}_A(s) \iff \mathrm{Onset}_A(s) \wedge \mathrm{IdentityOriginRealized}_A(s) \wedge \mathrm{ChangeBegins}_A(s)$.
Continuation realization	$\mathrm{ContinuationReal}_A(s) \iff \mathrm{LaterInHistory}_A(s) \wedge \mathrm{AlterReal}_A(s)$.
Total positive realization	$\mathrm{PhysReal}^{+}_{A}(s) \iff \mathrm{OnsetReal}_A(s) \oplus \mathrm{ContinuationReal}_A(s)$.
Initial cosmic stage	$\mathrm{Initial}_{\mathrm{C}}(s_0) \iff s_0 \in \mathcal{S}_C \wedge \neg\exists r \in \mathcal{S}_C(r \prec_C s_0)$.
COP	$\mathrm{COP} : \exists! s_0 \in \mathcal{S}_C[\mathrm{Initial}_{\mathrm{C}}(s_0) \wedge \mathcal{S}_{\mathrm{phys}}(s_0) \neq \varnothing \wedge \forall A \in \mathcal{S}_{\mathrm{phys}}(s_0)\ \ \mathrm{OnsetReal}_A(s_0)]$.
IOC	$\mathrm{IOC} : \forall A[\mathrm{PhysicalSystem}(A) \wedge I_A \neq \varnothing \implies \exists! s^0_A \in I_A\ \ \mathrm{OnsetReal}_A(s^0_A)]$.
Later Physical-Origin Postulate	Every non-initial $\mathrm{OnsetReal}_B(s)$ has a domain-warranted $\mathrm{OriginatesAt}(B, \mathcal{P}, s)$ relation to one or more direct contributors that are present at s and have prior realized histories; contributor termination is not required in every case.
IDC	$\mathrm{IDC} : \forall A \forall r, s, u[\mathrm{PhysicalSystem}(A) \wedge r, u \in I_A \wedge r \prec_C s \prec_C u \implies s \in I_A]$.
UCC	$\mathrm{PSR} \wedge \mathrm{CMA} \wedge \mathrm{IOC} \implies \forall A[\mathrm{PhysicalSystem}(A) \implies \mathrm{UCC}(A)]$; IDC independently excludes internal gaps in I_A.
Identity ending	$\mathrm{End}_A(e_A) \iff e_A \in I_A \wedge \neg\exists u \in I_A(e_A \prec_C u) \wedge \mathrm{IdentityEndingRealized}_A(e_A)$.
Unified transformation	$\mathrm{TransformAt}(\mathcal{P}, e, \mathcal{Q})$ requires nonempty predecessor and successor subsets of $\mathcal{U}_{\mathrm{phys}}$, warranted transformation and direct physical-origin links, every predecessor to end at e, and every successor to satisfy $\mathrm{OnsetReal}_B(e)$.
Ordinary successor formation	$\mathrm{OrdinaryEnd}_A(e_A) \iff \mathrm{TransformativeFailure}_A(e_A) \wedge \mathrm{TransformAt}(\{A\}, e_A, \mathrm{Succ}(A, e_A))$.

Item	Canonical statement
In-universe ending closure	$\mathrm{End}_A(e) \wedge \neg\,\mathrm{UniverseEnd}(e) \Longrightarrow \exists \mathcal{P}, \mathcal{Q}[A \in \mathcal{P} \wedge \mathrm{TransformAt}(\mathcal{P}, e, \mathcal{Q})]$.
Exceptional universe ending	If $\mathrm{UniverseEnd}(s_*)$, every extant identity ends, no general transformation or later physical origin begins a new identity there, and no later cosmic stage exists.
Record–stage boundary	$\mathrm{Type}(r) = \mathsf{PhysicalRecord}$, $\mathrm{Type}(s) = \mathsf{CommonCosmicStage}$, and $r \not\equiv_{\mathrm{type}} s$; $\mathrm{RecordRealizedAt}_D(r, s)$ may nevertheless hold.
Candidate-stage inference	$\mathrm{CandidateStages}^{A,\chi}_{P,M}(r) \subseteq \mathcal{S}_C$ is bearer- and target-occurrence-indexed, fallible, non-canonical, and not necessarily unique.
Noticeability limit	A valid record comparison does not warrant a unique exact-stage assignment without additional model-specific uniqueness conditions.
Restricted empirical architecture	A preregistered operational hypothesis, study admissibility, evidence set, decision rule, and restricted conclusion are formally distinct; accepted comparisons exclude self-comparison, an empty comparison set requires an inconclusive decision, $\mathrm{OperationalStasis}_{A;P,M,V,\varepsilon,J}$ requires a nonempty valid-comparison set in which no comparison exceeds the threshold, and adverse admissibility strengthens general admissibility.
Predictive fit	$d_{P,D}(O^{\mathrm{obs}}_{A,P}, \widehat{O}^{M}_{A,P}) \leq \varepsilon_{P,D}$ establishes approximate protocol-bounded fit and attributes no change to time.
Nondetection	$\neg\,\mathrm{Detected}_{P,M,\varepsilon}(A, s) \not\Rightarrow \neg\,\mathrm{PhysReal}^{+}_{A}(s)$, while non-detection alone does not identify a specific hidden content or mechanism.

B. Dependency Map

The explanatory order is

physical systems, internal factors, and actual engagements
$\Longrightarrow$ continuing bearer-specific physical change
$\Longrightarrow$ common cosmic stages
$\Longrightarrow$ their fixed, irreversible, and uninterrupted succession and ordering
$\Longrightarrow$ one common cosmic extension constituted by those stages
$\Longrightarrow$ the meaning denoted by time.

This is explanatory priority, not a strict mathematical construction of $\mathcal{S}_C$ from formulas that do not already use stage variables.

The formal dependency map is:

(i) the time definition fixes $T_{\text{ITOF}} = (\mathcal{S}_C, \prec_C)$;

(ii) Physical-System Realization independently supplies $I_A \neq \varnothing$ for every physical system;

(iii) COP independently postulates the unique initial cosmic stage and the onset realization of the first systems;

(iv) IOC independently supplies a unique onset realization within each nonempty physical-system identity domain;

(v) the Later Physical-Origin Postulate independently requires every non-initial bearer onset to have a warranted direct physical origin in contributors present at that onset stage and possessing prior realized histories;

(vi) CMA universally states nonempty stages, presence of every extant physical system, and bearer-specific physical realization there;

(vii) ECP is the bearer-level instantiation of CMA;

(viii) UCC follows from Physical-System Realization, CMA, and IOC: nonemptiness activates IOC's unique-onset conclusion, and CMA supplies continuation realization across I_A^{cont};

(ix) IDC universally excludes every internal gap in a physical-system identity domain and is not inferred from state similarity;

(x) identity ending does not follow from UCC; where an identity ends within the continuing universe, the in-universe ending-closure principle requires one unified transformation event.

The following nondependencies are mandatory:

$$\text{definition of time} \not\Rightarrow \text{physical causation},$$

$$\text{stage presence} \not\Rightarrow \text{equal bearer state or equal change content},$$

$$\text{clock output} \not\Rightarrow \text{identity of time},$$

$$\text{nondetection} \not\Rightarrow \text{stasis},$$

$$\text{finite record comparison} \not\Rightarrow \text{unique exact cosmic-stage assignment},$$

$$\text{UCC}(A) \not\Rightarrow \text{the ending of } A.$$

C. Identity Lifecycle Audit

For each bearer A, the audit asks:

(i) What physically individuates A?

(ii) Is A a physical system ontologically, and is it separately study-qualified for the current protocol?

(iii) Which unique stage satisfies OnsetReal_A, and what warrants the origin and immediate beginning of change there?

(iv) What warrants persistence of the same identity through continuing alteration?

(v) Which changes remain changes of A, and which physically end that identity?

(vi) Does functional failure occur without identity ending?

(vii) If ending occurs, is the endpoint an attained last member of I_A?

(viii) Which successor system or successor systems begin at the same common cosmic stage?

(ix) Does the case require a many-predecessor or many-successor transformation relation rather than a single-predecessor successor set?

(x) Is the predecessor–successor stage overlap stated without merging their identities?

A lifecycle claim is invalid when it changes the bearer without notice, treats a part as the whole, treats a class description as an individual history, or infers identity termination from functional failure alone.

D. Observation, Record, and Reconstruction Audit

Five-level separation

Every observational claim should distinguish at least five levels:

(i) physical realization in the bearer;

(ii) manifestation of an effect available to interaction;

(iii) interaction with detector or observer;

(iv) material or digital record;

(v) reading, model fit, or inference.

Collapsing these levels produces common errors: treating absence of a record as absence of change, treating a record as the original state, or treating a model coordinate as the observed physical stage.

Record provenance

A record claim should report the chain

$$\mathcal{P}_r = (A, \chi, D, \Theta_D, P, r), \tag{166}$$

where A is the bearer, χ the physical interaction or effect, D the detector, Θ_D detector conditions, P the protocol, and r the record. The tuple is a provenance template rather than a universal formal requirement. Missing provenance weakens attribution.

Direct and mediated records

A direct record is produced through a comparatively short and controlled physical chain. A mediated record may pass through propagation, transformation, storage, reconstruction, and model correction. Directness is a matter of chain structure, not ontological immediacy. Even a local detector record is later than the interaction that formed it and remains physically distinct from the sample realization.

Threshold conditions

For a claimed null result, report:

$$\epsilon_D, \qquad \mathcal{B}_D, \qquad \mathcal{S}_D, \qquad J, \tag{167}$$

where ϵ_D is sensitivity, $\mathcal{B}_D$ bandwidth or coverage, $\mathcal{S}_D$ selectivity, and J the observation domain. A null outside the covered domain cannot support equivalence under a bearer-complete criterion.

Noise and confounding

A record difference does not establish bearer change if the difference is attributable to detector noise, processing, drift, or another source. The inference requires

$$\mathrm{Difference}(r_1, r_2) \wedge \mathrm{AttributableToBearer}_P(r_1, r_2; A) \Longrightarrow \mathrm{Warrant}_P[\mathrm{WitnessOfChange}_A]\,. \tag{168}$$

Without the second premise the record difference remains ambiguous.

Reconstruction uncertainty

A reconstructed past quantity should be reported as

$$\widehat{q}^{\,\mathrm{past}}_{A,P} \pm \nu_{A,P}, \tag{169}$$

where $\nu_{A,P}$ summarizes uncertainty under the adopted convention. If Bayesian or frequentist structures are used, their interpretation must be stated rather than mixed. Standards for measurement uncertainty provide useful discipline [14, 15].

Delayed-manifestation conditions

When an effect becomes visible at record r_k, do not write that the change "occurred at" r_k unless the physical model supports that conclusion. Prefer:

$$\mathrm{EffectResolvedAt}(r_k) \not\Rightarrow \mathrm{ChangeBeganAt}(r_k). \tag{170}$$

The distinction is mandatory for ageing, cumulative damage, genetic evolution, geological processes, and remote astrophysical records.

Operational windows and limits on exact notice-stage warrant

No finite record claim may use a clock reading, coordinate, or reconstructed date as a uniquely warranted identification of the exact common cosmic stage without an additional validated physical model that supplies a uniqueness condition. Such quantities locate or order records, readings, and reconstructed coordinates within a model and protocol. High precision within an operational scale remains distinct from a canonical ITOF stage identification. A model may return a candidate-stage set, but the record does not become a stage and uniqueness is not presumed.

Researcher and laboratory inclusion

Experimental prose should not describe the apparatus as fixed while the sample alone changes. Fixed means controlled relative to selected variables. The observer, detector, support, electronics, air, building, and Earth remain physical systems. Their inclusion does not make measurement impossible; it motivates calibration, isolation, differential design, and uncertainty control.

D.1 Clock and Operational Comparison Audit

Clock construction checklist

For each clock model, state:

(1) bearer system C;

(2) physical process or transition used;

(3) record-producing mechanism;

(4) record-production map $\mathcal{R}_{C,P}$ and numerical reading map $N_{C,P}$;

(5) unit and scale convention;

(6) relevant physical and protocol conditions $\Theta_{C,P}$;

(7) uncertainty and drift model;

(8) relation, if any, to a relativistic prediction.

The clock is not fully specified by naming an oscillation frequency.

Record-to-reading map

The valid direction is

$$(X_C, \Theta_{C,P}) \xrightarrow{\mathcal{R}_{C,P}} r_C \xrightarrow{N_{C,P}} n_C \in \mathbb{R}_P. \tag{171}$$

The map is not reversed to make the reading the cause of the physical clock state. Nor is r_C treated as a common cosmic stage.

Comparison protocol

A two-clock comparison requires a pairing rule. The mere existence of two readings does not define which records are compared. The protocol may use reunion, signal exchange, common detector, transported records, or coordinate reconstruction. The pairing map can be written

$$\Pi^P_{12} : (r_{C_1,i}, r_{C_2,j}) \longmapsto \text{comparison pair}. \tag{172}$$

The map belongs to the experiment, not to the cosmic-stage ontology.

Native and common codomains

If clocks report different native units or scales, comparison requires transformations $\Gamma_{i,P_{12}}$ as in Equation (53). A subtraction made before unit and scale reconciliation is formally invalid. The common codomain is numerical and conventional; it is not the common cosmic stage.

Clock-rate statements

A statement that clock C_1 "runs slower" than C_2 must specify the ratio or difference:

$$\mathcal{R}_{12}^{P} := \frac{\Delta_P \Gamma_{1,P}(n_{C_1})}{\Delta_P \Gamma_{2,P}(n_{C_2})}, \qquad \Delta_P \Gamma_{2,P}(n_{C_2}) \neq 0, \tag{173}$$

where each finite difference is constructed from record pairs selected by the same declared comparison protocol. The phrase does not mean that T_{ITOF} has two rates.

Relativistic prediction conditions

When a clock is predicted by proper time, distinguish:

$$\tau[\gamma, g] \quad \text{metric functional,} \tag{174}$$

$$n_{C,P}^{\mathrm{pred}} \quad \text{predicted numerical clock reading,} \tag{175}$$

$$n_{C,P}^{\mathrm{obs}} \quad \text{observed numerical reading,} \tag{176}$$

$$\delta n_C := n_{C,P}^{\mathrm{obs}} - n_{C,P}^{\mathrm{pred}} \quad \text{residual.} \tag{177}$$

Agreement concerns the model and physical clock. It does not prove $\tau \equiv T_{\mathrm{ITOF}}$.

Drift and residual conditions

A drift model may write

$$n_{C,P}^{\mathrm{obs}} = n_{C,P}^{\mathrm{ideal}} + b_C + s_C + \eta_C, \tag{178}$$

where b_C is bias, s_C systematic correction, and η_C stochastic contribution, with meanings fixed by the experiment. The decomposition is illustrative. Every term belongs to clock performance and analysis.

Clock records and stage succession

Any sentence claiming that a clock counts stages must be rejected. A clock counts or estimates cycles, transitions, phase increments, pulses, or other physical outputs. Cosmic stages are not instrumentally discretized. If the manuscript uses "stage count" as a metaphor, replace it with the actual clock variable.

Clock coherence condition

A coherent clock analysis must identify the material bearer, the selected physical process, the record-producing dynamics, the numerical reading map, the environmental and device conditions, and the comparison protocol. Its logical direction is

$$(X_C, \Theta_{C,P}) \xrightarrow{\mathcal{R}_{C,P}} r_C \xrightarrow{N_{C,P}} n_C, \qquad n_C \not\equiv_{\text{type}} T_{\text{ITOF}}, \qquad r_C \not\equiv_{\text{type}} s. \tag{179}$$

The reading is a macroscopic accumulated record of selected physical transitions or signals. It neither counts common cosmic stages nor measures time as an independent physical object. A relativistic functional may enter only through an explicitly declared model-specific prediction, never as the ontological identity of the clock output or of time. This criterion applies equally to laboratory clocks and to astrophysical "clocks" such as pulsations, rotations, or orbital periodicities.

E. Difficult Systems and Test Protocols

Why the principle needs an architecture

The derived statement that all physical systems realize onset or continuing change throughout their identity domains is broader than any single experiment. Its scientific credibility depends on separating deductive structure, physical routes, class evidence, and unresolved candidates. The architecture is not a formal proof from a finite premise set that enumerates nature. It is a disciplined programme for supporting or defeating a universal physical principle.

Route I: persistent effective processes

For many systems, known internal processes and external engagements provide continuing routes to realization. The route has the form

$$\begin{aligned} &\text{IdentityPersists}(A, J) \wedge \forall s \in J_{\text{C}},\ \text{EffectiveRealizationRoute}_A(s) \\ &\quad \Longrightarrow \forall s \in J_{\text{C}} \cap I_A\ \text{PhysReal}_A^+(s). \end{aligned} \tag{180}$$

The premise must be physically supported. It cannot be replaced by the generic phrase "everything interacts" if exact isolation is under consideration.

Route II: cumulative manifestation

Some changes are individually unresolved but cumulatively detectable. Let δ_k denote physically attributable contributions whose combined effect is D_n. Schematically,

$$D_n = \mathcal{A}(\delta_1, \ldots, \delta_n), \tag{181}$$

where $\mathcal{A}$ is a domain-specific accumulation rule and need not be simple addition. If the final effect and model validly require prior contributions, the evidence supports continuing realization over the accumulation domain.

Route III: class exclusion of complete stasis

A class may be supported by showing that every admissible member satisfying identity conditions necessarily has at least one physically active route. The form is

$$\forall A \in \mathcal{C}, \quad \mathrm{PhysicalSystem}(A) \wedge \mathrm{IdentityPersists}(A) \Longrightarrow \bigvee_{k=1}^{m} \mathrm{ActiveRoute}_k(A). \tag{182}$$

The disjunction must cover the class without assuming the conclusion. If a member can evade all routes, it remains a difficult candidate.

Route IV: direct positive witnesses

Longitudinal records can directly establish changes in representative systems. The evidence is strong for those systems and changes. Universal use requires a class argument showing why the sample and physical routes cover the proposed domain. Statistical generalization alone may be insufficient when rare exact-stasis candidates are conceptually possible.

Route V: theoretical dynamics with empirical support

A well-tested dynamical theory may imply continuing evolution under specified conditions. The implication supports ITOF only if the model variables and bearer are physically adequate. Effective theories may omit sectors relevant to a bearer-complete criterion. The theory's success therefore contributes evidence without automatically closing ontology.

Permanent cancellation

Opposing processes can produce a constant selected quantity. To support complete stasis through permanent cancellation, one must show not merely that net outputs vanish but that the opposing processes themselves produce no state difference. In many cases the existence of cancellation already implies continuing physical processes.

Approximate isolation

Isolation is always relative to specified couplings and sensitivity. An approximately isolated system can still undergo internal realization. An exactly isolated ideal in a model must be examined separately. The proof architecture records whether the universal claim depends on excluding exact isolation or on showing internal routes within it.

Finite windows

No finite observation window demonstrates indefinite continuation, and a finite null window does not demonstrate cessation. An apparently unchanged stone may undergo minute changes whose accumulated manifestation becomes visible only after years or centuries. The later visible effect does not imply that the complete alteration occurred once at the moment of detection. Evidence from finite windows supports or challenges restricted hypotheses through physical theory, repeatability, and class synthesis, while the unrestricted UCC theorem remains dependent on the revisability of its foundational physical premises.

Continuing realization throughout identity persistence

The phrase “static tail” denotes a hypothetical identity-preserving continuation after all change ends. It is not admitted as compatible with the universal principle. To challenge the principle, the tail must be physically established, not inferred from a quiet record. The manuscript avoids using the static tail as a hidden object in equations.

Universal synthesis

A responsible synthesis reports:

- classes with strong direct evidence;
- classes supported by well-tested dynamics;
- classes supported by exclusion of complete stasis;
- difficult candidates with unresolved bearer-complete questions;
- possible adverse outcomes and revision rules.

This is more rigorous than both dogmatic universal assertion and premature suspension based on one idealized stationary model.

History-informed prediction audit

A comparative prediction study must pre-register the class-only model, the history-informed model, training and validation sets, performance metric, uncertainty procedure, and adverse result. Improvement must be evaluated out of sample. A successful result supports the relevance of bearer history but is not presented as exclusive proof of the complete cosmic ontology.

E.1 Difficult-System and Class Matrix

Matrix purpose

The matrix translates broad universal claims into class-specific proof obligations. It treats realization mechanisms as class-specific and requires each class to state its own physical routes. For each candidate, the investigation identifies the bearer, state description, identity criterion, reported constancy claim, plausible realization routes, evidence channels, and domain-qualified challenge.

Class	Bearer and identity	Reported constancy claim
Constructed material	Declared specimen, composition, and structural continuity	Measured properties remain within declared tolerances
Atomic system	Atom or ion under species and confinement criterion	Stationary internal state
Molecular system	Molecule under bonding and composition criterion	Ground or equilibrium state

Class	Bearer and identity	Reported constancy claim
Open quantum system	System plus declared boundary and coupling	Steady density operator
Ground-state candidate	Physical bearer under Hamiltonian and boundary conditions	Exact lowest-energy stationarity
Vacuum or field configuration	Declared field domain and boundary conditions	Vacuum invariance
Classical equilibrium	Material system under thermodynamic constraints	Constant macroscopic variables and zero net flux
Fixed-point model	Physical system represented by $\dot{\boldsymbol{x}} = 0$	Exact model stationarity
Periodic system	Oscillator, orbit, or recurrent process	Exact return of selected state variables
Stable particle	Particle under species identity	Species identity and internal observables remain invariant
Geological object	Rock, mineral, or landform under structural identity	Apparent macroscopic permanence
Planetary system	Planet or subsystem under gravitational and material identity	Stable orbit or structure
Stellar system	Star under astrophysical identity	Long stable phase
Living system	Cell, organism, or lineage under biological identity	Homeostasis or phenotypic stability
Genetic bearer	Molecule, cell, tissue, or lineage	Sequence and expression remain equivalent within declared coverage
Clock	Device under functional identity	Stable calibrated rate
Stationary spacetime model	Metric solution with symmetry	Adapted-chart metric components remain constant

Class	Required realization analysis	Qualified adverse condition
Constructed material	Thermal, chemical, radiative, mechanical, and microstructural channels	Equivalence under a bearer-complete criterion with robust multichannel coverage.
Atomic system	Coupling, emission, absorption, field interaction, recoil, and environmental channels	Identity persists with equivalence under a bearer-complete criterion in adequately isolated conditions.
Molecular system	Vibrational, rotational, electronic, collision, and radiative routes	Equivalence under a bearer-complete criterion across every physically relevant sector.

Class	Required realization analysis	Qualified adverse condition
Open quantum system	Quantum trajectories, exchange, decoherence, jumps, and correlations	Equivalence under a bearer-complete criterion throughout continuing identity and declared open coupling.
Ground-state candidate	Representation, environment, detector coupling, and physically meaningful observables	Equivalence under a bearer-complete criterion in the fully specified physical model.
Vacuum or field configuration	Field observables, boundary changes, detector response, interaction, and representation dependence	The physical bearer satisfies the declared bearer-complete criterion across field and boundary coverage.
Classical equilibrium	Microscopic processes, fluctuations, exchange, and omitted degrees of freedom	Equivalence under a bearer-complete criterion rather than net balance.
Fixed-point model	Completeness of variables, physical instantiation, perturbations, and hidden sectors	The model variables are shown to exhaust the bearer-complete criterion and remain equivalent at a later stage.
Periodic system	Intermediate states, environment, phase, dissipation, and complete-state comparison	The complete bearer state and relevant surroundings satisfy a bearer-complete criterion at a later stage.
Stable particle	Interaction, propagation, field relations, and exact isolation claim	Identity persists with equivalence under a bearer-complete criterion.
Geological object	Radiometric, chemical, mechanical, erosion, thermal, and surface channels	Comprehensive evidence supports equivalence under a bearer-complete criterion over the declared domain.
Planetary system	Rotation, orbit, tides, atmosphere, interior, radiation, and impacts	Equivalence under a bearer-complete criterion across every relevant planetary sector.
Stellar system	Fusion, transport, oscillation, magnetic, emission, and mass-loss channels	Equivalence under a bearer-complete criterion throughout the identity-valid observation domain.
Living system	Metabolism, repair, exchange, expression, mutation, and turnover	Equivalence under a bearer-complete criterion with continuing biological identity.

Class	Required realization analysis	Qualified adverse condition
Genetic bearer	Mutation, repair, epigenetics, copy number, and sampling coverage	Equivalence under a bearer-complete criterion across molecular and organizational components.
Clock	Oscillation, control, environment, drift, readout, and relativistic conditions	Equivalence under a bearer-complete criterion throughout continuing clock identity, including the physical process required for operation.
Stationary spacetime model	Distinguish metric symmetry from material systems and cosmic extension	A physical bearer, not geometry alone, satisfies an identity-preserving bearer-complete criterion at a later stage.

Constructed materials

Materials offer controlled exposure and multichannel analysis. A strong programme combines mechanical, spectroscopic, chemical, and imaging evidence. Accelerated tests do not simply compress "time"; they alter physical factors such as radiation, temperature, humidity, or stress. Extrapolation to service conditions requires a model and uncertainty statement.

Atomic and molecular systems

Precision spectroscopy can resolve extremely small changes, but resolution is not complete-state access. Preparation and measurement place the system in an experimental environment. The strongest stationary claims should be tested under clearly defined isolation and Hamiltonian assumptions. Observation of quantum jumps demonstrates discrete recordable transitions in some systems, not a universal cosmic-stage order.

Ground states and vacuum candidates

These classes require special restraint because formal language can outrun physical attribution. The investigation should distinguish exact mathematical state, approximate laboratory preparation, environmental coupling, detector interaction, and interpretation. Neither "zero-point activity" nor "stationarity" should be used as a slogan. The claim must be attached to a bearer and evidence.

Stable particles

For a particle regarded as exactly stable, decay is not the only possible form of realization. Motion, scattering, field interaction, and participation in composite structures may supply change. An exactly isolated free particle in a state treated as invariant remains a difficult limiting case. V26/F6 records the obligation rather than disguising it with an unspecified mechanism.

Geophysical and planetary systems

Earth materials, glaciers, atmosphere, crust, mantle, oceans, and planetary orbits provide multiple independent records of change [49, 50, 51, 52]. The evidential strength lies in convergence across physical channels. These domains also demonstrate that apparent stability over a human interval can coexist with continuing realization at smaller scales or longer accumulation windows.

Stellar and remote systems

Remote systems require propagation modelling and record reconstruction. A variable signal establishes source or path change only after alternatives are analysed. Stable luminosity in a band is not complete stellar-state equivalence. Surveys and asteroseismology provide rich change witnesses while preserving the distinction between emission and arrival. Terminal stellar transformations and galactic interactions add identity-lifecycle tests: the investigation must distinguish continuing evolution under one bearer criterion from cessation of a predecessor and onset of successor systems.

Living and genetic systems

Biological identity is organizational and lineage-dependent. Molecular turnover can be extensive while organism identity persists. Conversely, a mutation can be physically real without changing phenotype. Sampling and tissue heterogeneity must be incorporated. Longitudinal genomics and somatic-mutation studies illustrate both the power and limitations of present access. Organismal life histories additionally provide ordered domain models from identity onset through development, health, disease, recovery, ageing, and identity termination. Disease is a criterion-relative failure candidate, not an automatic identity-end condition.

Clock systems

A functioning clock necessarily produces physical transitions and records. Its stable operation therefore supplies a direct example of stability through change. Clock comparisons are not evidence that time itself changes; they are evidence that physical processes and outputs depend on conditions in predictable ways.

Class synthesis obligation

Universal support requires a reasoned synthesis of classes, not a list of examples. The synthesis should state which physical routes are common, which are class-specific, which candidates remain difficult, and what adverse result would revise the claim. This is stronger than asserting that "everything changes" as an unexamined maxim.

Empirical class	Primary bearer	Evidential contribution
Small-scale, genetic, and cellular	Molecule, cell, tissue, organism, or lineage under an explicit attribution rule	Localized mutations, turnover, regulation, and molecular or cellular differences show continuing realization under persisting higher-level identity.

Empirical class	Primary bearer	Evidential contribution
Organismal life history	Organism under a declared biological identity criterion	Development, disease, recovery, recurrence, ageing, and terminal change provide ordered witnesses across an identity-bounded history.
Geophysical and planetary	Glacier, crustal region, atmosphere, ocean, mantle, planetary interior, or orbital system	Independent monitoring channels show cumulative and multi-scale change beneath apparently stable macroscopic descriptions.
Stellar and remote	Star, compact object, galaxy, or other remote source	Variability, terminal stellar transformation, galactic interaction, and merger provide witnesses of continuing change and possible successor-system formation when source, propagation, arrival, and reconstruction are distinguished.
Laboratory and clock systems	Material device, transition, oscillator, detector, or controlled ensemble	Repeated physical transitions and records demonstrate stable operation through change and permit calibrated numerical comparison.
Difficult idealized candidates	Stationary quantum model, exactly stable particle, or ideally isolated free particle	These cases expose the strongest bearer-completeness and omitted-variable obligations and therefore serve as stress tests.

Empirical class	Necessary limit on inference
Small-scale, genetic, and cellular	A sampled difference supports only the bearer and level to which it is validly attributed; it does not assign an exact cosmic stage.
Organismal life history	Biological phases are coarse-grained state classifications; disease or functional failure does not by itself establish identity termination, and no fixed calendar age defines the endpoint.
Geophysical and planetary	Stability over a human window or in one observable is not equivalence under a bearer-complete criterion.
Stellar and remote	Arrival records constrain source windows rather than exact stages; identity termination requires an explicit stellar or galactic criterion and is not inferred from variability alone.
Laboratory and clock systems	Numerical output is neither time nor a count of common cosmic stages; model fit remains model-bounded.

Empirical class	Necessary limit on inference
Difficult idealized candidates	No unspecified hidden mechanism may be invented; a genuine adverse result requires warranted identity-preserving equivalence under a bearer-complete criterion at a later stage.

The synthesis is cumulative and revisable. Heterogeneous evidence can support universal change continuity across classes, but it is not a direct observation of every common cosmic stage and does not by itself prove the Cosmic Moment Axiom for every system in the universe.

F. Relativistic Reclassification and Type Boundaries

Purpose

Whenever a relativistic formalism is cited, its notation is reproduced according to the model that defines it and then subjected to ITOF type criticism. The following classification does not accept or validate the equations; it prevents an unsupported transfer of temporal identity. Type non-identity establishes only the absence of a type-preserving identity with ITOF time. The broader rejection of relativistic geometry as the ontology or definition of time is an independent governing commitment of V26/F6 and is not presented as a theorem derived from type separation alone.

Ontological participation and the representation bridge

The relation $A \in \mathcal{S}_{\text{phys}}(s)$ states that bearer A is a physical system whose identity is realized at cosmic stage s. It is the membership condition used by CMA; ECP is merely its bearer-level instantiation and introduces no second primitive participation relation. Relativistic representation has a different typed form:

$$\mathcal{M}_{\text{rel},A} : \mathfrak{H}_A^{\text{phys,adm}} \longrightarrow \mathfrak{R}_A^{\text{rel}}. \tag{183}$$

Its codomain contains coordinate, metric, causal, worldline, field, and prediction objects. It represents a physical history or occurrence range and does not define the common cosmic stage. The operational marker u_{obs} constrains manifestation and recording windows; it is neither an event-to-stage map nor a stage variable.

Coordinate type boundary

For every coordinate expression, ask:

(1) Which chart or observer convention defines the coordinates?

(2) Is the statement about an event, a coordinate value, or a coordinate difference?

(3) Which transformations preserve the claimed relation?

(4) Has a coordinate component been called time without clarifying its type?

(5) Has coordinate equality been confused with the common cosmic stage?

The correct type statement is

$$x_F^\mu(e) \in \mathbb{R}_F^4, \tag{184}$$

not $x_F^0(e) \in \mathcal{S}_\mathrm{C}$ and not $x_F^0(e) \equiv T_\mathrm{ITOF}$.

Lorentz-transformation type boundary

Equation (124) relates coordinate assignments (t, x) and (t', x'). The transformation domain excludes T_ITOF; therefore the cosmic extension is neither transformed, mixed with space, nor made observer-dependent by this equation.

A safe summary is

$$\Lambda \in \mathrm{Aut}(\mathcal{M}_\mathrm{Mink}), \qquad T_\mathrm{ITOF} \notin \mathrm{Dom}(\Lambda), \tag{185}$$

where the first relation is schematic and the second is a type restriction, not a new mathematical theorem about Lorentz groups.

Proper-time type boundary

A proper-time passage must state:

- the worldline γ is timelike;
- the metric and sign convention are fixed;
- τ is a scalar functional of (γ, g);
- a real clock's relation to τ requires a physical model;
- unequal values do not imply unequal cosmic extensions.

The sentence "the clock measures time" should be replaced by "the clock output tracks proper time under the stated idealization" or by an equally explicit physical statement.

F.1 Clock-experiment type boundary

The general temporal-attribution boundary for atomic-clock outputs is established in Subsection 13.3.

Relativistic clock experiments commonly compare frequencies or accumulated readings. Their type structure separates

$$\text{metric prediction} \longrightarrow \text{device prediction} \longrightarrow \text{observed record} \longrightarrow \text{comparison residual.} \tag{186}$$

A paper reporting centimetre-scale gravitational redshift, for example, provides high-precision evidence for the relation among clocks, height, and metric prediction. The result remains evidence about physical outputs, not direct observation of the cosmic stage.

Frequency-shift type boundary

For every redshift or Doppler equation, identify:

(a) emitter process;

(b) emitted frequency definition;

(c) propagation conditions;

(d) receiver process;

(e) received frequency extraction;

(f) observer or coordinate assumptions.

Frequency belongs to a physical process or signal; it is not a property of time in ITOF.

Metric and curvature type boundary

Curvature is a predicate of a declared geometric object: metric, connection, Riemann tensor, Ricci tensor, scalar curvature, or geodesic deviation. The predicate remains exclusively in that geometric domain. Since V26/F6 defines no metric or connection on the cosmic extension, curvature is ill-typed when applied to T_{ITOF}. The manuscript therefore rejects "curved time" rather than treating it as an optional interpretation.

The type relation is

$$\mathrm{Curvature} : (M, g) \longmapsto R^{\rho}{}_{\sigma\mu\nu}, \tag{187}$$

with the explicit boundary

$$T_{\mathrm{ITOF}} \notin \mathrm{Dom}(\mathrm{Curvature})\,. \tag{188}$$

Field-equation type boundary

The Einstein field equation may be cited as the equation defined by general relativity, with its geometrical and stress–energy objects. Citation or calculation does not endorse its physical adequacy or temporal interpretation. No ITOF term is inserted into it. If an application speaks of the "effect of time" on matter, replace the phrase with the actual metric, field, trajectory, or environmental relation.

Spacetime type boundary

Spacetime is a geometrical model whose claimed physical interpretation depends on explicit assumptions and inferential links to records. Four-dimensional or higher-dimensional coordinate arrangements are not the ontology of time; a manifold point is not a physical realization; a hypersurface is not the common cosmic stage; and warped, compactified, or multiply timelike geometries do not multiply or deform the common cosmic extension common to all physical systems. V26/F6 does not endorse the geometry as the confirmed physical nature of the universe and categorically rejects its identity with time.

Coordinate synchronization boundary

V26/F6 replaces the V24/F4 pairwise relation $\sim_{\text{abs}}$ with direct common cosmic-stage membership and a derived co-stage relation. The formal distinction is:

$$\text{Sync}_{F,P}(e_1, e_2) \quad \text{coordinate or protocol relation,} \tag{189}$$

$$\text{CMA} \quad \text{foundational common-stage axiom.} \tag{190}$$

The relations are formally distinct. Coordinate synchronization organizes coordinate assignments under a protocol; CMA states the presence and bearer-specific physical realization of all extant physical systems at the common cosmic stage.

Causal-order boundary

No relativistic causal classification is adopted as a governing constraint on ITOF. Any representation used in an application must be checked against independently warranted physical interactions and record order. Ontological participation is stated by $A \in \mathcal{S}_{\text{phys}}(s)$, while records and u_{obs} constrain operational windows rather than assigning an exact stage by themselves.

Covariance boundary

Covariance is a formal property claimed for relativistic equations under coordinate change. ITOF does not treat it as evidence that the equations describe temporal reality. Ontological participation occupies a non-numerical relational type and introduces no coordinate assignment or relativistic correction term; the common cosmic stage is asserted through $A \in \mathcal{S}_{\text{phys}}(s)$ independently of covariance.

Relativistic classification table

Object	**Relativistic role**	**ITOF type boundary**
t_F	Coordinate component in chart F	Coordinate type distinct from T_{ITOF}
Δt_F	Coordinate interval	Coordinate interval distinct from cosmic extension
ds^2	Metric interval	Metric interval distinct from time
$\tau[\gamma, g]$	Timelike worldline functional	Metric functional distinct from time and stage count
$N_{C,P}$	Reading map from clock records to numbers	Clock-map type distinct from time and stage
n_C	Numerical clock output	Clock-output type distinct from time and stage
z	Frequency ratio	Frequency-ratio type distinct from temporal ontology
$g_{\mu\nu}$	Metric field	Metric-field type distinct from temporal order

Object	Relativistic role	ITOF type boundary
$R^{\rho}{}_{\sigma\mu\nu}$	Curvature tensor	Curvature predicate remains attached to metric geometry
(M, g)	Spacetime model	T_{ITOF}
Σ_t	Hypersurface or foliation leaf	Hypersurface type distinct from common-stage type
$\text{Sync}_{F,P}$	Coordinate synchronization relation	Synchronization relation distinct from the axiom
$A \in \mathcal{S}_{\text{phys}}(s)$	Extant bearer at a common stage	Direct membership in the bearer domain of the shared stage
$\mathcal{M}_{\text{rel},A}$	Relativistic representation bridge	Representation bridge with bounded evidential output

Object	Required clarification
t_F	State chart and synchronization convention.
Δt_F	State endpoints and frame.
ds^2	State signature and invariant role.
$\tau[\gamma, g]$	State path and metric.
$N_{C,P}$	State clock process, record domain, codomain, and protocol.
n_C	State the generating record and reading map.
z	State emitter, receiver, and model.
$g_{\mu\nu}$	State geometrical and dynamical role.
$R^{\rho}{}_{\sigma\mu\nu}$	State connection and metric.
(M, g)	Distinguish representation and ontology.
Σ_t	State foliation dependence.
$\text{Sync}_{F,P}$	State physical procedure and convention.
$A \in \mathcal{S}_{\text{phys}}(s)$	State bearer identity and stage domain.
$\mathcal{M}_{\text{rel},A}$	State model codomain and evidential limits.

Relativistic classification conclusion

The relativistic critique is complete only when each cited equation has an explicit domain, codomain, assumed bearer or record chain, and ontological type. Agreement with selected records establishes at most model-bounded calculational adequacy; it does not establish the represented geometry as physical reality or grant temporal identity. V26/F6 cites the equations for examination and states the identity rejection directly.

G. Worked Applications and Formal Propositions

Atomic emission or absorption

Let A be an atom or ion whose identity remains valid across an interaction. Two compared state descriptions may differ in an attributable electronic, nuclear, motional, or coupled condition. That difference can witness a physical alteration, but it does not define change through stage-order terminology. If the alteration actually occurs,

$$\begin{aligned} &\mathrm{PhysicalSystem}(A) \wedge s \in I_A \wedge \exists r \in I_A \, (r \prec_C s) \\ &\wedge \mathrm{ContinuingPhysicalChangeAt}(A, s) \wedge \mathrm{BearerAttribution}_A(s) \\ &\qquad \Longrightarrow \mathrm{ContinuationReal}_A(s) \Longrightarrow \mathrm{PhysReal}_A^{+}(s). \end{aligned} \tag{191}$$

A photon emitted or absorbed is part of the physical engagement and may later produce a detector record. The photon record is not the atomic realization, and the detector reading does not identify the exact common stage of the atomic transition.

If the transition is used as a clock process, the protocol counts or estimates repeated atomic records. The clock's stability concerns the reproducibility of the transition frequency and apparatus, not absence of physical change. The common cosmic stage is shared with all other existing systems throughout the process.

Localized material change

Let a polymer specimen A undergo localized oxidation in region k. The macroscopic dimensions may remain within tolerance while chemical bonds and local composition change. A valid witness may be a spectroscopic feature $q_{A,k}$. Then

$$q_{A,k}(s) \neq q_{A,k}(t) \wedge \mathrm{ValidAttribution}_{A,P,M}(k; s, t) \Longrightarrow \mathrm{Warrant}_{P,M}[X_A(s) \not\equiv_{\Gamma_A} X_A(t)]\,. \tag{192}$$

The conclusion is evidential support for physical change in the specimen, not merely change in the spectrum, provided the instrument model and attribution are independently validated. The state comparison is a witness, not the ontological definition. The later visible crack may be a delayed manifestation of accumulated realizations.

Genetic difference in a continuing cell lineage

Let A be a cell lineage under a valid lineage identity criterion. A molecular record indicates a sequence substitution in a descendant. The correct chain is

$$\text{molecular transition} \longrightarrow \text{sample interaction} \longrightarrow \text{sequencing record} \longrightarrow \text{variant inference.} \tag{193}$$

If alternative technical artefacts are excluded and attribution is valid, the genetic component differs and the lineage has undergone physical change. No claim follows that phenotype changed at the same stage or that the sequencing date identifies the stage of mutation onset.

Clock-system change

Let C be an optical clock. Laser fields, trapped atoms or ions, control electronics, thermal environment, and readout apparatus form an interacting physical system. Each interrogation cycle produces records. The reported reading is

$$n_C = N_{C,P}(r_C), \qquad N_{C,P} : \mathfrak{R}_{C,P} \longrightarrow \mathbb{R}_P. \tag{194}$$

A gravitational comparison with another clock predicts a frequency ratio through the relativistic model. Agreement can support only the bounded adequacy of the declared calculation and device description for the selected records; it does not confirm the metric geometry as physical reality. It also does not imply that the common cosmic stage has a frequency or that each clock possesses a local time.

Remote astrophysical record

Let S be a variable star and D a terrestrial detector. Source realization affects emitted flux; propagation carries the record; detection produces a time-series sample. The detector can infer variability under calibration and propagation assumptions. The inference remains

$$\widehat{X}^{\mathrm{emit}}_{S,P} \not\equiv_{\mathrm{type}} X^{\mathrm{emit}}_{S}. \tag{195}$$

The relation is an identity boundary: the reconstruction represents but is not the original state. The source's common cosmic-stage participation is not delayed until detection.

Stationary quantum representation

Let a model assign ρ_A such that

$$\mathcal{L}(\rho_A) = 0. \tag{196}$$

The equation establishes stationarity under generator $\mathcal{L}$. To infer complete physical stasis, the investigator must establish that ρ_A is bearer-complete, that no physically relevant coupling or trajectory information is omitted, and that the represented state remains exactly instantiated. If quantum-jump records occur, change is directly established. If no records occur, the result is classified by coverage, not declared stasis.

Periodic observable return

For a periodic observable,

$$Q_A(\lambda + T) = Q_A(\lambda), \tag{197}$$

where λ is a model or operational parameter. The system realizes intermediate physical conditions before the selected quantity returns to the same value. The repeated value does not satisfy $s = q$. The period T is not an amount of cosmic extension; it is a quantity in the model or clock scale.

Identity termination

Suppose a star undergoes a transformation in which the original stellar identity physically ceases, as judged through a declared astrophysical criterion and evidence. The ordinary transition yields one or more successor systems. For the ontic ending stage e_A, the valid statement is

$$\mathrm{OrdinaryEnd}_A(e_A) \wedge \mathrm{Succ}(A, e_A) \neq \varnothing \wedge \forall B \in \mathrm{Succ}(A, e_A)\ \mathrm{OnsetReal}_B(e_A). \tag{198}$$

The physical history $\mathcal{H}_A$ ends when the identity of A ends; no local time or private temporal extension terminates. At that same common cosmic stage, the successor bearers begin their own identity domains, physical histories, and immediate changes within the common cosmic extension and its fixed, irreversible, and uninterrupted ordering and succession.

Subthreshold difference

Let a predicted material change satisfy $0 < |\delta q| < \epsilon_D$. A null record is expected under detector D. The scientific statement is

$$\mathrm{NoResolvedDifference}_D \wedge \mathrm{InsufficientCoverage}_D \Longrightarrow \mathrm{InconclusiveNull}, \tag{199}$$

not proof of change and not proof of stasis. Independent higher-sensitivity channels can revise the classification.

Dynamic equilibrium

Let opposing fluxes J_+ and J_- satisfy

$$J_+ + J_- = 0, \qquad J_+ \neq 0, \qquad J_- \neq 0. \tag{200}$$

The net quantity is stable while processes continue. This is a direct demonstration that equality of a macroscopic derivative can coexist with physical realization. If instead each flux is modelled as zero, other state components still require domain-complete assessment before complete stasis is inferred.

Terrestrial rest

Let a sample be fixed in a laboratory so that $\boldsymbol{v}_{A/R_{\mathrm{lab}}} = 0$. The sample shares Earth's rotational and orbital motion and may undergo internal processes. The example supports two separate conclusions: the kinematic rest statement is reference-relative, and physical realization is not conditional on translational motion. Neither conclusion uses cosmic-stage observation.

Spacetime model with a stationary metric

Let a metric admit a Killing field and coordinates in which $\partial_t g_{\mu\nu} = 0$. The geometrical statement is captured by

$$\partial_t g_{\mu\nu} = 0 \nRightarrow \mathrm{NoPhysicalRealization}(A). \tag{201}$$

for every system represented in that spacetime. Nor does it imply that cosmic succession ceases or that the common cosmic extension loses its order. The model symmetry and the temporal ontology remain distinct.

Pattern summary

Every worked application follows the same order:

$$\boxed{\text{bearer} \to \text{state} \to \text{actual difference} \to \text{physical realization} \to \text{record and inference if available}} \tag{202}$$

The common cosmic stage and time are not inserted into the physical mechanism. They enter through the foundational cosmic relation and extension.

G.1 Formal Propositions and Proof Sketches

Purpose and limit

The propositions in this appendix are consequences of the adopted definitions, the physical-system realization postulate, COP, IOC, the Later Physical-Origin Postulate, IDC, CMA, and declared bridge assumptions. They do not replace domain dynamics or establish the physical truth of the foundational premises by logic alone. A proof sketch shows the dependency of a claim and makes hidden premises visible.

Proposition G.1 (Selected-quantity insufficiency)**.** For a physical system A, equality of a selected quantity at two records does not entail physical equivalence of the complete state unless the quantity is proven complete for the claim.

Proof sketch. By Section 7, $X_A \not\equiv_{\text{type}} Q_A$. Equality $Q_A(s) = Q_A(t)$ constrains the selected map only. A difference may remain in another component of X_A. To infer $X_A(s) \equiv_{\Gamma_A} X_A(t)$, one must add the premise that the selected description is complete for every physically relevant difference. Without that premise the inference is invalid.

Proposition G.2 (Local-difference sufficiency)**.** If a physically real difference occurs in a component or relation validly attributable to A, and identity persists, then the system states are physically non-equivalent.

Proof sketch. The complete state includes the attributable component or relation. If that component differs physically, the state descriptions cannot be equivalent under a physical-equivalence relation that respects attributable components. The result does not require global reconfiguration.

Proposition G.3 (Realization–record non-identity)**.** A record caused by or physically linked to a realization is not identical with that realization.

Proof sketch. The realization is identity onset or continuing physical change in bearer A; the record is a distinct physical configuration in detector or storage system D. They have different functions and positions in the measurement chain. Even when $A = D$, the record configuration is a result or representation, not the physical change itself.

Proposition G.4 (Common-stage content non-identity)**.** The realization of change by systems A and B at the same common cosmic stage does not entail equality of their states, changes, or mechanisms.

Proof sketch. The common cosmic domain supplies the common cosmic stages, CMA states the presence and bearer-specific physical realization of every physical system whose identity is then realized there. Equality of stage is not defined as equality of state. Therefore the conclusion does not follow.

Proposition G.5 (No private temporal extension)**.** No physical system possesses an independent temporal extension within V26/F6.

Proof sketch. The only temporal-stage domain is the universal common cosmic-stage domain. Systems bear states and realize physically diverse changes, but no system bears a private temporal stage or a private temporal order. Each identity domain restricts the same relation $\prec_C$, which orders the fixed, irreversible, and uninterrupted succession and ordering of the common stages; no independent system time is formed.

Proposition G.6 (Historical plurality)**.** Plural common cosmic stages refer to their ordered succession within the common cosmic extension, not to multiple private system stages corresponding to the same common stage.

Proof sketch. The axiom supplies the presence of extant systems within the common cosmic stages and bearer-specific physical realization in every such system. Common cosmic stages occur in one fixed, irreversible, and uninterrupted ordered succession within the common cosmic extension; the plurality is the ordered succession within the common cosmic extension along $\prec_C$, not a plurality of private temporal containers or system times.

Proposition G.7 (Non-recurrence of stage)**.** Recurrence of a system quantity does not imply recurrence of the common cosmic stage.

Proof sketch. Q_A is a selected physical quantity; $\mathcal{S}_C$ is a temporal-stage term. Their types differ. The extension is non-reversing, so a later stage cannot be identical with an earlier stage merely because a quantity repeats.

Proposition G.8 (Clock-output diversity under common-stage presence and bearer-specific change)**.** Unequal clock readings can occur while clock systems are co-present at the same common cosmic stage and realize their own bearer-specific changes.

Proof sketch. Clock readings depend on clock states, trajectories, conditions, and protocols. CMA states both common-stage presence and bearer-specific change; neither states equality of state, change content, or output. Therefore a non-zero differential reading does not alter common-stage unity.

Proposition G.9 (Coordinate non-identity)**.** A coordinate component used to order or label events is not thereby identical with time in ITOF.

Proof sketch. A coordinate is defined within a chart and transforms under chart changes. Under the canonical time definition in Section 4 (Definition 4.1), time is not a coordinate object, and the fixed, irreversible, and uninterrupted succession and ordering of its common stages is ordered separately by $\prec_C$. Use and nomenclature do not supply an identity bridge.

Proposition G.10 (Proper-time non-identity)**.** The relativistic proper-time functional is not identical with time in ITOF.

Proof sketch. Proper time is defined by an integral of metric line element along a timelike worldline and depends on (γ, g). The ITOF time definition is non-metric and common rather than path-dependent. The objects have different defining properties and types.

Proposition G.11 (Categorical curvature exclusion)**.** Curvature is not a predicate of time in ITOF.

Proof sketch. Curvature is defined for a connection or metric on a manifold. No metric or connection is assigned to T_{ITOF} under the canonical definition and type discipline. The application of curvature to time is therefore ill-typed and is rejected by V26/F6.

Proposition G.12 (Synchronization independence)**.** A coordinate synchronization relation neither creates nor refutes the common cosmic stage.

Proof sketch. Synchronization is protocol- and frame-dependent and relates coordinate assignments. The common cosmic stage is asserted under the Cosmic Moment Axiom and makes no coordinate prediction. The two relations have different domains and functions.

Proposition G.13 (Distance-access separation)**.** Spatial distance can delay observational access without delaying the system's physical realization at the common cosmic stage.

Proof sketch. Common-stage presence and bearer-specific physical realization are jointly foundational under CMA. Access requires physical propagation, which has finite speed and path dependence. The latter changes record arrival, not original occurrence.

Proposition G.14 (Rest non-stasis)**.** Kinematic rest relative to a selected reference does not entail complete physical stasis.

Proof sketch. Rest constrains relative position or velocity. Complete physical state contains additional components and processes. Therefore state equivalence does not follow.

Proposition G.15 (Equilibrium non-stasis)**.** A zero net macroscopic flux does not entail absence of physical realization.

Proof sketch. Opposing non-zero fluxes may cancel, and unmeasured microscopic processes may continue. The net condition is a relation among selected quantities, not a complete-state identity.

Proposition G.16 (Delayed-manifestation separation)**.** The operational record or observation window in which an effect first becomes detectable does not, by itself, identify one exact common cosmic stage at which the underlying continuing change began or first crossed the declared noticeability criterion.

Proof sketch. A detector has threshold and integration conditions; effects may accumulate or propagate while bearer-specific change continues without interruption. Detection therefore establishes a protocol-dependent manifestation within an operational window, not an exact common cosmic stage of beginning or noticeability.

Proposition G.17 (Common-stage presence and bearer-specific realization)**.** CMA states that every physical bearer then existing is present at the same common cosmic stage and realizes its own bearer-specific change there.

Proof sketch. CMA quantifies over $\mathcal{S}_{\text{phys}}(s)$ and requires both $\text{Present}_{\text{C}}(A; s)$ and $\text{PhysReal}_A^+(s)$ for each member. Neither equates their states, mechanisms, magnitudes, or manifestations. The UCC theorem follows from the physical-system realization postulate, IOC, and CMA: the first supplies identity-domain nonemptiness, IOC then supplies unique realized onset within that domain, and CMA applies across the later identity domain; IDC excludes identity-domain gaps, while COP governs the collective origin and immediate bearer-specific physical change of the first physical systems at the initial cosmic stage.

Proposition G.18 (Change warrant without uniquely warranted exact-stage assignment)**.** A valid same-bearer record comparison may warrant a noticeable, physically attributable difference without by itself warranting one unique common cosmic stage of noticeability.

Proof sketch. Valid attribution and a same-bearer warrant can support a noticeable physical difference between the compared records within the declared protocol. The records are not stages. A declared model may return candidate stages, but the record comparison alone does not establish a unique exact common cosmic stage of noticeability.

Proposition G.19 (Cross-domain convergence without unrestricted proof)**.** Reconstructed records concerning distinct physical systems across cosmological, biological, astrophysical, and geophysical domains can jointly provide cumulative empirical warrant for onset, succession, continuing change, identity termination, and successor-system claims without deductively proving CMA or UCC for every physical bearer in the universe.

Proof sketch. Each covered domain supplies declared bearer criteria, ordered records, valid attribution, and class-specific physical routes. Independence of mechanisms and access channels strengthens convergence and transformation witnesses extend the evidence beyond persistence of one identity. The unrestricted claims quantify over all physical bearers and applicable stages, whereas the archive remains finite, model-conditioned, and class-bounded. The result is therefore cumulative empirical warrant rather than deductive exhaustion of the universal quantifier.

Proposition G.20 (Finite-record limit on exact notice-stage assignment)**.** A finite protocol may identify a qualitative operational onset of detectability, but the physical record alone does not warrant one unique common cosmic stage at which a continuing change became noticeable or crossed the declared threshold.

Proof sketch. For an already realized bearer, continuing change may precede and pass through detection, while the instrument, integration process, threshold, storage system, and observer are themselves physical processes. Bearer onset instead has no earlier same-bearer state. A record therefore warrants a thresholded manifestation and its comparison within the declared operational domain. A model may narrow candidate stages, but unique ontic assignment requires additional validated premises.

Proposition G.21 (One time and many physical histories)**.** Distinct bearer-specific histories do not entail distinct temporal extensions.

Proof sketch. Each history $\mathcal{H}_A$ is defined on an identity domain $I_A \subseteq \mathcal{S}_C$ and inherits the restriction of the same cosmic order $\prec_C$. Differences in state, path, rate, clock output, or proper-time accumulation therefore remain differences within the common cosmic extension.

Proposition G.22 (No temporal prediction from the axiom alone)**.** The Cosmic Moment Axiom does not by itself predict a coordinate value, clock reading, duration, frequency, or gravitational effect.

Proof sketch. The axiom contains no metric, coordinate, device, field, or dynamical term. Such predictions require additional physical theories and models.

Empirical propositions versus definitional propositions

The preceding propositions divide into definitional, axiomatic, and empirical consequences. CMA states universal common-stage presence and bearer-specific physical realization, while the derived UCC theorem states the immediate-onset and uninterrupted-continuation consequence for each bearer and organizes domain-specific testing. The formal dependency does not derive physical change from the definition of time and does not assign causal agency to the stage or order. System-specific change remains distinct from the cosmic order and from the common-stage co-presence stated by CMA.

Proof-sketch conditions

The following hidden premises are excluded from every proof sketch:

- every physical difference is observable;
- every record difference is attributable to the bearer;
- every stationary equation describes a complete physical state;
- every coordinate called temporal is time;
- every system possesses an independent domain of stages;
- the universe is enumerable;
- coordinate synchronization identifies the common stage;
- relativistic success decides temporal ontology.

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