Invariant Temporal Ordering Framework V36/F16: Universal Cosmic Extension, Common Cosmic Change Stages, and System-Specific Physical Change

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Abstract

The Invariant Temporal Ordering Framework V36/F16 defines time as the one universal cosmic extension of common cosmic change stages, constituted by their invariant earlier–later ordering and succession:

$$T_{\mathrm{ITOF}} := \mathcal{E}_{\mathrm{C}} := \left(\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \prec_{\mathrm{C}}\right). \tag{1}$$

Here $\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}$ is the formal universal common cosmic-stage carrier and $\prec_{\mathrm{C}}$ is the governing universal earlier–later relation. In every admissible V36/F16 realization, the admitted members of $\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}$ instantiate the literal governing ontological role *common cosmic change stage*. Bare carrier membership remains a type- and dependency-level condition and does not analytically entail memberwise physical change; CSPP, CMA, and UCC jointly secure the populated, one-common-stage, universally change-realizing full-theory role. Strict Cosmic Ordering separately makes $\prec_{\mathrm{C}}$ a strict total order and therefore fixes its irreversibility. NoInterruption and NoTerminalStage are separately adopted succession commitments: under them the universal cosmic extension is uninterrupted and continuing. These succession properties are non-metric and do not assert topological continuity, density, adjacency, differentiability, equal spacing, or metric duration; they are not part of the minimal governing definition of time.

The Cosmic Change-Stage Population Postulate (CSPP) excludes population-empty admitted stages. The Cosmic Moment Axiom (CMA) states that, at every common cosmic change stage, the complete qualified physical-system population whose numerical identities are then realized in the universe is realized at literally that same one objective common cosmic change stage. Universal Change Continuity (UCC) separately requires actual system-specific physical change in every qualified system realized there. The common cosmic change stage is not itself a physical change, a packet or quantity of change, a cause of change, or a carrier of change.

Each physical-system identity has an identity-realization range $I_A \subseteq \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}$, which restricts the common cosmic stages at which that identity is realized without creating private stages or private time. For actual change pairs, V36/F16 types system-specific change content by $\Delta_A^{\mathrm{phys}} : I_A^{\Delta} \to \Xi_A$, where $I_A^{\Delta} := \{s \in I_A \mid \mathrm{PhysReal}_A^{+}(s)\}$; UCC entails $I_A^{\Delta} = I_A$. Complete-population change

coverage is made explicit by

$$\mathcal{B}_\Delta(s) := \left\{ A \in \mathcal{S}_{\text{phys}}(s) \mid \text{PhysReal}^+_A(s) \right\}, \tag{2}$$

with UCC $\iff \forall s \in \mathcal{S}^{\text{tot}}_{\text{C}} \left[\mathcal{B}_\Delta(s) = \mathcal{S}_{\text{phys}}(s)\right]$. The system-indexed common-stage change profile preserves distinct change-content types, and the foundational stage-to-change bridge is a conservative defined representation of CMA-governed common-stage unity together with UCC-equivalent complete-population change coverage. Neither construction introduces a universal change substance, causal transmission mechanism, synchronization rule, measurement map, or additional temporal entity.

Physical causation remains system-specific and physical. Time, the common cosmic extension, the ordering, the common stage, the full-theory change-stage role, and historical accumulation are not additional causal-source classes. Identity formation, continued development, ending, and conditional successor attribution remain distinguished. Historical physical accumulation is separated from the present cumulative physical resultant, and UCC continues through an actual identity-ending stage without making accumulation itself a universal ending cause or threshold.

Observation remains epistemically distinct from physical actuality. Physical change may be conspicuous, minute, sub-threshold, masked, or otherwise unresolved, while UCC requires it to remain actual throughout every realized identity range. A valid record may therefore warrant an actual manifestation or measured physical difference without identifying the exact common cosmic change stage or its exact global order position. A first accepted notice marks an observational threshold, not the beginning of physical change and not an inverse label for one exact stage. V36/F16 further distinguishes formal counterconditions from finite experimental access: universal or cosmological commitments are challenged only through the evidential scope actually warranted, and application-model failure reaches a foundational commitment only through an explicit derivational bridge with independently specified auxiliary premises.

Relativistic coordinates, metric quantities, proper-time functionals, synchronization relations, geometrical constructions, and clock outputs remain external representational or operational quantities and are not identified with T_{ITOF}. Where a relativistic temporal ontology denies the universal common cosmic-stage realization governed by CMA, its disagreement with ITOF is foundational; calculational or operational success does not transfer temporal identity.

Keywords: ITOF; time; invariant cosmic ordering; invariant cosmic succession; universal cosmic extension; common cosmic change stages; common cosmic change-stage realization; Cosmic Moment Axiom; Cosmic Change-Stage Population Postulate; Universal Change Continuity; system-specific physical change; complete-population change coverage; foundational stage-to-change bridge; non-terminating cosmic succession; physical-system identity; physical history; Exact-Change-Stage Restraint; Non-Transfer Principle; atomic clocks; relativistic temporal identification.

Authorship and Intellectual Provenance

The Invariant Temporal Ordering Framework was conceived, initiated, and developed by Youssry Ghandour through sustained independent research. V36/F16 is the historical-critical successor to the immediately preceding V35/F15 formulation, not a cumulative restatement of it. Historical priority and present authority are distinguished: an earlier formulation remains documentary evidence of the framework's development, while the governing status of a definition, axiom, postulate, principle, equation, or explanatory claim is fixed only by its role in V36/F16.

V35/F15 remains the immediate published predecessor for direct architectural comparison [1]. The V14–V35 foundation-series sequence is documented through the consolidated ITOF project and archive records deposited in OSF and Zenodo [2]. V36/F16 retains the formal ordered pair $(\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \prec_{\mathrm{C}})$ while intentionally refining its governing denotation. V35/F15 gave ordering and succession denotational priority within one common extension; V36/F16 makes the one universal cosmic extension of common cosmic change stages the denotational head, constituted by their invariant earlier–later ordering and succession. Strict Cosmic Ordering fixes the ordering as irreversible. NoInterruption and NoTerminalStage separately govern the uninterrupted and continuing character of the actual cosmic succession; those properties are not part of the minimal definition of time. V36/F16 also preserves the strengthened realization architecture: CMA states one-common-change-stage realization for the complete then-realized qualified physical-system population, UCC independently supplies universal memberwise physical-change actuality, and the complete-population coverage and conservative stage-to-change representation make their joint content explicit without adding a new causal or empirical mechanism.

Editorial, computational, and artificial-intelligence-assisted tools were used as assistive instruments in parts of the writing and production process, including language refinement, candidate wording, document organization, consistency review, comparison of formulations, typesetting, and editorial checking. Suggestions produced by such tools were subject to the author's examination and were accepted, modified, or rejected according to his own theoretical judgment. No computational or artificial-intelligence system is presented as an author, originator of ITOF, independent scientific authority, evidentiary source, or substitute for the author's responsibility. All theoretical commitments, interpretive positions, formal statements, inclusions, exclusions, revisions, and final publication decisions remain the responsibility of Youssry Ghandour.

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1. Foundational Meaning of Time

1.1 Governing definition

Definition 1.1 (Time in ITOF)**.** Time denotes the one universal cosmic extension of common cosmic change stages, constituted by their invariant universal earlier–later ordering and succession:

$$\boxed{T_{\mathrm{ITOF}} := \mathcal{E}_{\mathrm{C}} := \left(\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \prec_{\mathrm{C}}\right).} \tag{3}$$

Here $\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}} \neq \varnothing$ is the formal universal common cosmic-stage carrier and $\prec_{\mathrm{C}}$ is the governing universal earlier–later relation. In every admissible V36/F16 realization, the admitted members of $\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}$ instantiate the literal governing ontological role *common cosmic change stage*. *Invariant* means that this one objective ordering is the same governing relation for all qualified physical systems and is not altered by observer choice, coordinate representation, clock output, record convention, or system-specific physical state. Strict Cosmic Ordering separately makes the relation a strict total order and therefore fixes its irreversibility.

Under the separately adopted NoInterruption and NoTerminalStage commitments, the universal cosmic extension is uninterrupted and continuing. These succession properties are additional foundational commitments about the actual cosmic succession; they are not additional members of the ordered pair, do not add a metric component, and are not part of the minimal governing definition of time. They do not assert topological continuity, density, adjacency, differentiability, equal stage spacing, or metric duration.

The symbol $\mathcal{E}_{\mathrm{C}}$ names the same temporal referent as T_{ITOF}, not a third temporal component or second temporal object. The common cosmic extension is the extension of the invariantly ordered succession itself. Ordering and succession therefore constitute the extension; they are not independent temporal objects added beside it. Bare membership $s \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}$ remains a formal carrier condition in dependency analysis and does not by itself analytically entail $\mathrm{PhysReal}_A^+(s)$; the physically literal full-theory change-stage role is jointly secured by CSPP, CMA, and UCC in every admissible V36/F16 realization.

1.2 Common cosmic extension and the full-theory change-stage role

The common cosmic extension is the non-metric extension of the ordered succession itself. It is not a container in which stages are placed, a substance through which systems move, an independently moving carrier, or a measure of elapsed duration. As later common cosmic stages stand after earlier ones in the single fixed ordering, the common succession extends in that ordering. No additional spatial or metric magnitude is introduced by the word *extension*.

Accordingly,

$$\mathcal{E}_{\mathrm{C}} \not\equiv_{\mathrm{type}} \left\{ \begin{array}{c} \text{spatial length, metric duration, coordinate interval, proper-time functional,} \\ \text{physical medium, moving carrier, material container, or causal process} \end{array} \right\}. \tag{4}$$

The governing V36/F16 ontology designates every admitted member of the cosmic succession as a *common cosmic change stage*. This is a literal full-theory ontological role-name, not a definition of carrier membership by memberwise change. Formally, bare $s \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}$ fixes carrier membership and order position only. In every admissible V36/F16 realization, CSPP excludes population-empty stages, CMA fixes one-common-change-stage realization for the complete qualified population, and UCC independently supplies exhaustive system-specific physical-change actuality for every qualified system realized there. Thus the role-name remains physically literal without making UCC analytically redundant.

This distinction also governs dependency witnesses. A typed witness may preserve the carrier, ordering, and CMA-governed common-stage semantics while deliberately violating UCC at a qualified pair. Such a witness is not an admissible full V36/F16 realization and does not represent a physically admissible changeless *change stage*; its logical function is only to test whether another commitment entails UCC. Thus UCC retains substantive physical content without being hidden inside the temporal definition or the bare stage terminology.

Under the governing full theory, physical change is realized system-specifically at each applicable common cosmic stage. For a numerical identity A, UCC requires change at every $s \in I_A$; no member of the realized identity history is a point of complete physical stasis. This stagewise actuality does not impose metric continuity, differentiability, equal increments, infinitesimal steps, or a point-like transition between stages.

Ordering and physical realization remain different logical roles. If $r \prec_{\mathrm{C}} s$, the ordering makes s later than r; no physical-change magnitude causes that order relation. Under CSPP–CMA–UCC, the physical realization of s under the full-theory change-stage role is supplied by the actual system-specific changes of the qualified systems whose identities are realized there. The stage is not itself a physical change, a packet or quantity of change, a physical cause, a carrier of change, or any system-specific change content.

Equation (3) therefore fixes the referent of time as the one universal cosmic extension of common cosmic change stages. The invariant earlier–later ordering and succession constitute that extension; Strict Cosmic Ordering fixes the ordering as irreversible. NoInterruption and NoTerminalStage separately govern the uninterrupted and continuing character of the actual cosmic succession. These additional commitments do not introduce a metric component, duration, or coordinate interval and are not hidden components of the minimal temporal definition. Physical change and its causal content belong to physical systems; neither time, the ordering, the common cosmic change stage, nor the common cosmic extension is assigned physical causal agency.

1.3 Temporal type boundary

The governing temporal referent is type-distinct from physical and operational quantities that may be used in physical models or measurements:

$$T_{\mathrm{ITOF}} \not\equiv_{\mathrm{type}} \left\{ \begin{array}{c} \text{matter, energy, field, force, physical system,} \\ \text{coordinate value, metric interval, proper-time functional,} \\ \text{clock output, record, signal, or causal contributor} \end{array} \right\}. \tag{5}$$

Equation (5) is a type boundary. It does not deny the physical or mathematical usefulness of any listed quantity within an appropriate domain.

Logical notation discipline.

Throughout V36/F16, $P \not\Rightarrow Q$ is used as compact meta-level notation that premise or condition P, by itself, does not license the stated conclusion Q under the declared framework. It is not introduced as a new object-language connective. Where syntactic derivability is at issue, $\vdash$ or

$\nvdash$ denotes derivability or non-derivability from the explicitly stated substantive premises under the governing definitions and declared background logic. When the definitional background is itself material to a dependency claim, that background is named explicitly. For cross-formulation comparisons, $P \equiv_D Q$ denotes meta-level semantic or model-content equivalence relative to the declared definitional background D; it is not an additional object-language connective. Definitional nonidentity and type nonidentity remain expressed separately by $\not\equiv_{\text{def}}$ and $\not\equiv_{\text{type}}$. This convention prevents logical non-entailment, definitional distinction, type distinction, background-relative equivalence, and observational non-warrant from being conflated.

For compact multi-term statements, V36/F16 also uses the meta-level abbreviations

$$\mathrm{PairwiseDefDistinct}(x_1, \ldots, x_n) \iff \bigwedge_{1 \le i < j \le n} (x_i \not\equiv_{\text{def}} x_j),$$

and

$$\mathrm{PairwiseTypeDistinct}(x_1, \ldots, x_n) \iff \bigwedge_{1 \le i < j \le n} (x_i \not\equiv_{\text{type}} x_j).$$

These are notation-saving meta-abbreviations only; they add no physical relation or ontological commitment. A displayed formula with physical-system, common cosmic-stage, record, or model variables is schematic only where the immediately preceding text fixes those variables arbitrarily and declares their domains; otherwise its governing quantifiers are written explicitly. This convention is used to prevent prose from silently supplying a logical scope that the display itself leaves ambiguous.

1.4 Strict universal earlier–later ordering

Axiom 1.2 (Strict Cosmic Ordering)**.** The relation $\prec_{\mathrm{C}}$ is a strict total order on $\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}$:

$$\mathrm{StrictTotalOrder}\left(\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \prec_{\mathrm{C}}\right). \tag{6}$$

Equivalently, for all $r, s, t \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}$,

$$\neg(r \prec_{\mathrm{C}} r), \tag{7}$$

$$r \prec_{\mathrm{C}} s \wedge s \prec_{\mathrm{C}} t \Longrightarrow r \prec_{\mathrm{C}} t, \tag{8}$$

$$r \neq s \Longrightarrow (r \prec_{\mathrm{C}} s \vee s \prec_{\mathrm{C}} r). \tag{9}$$

Proposition 1.3 (Irreversibility of the ordering)**.** For all $r, s \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}$,

$$r \prec_{\mathrm{C}} s \Longrightarrow \neg(s \prec_{\mathrm{C}} r). \tag{10}$$

Proof. If both $r \prec_{\mathrm{C}} s$ and $s \prec_{\mathrm{C}} r$ held, transitivity would imply $r \prec_{\mathrm{C}} r$, contradicting Equation (7).

A later physical state may resemble an earlier physical state under a declared criterion. Such recurrence does not alter Equation (10). State recurrence and order reversal are different claims.

1.5 No motion of time, the cosmic extension, or the common cosmic stages

The ordering relation does not describe common cosmic stages travelling, flowing, or carrying physical systems. If

$$r \prec_{\mathrm{C}} s,$$

the statement fixes an earlier–later relation between two common cosmic stages. It does not state that r moved into s, that a system travelled through a temporal substance, or that the cosmic extension possesses a physical velocity.

The statement that the cosmic extension continues means only that later common cosmic stages continue to stand after earlier ones in the same governing ordering. The extension does not itself move, expand as a spatial body, transport systems, or cause later stages. Physical motion, where present, belongs to physical systems and is one form of physical change. It is not motion of T_{ITOF} or of $\mathcal{E}_{\mathrm{C}}$.

2. Invariant Uninterrupted Cosmic Succession

2.1 Non-interruption

Strict ordering alone does not state that the actual cosmic succession is uninterrupted. V36/F16 therefore retains non-interruption as an independent foundational commitment.

Postulate 2.1 (Uninterrupted Cosmic Succession)**.**

$$\mathrm{NoInterruption}_{\mathrm{C}}\left(\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \prec_{\mathrm{C}}\right). \tag{11}$$

After Equation (11), the bare symbol $\mathrm{NoInterruption}_{\mathrm{C}}$ abbreviates this declared condition for the governing pair $(\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \prec_{\mathrm{C}})$; it does not denote a second zero-argument postulate with different content.

The postulate states that the common cosmic stages of the governed totality belong to one intrinsically uninterrupted succession. In the ontological sense adopted here, this succession is connected as one continuing cosmic extension: no independently inserted waiting layer, temporal pause, or additional break is placed between admitted members. *Connected* in this use is not a topological, metric, adjacency, density, order-completeness, or mathematical-continuity condition.

Non-interruption by itself does not replace the realization commitments. CSPP separately requires a nonempty qualified physical-system population at every member of the common cosmic-stage totality, CMA governs literal unity of that common stage, and UCC requires every qualified realized physical system to undergo its own system-specific physical change there. Under the full governing conjunction, the uninterrupted extension therefore contains no population-empty member, no physically change-empty member, and no admitted stage at which a qualified realized system is in complete physical stasis. These consequences follow from CSPP and UCC within the uninterrupted succession; they are not silently redefined as the meaning of $\mathrm{NoInterruption}_{\mathrm{C}}$ alone.

Accordingly, $\mathrm{NoInterruption}_{\mathrm{C}}$ adds no numerical stage index, equal stage spacing, metric duration, temporal velocity, density requirement, adjacency relation, or differentiability condition. No such mathematical property may be derived from non-interruption without an additional independently stated premise.

2.2 No terminal common cosmic stage

Non-interruption and non-termination are not the same statement. A finite ordered stage totality can be internally uninterrupted under a declared interpretation while still possessing a greatest member. V36/F16 therefore states non-termination directly within the cosmic-succession architecture.

Postulate 2.2 (Non-Terminating Cosmic Succession)**.** Every common cosmic stage has a later common cosmic stage:

$$\boxed{\mathrm{NoTerminalStage}_{\mathrm{C}} \iff \forall s \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}\ \exists t \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}\ (s \prec_{\mathrm{C}} t)\,.} \tag{12}$$

This postulate does not require an immediate successor of s. It therefore does not introduce adjacency, discreteness, density, or equal spacing. It requires only that no member of $\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}$ be terminal.

Definition 2.3 (Integrated Cosmic Succession Condition)**.** For compact reference,

$$\mathrm{IntegratedCosmicSuccession}_{\mathrm{C}} \iff \mathrm{NoInterruption}_{\mathrm{C}} \wedge \mathrm{NoTerminalStage}_{\mathrm{C}}\,. \tag{13}$$

Proposition 2.4 (No greatest common cosmic stage)**.** Under Equation (12),

$$\nexists g \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}\ \forall s \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}\ (s = g \vee s \prec_{\mathrm{C}} g)\,. \tag{14}$$

Proof. Assume that $g \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}$ is greatest. By Equation (12), there exists $t \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}$ such that $g \prec_{\mathrm{C}} t$, contradicting the assumed greatest-member status of g.

Corollary 2.5 (Infinite common cosmic-stage totality)**.** Because $\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}} \neq \varnothing$, strict total ordering together with Equation (12) entails

$$\mathrm{Infinite}(\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}). \tag{15}$$

A finite nonempty strict total order always possesses a greatest member. Equation (14) therefore excludes a finite $\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}$.

This infinitude is an intended order-theoretic consequence of the adopted Non-Terminating Cosmic Succession postulate. It is deliberately independent of physical-system ending, successor formation, or any lifecycle commitment. Cosmic continuation is not inferred from a requirement that every ending system produce a new identity. Under the separately stated CSPP and UEIE commitments, the same non-terminal succession will also entail an infinite total physical-system identity totality; that later result is a consequence of the combined premises, not part of the definition of time.

2.3 Cosmic origin as an independent cosmological commitment

The definition of time and the ordering axioms do not entail that $\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}$ has a least member. A cosmic origin, if adopted, therefore remains an independent cosmological commitment rather than part of the minimal definition of time.

Postulate 2.6 (Cosmic Origin — Cosmological Module)**.**

$$\mathrm{CosmicOrigin} \iff \exists! s_{\mathrm{C}}^{0} \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}} \left[\nexists r \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}} \left(r \prec_{\mathrm{C}} s_{\mathrm{C}}^{0}\right)\right]. \tag{16}$$

Equation (16) is not required for Equations (3), (6), (11), or (12).

If Cosmic Origin is adopted together with non-termination, extension beyond the origin is derived rather than separately postulated:

$$\{\mathrm{CosmicOrigin}, \mathrm{NoTerminalStage}_{\mathrm{C}}\} \Longrightarrow \exists s \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}} \left(s_{\mathrm{C}}^{0} \prec_{\mathrm{C}} s \right). \tag{17}$$

V36/F16 therefore introduces no separate "Cosmic Extension Beyond Origin" postulate.

2.4 Full cosmic stage totality and attained prefix

The totality $\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}$ comprises every common cosmic stage admitted to the objective total history governed by the framework. In this ontological sense, a member of $\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}$ is an admitted member of the total cosmic extension. This status must be distinguished from stage-relative attainment.

Membership in $\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}$ does not imply that every member is already attained relative to an attained reference stage. Throughout V36/F16, when *actual common cosmic stage* is used, *actual* means ontically admitted to this governed total history; it does not mean already attained relative to an arbitrary reference stage a. The predicate AttainedAt alone carries that relative attained-status meaning.

For reference stage $a \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}$, define

$$\mathrm{AttainedAt}(v; a) \Longleftrightarrow [v = a \vee v \prec_{\mathrm{C}} a]. \tag{18}$$

The attained prefix at a is

$$\mathcal{S}_{\mathrm{C}}^{\leq a} := \left\{ v \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}} \mid \mathrm{AttainedAt}(v; a) \right\}. \tag{19}$$

If

$$a \prec_{\mathrm{C}} v, \tag{20}$$

then

$$\neg \,\mathrm{AttainedAt}(v; a). \tag{21}$$

Therefore,

$$\boxed{\mathrm{NoTerminalStage}_{\mathrm{C}} \Longrightarrow \forall a \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}\ \exists v \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}\ [a \prec_{\mathrm{C}} v \wedge \neg\, \mathrm{AttainedAt}(v; a)].} \tag{22}$$

Thus Non-Terminating Cosmic Succession makes the stage-relative non-attainment of some later member explicit for every attained reference stage a.

ITOF therefore rejects identification of its full common cosmic-stage totality with an already attained total block relative to an attained reference stage.

This result concerns stage-relative attainment. It does not depend on assigning one meaning to every philosophical use of the term "block universe."

3. Physical Totality and Common Cosmic-Stage Realization

3.1 Identity realization and the qualified physical-system totality

For a candidate physical-system identity A and a common cosmic stage $s \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}$, let

$$\mathrm{ExistsAs}(A, s) \tag{23}$$

state that the numerical identity of A is physically realized at s.

Definition 3.1 (Total Qualified Physical-System Identities)**.** The governed physical-system totality contains exactly those qualified physical systems whose numerical identities are physically realized at one or more common cosmic stages:

$$\boxed{\mathcal{U}_{\mathrm{phys}} := \left\{A \mid \mathrm{PhysicalSystem}(A) \wedge \exists s \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}\ \mathrm{ExistsAs}(A, s)\right\}.} \tag{24}$$

Equation (24) closes the physical-system domain against empty identity-realization ranges. Thus every $A \in \mathcal{U}_{\mathrm{phys}}$ is a qualified physical system actually realized somewhere in the governed cosmic history, although it need not be realized at every common cosmic stage and need not already be attained relative to an arbitrary attained reference stage.

The universe is not introduced as a containing physical system above those physical systems.

Definition 3.2 (Universe as Physical Totality)**.**

$$\mathcal{U} := \mathrm{Totality}(\mathcal{U}_{\mathrm{phys}}). \tag{25}$$

Equation (25) states physical totality, not containment, and adds no independent universe-container identity above the physical systems. It also does not assert that every member of $\mathcal{U}_{\mathrm{phys}}$ is co-realized at one common cosmic stage.

3.2 Identity realization across the common cosmic-stage extension

Definition 3.3 (Identity-Realization Range)**.**

$$\boxed{I_A := \left\{s \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}} \mid \mathrm{ExistsAs}(A, s)\right\}.} \tag{26}$$

From Equation (24),

$$\boxed{\forall A \in \mathcal{U}_{\mathrm{phys}}, \qquad I_A \neq \varnothing.} \tag{27}$$

Thus no member of the qualified physical-system totality is a formally admitted identity with an empty physical-realization range in the governed common cosmic extension.

The set I_A restricts the common cosmic stages at which the numerical identity of A is realized. It is not a private stage succession owned by A, and it introduces no private time. Accordingly,

$$I_A \subseteq \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}. \tag{28}$$

No additional system-specific temporal order $\prec_A$ is introduced. The ordering applicable throughout I_A is the restriction of the same universal cosmic ordering:

$$\prec_{\mathrm{C}} \big|_{I_A}. \tag{29}$$

Thus, if A and B are both realized at s,

$$s \in I_A \wedge s \in I_B, \tag{30}$$

the symbol s denotes literally the same common cosmic stage for both systems. It does not abbreviate two private stages later declared simultaneous, equivalent, or synchronized.

3.3 Physical-system population at a common cosmic stage

Definition 3.4 (Physical-System Population at a Common Cosmic Stage)**.** For each $s \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}$,

$$\boxed{\mathcal{S}_{\mathrm{phys}}(s) := \{A \in \mathcal{U}_{\mathrm{phys}} \mid \mathrm{ExistsAs}(A, s)\}\,.} \tag{31}$$

The physical totality realized at s is

$$\mathrm{UniverseAt}(s) := \mathrm{Totality}(\mathcal{S}_{\mathrm{phys}}(s))\,. \tag{32}$$

Equation (31) is exhaustive over the qualified physical systems whose numerical identities are realized at s. It does not place them inside a temporal container. Since s is already a member of the one common cosmic stage totality, membership through $\mathrm{ExistsAs}(A, s)$ refers to that same common stage rather than to a family of system-private stages hidden behind a shared label.

3.4 Cosmic Change-Stage Population Postulate

Postulate 3.5 (Cosmic Change-Stage Population Postulate — CSPP)**.** Every member of the governed common cosmic-stage totality has a nonempty qualified physical-system population:

$$\boxed{\mathrm{CSPP} \iff \forall s \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \quad \mathcal{S}_{\mathrm{phys}}(s) \neq \varnothing.} \tag{33}$$

CSPP excludes population-empty stage vacuity. It states only nonemptiness; it does not assert identical states, identical change contents, common mechanisms, all-to-all interaction, or equal observational outcomes. Together with UCC it ensures that every member of $\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}$ is not only populated but is physically change-realizing in every member of its then-realized population.

3.5 Governing semantics of common cosmic change-stage realization

For compact statement, recall

$$\mathcal{S}_{\mathrm{phys}}(s) := \{A \in \mathcal{U}_{\mathrm{phys}} \mid \mathrm{ExistsAs}(A, s)\}\,. \tag{34}$$

In the governing V36/F16 ontology, s denotes one objective common cosmic change stage in the single universal cosmic extension. The formal carrier notation does not make it a placeholder for separate stages for different physical systems.

Let

$$\mathrm{CosmicCoPresence}_{\mathrm{C}}\left(\mathcal{S}_{\mathrm{phys}}(s); s\right) \tag{35}$$

state the governing semantic–ontological content that every identity in $\mathcal{S}_{\text{phys}}(s)$ is realized at literally that same one objective common cosmic stage s. This notation is not definitionally reduced to clock agreement, signal exchange, coordinate synchronization, spatial co-location, or an observational equivalence relation. It also is not an independently toggleable primitive while the declared meanings of $\mathcal{S}_{\text{C}}^{\text{tot}}$, s, ExistsAs, and $\mathcal{S}_{\text{phys}}(s)$ are held fixed. A purported construction that keeps those meanings unchanged while reinterpreting the same s as distinct private system stages has changed the common-stage ontology rather than produced a countermodel within it.

Axiom 3.6 (Cosmic Moment Axiom — CMA)**.** At every common cosmic change stage, the complete qualified physical-system population whose numerical identities are then realized in the universe is realized at literally that same one objective common cosmic change stage. No member of that population possesses a private cosmic stage, private stage succession, or private time that is subsequently synchronized or equated with the stages of other systems:

$$\boxed{\text{CMA} \iff \forall s \in \mathcal{S}_{\text{C}}^{\text{tot}}, \quad \text{CosmicCoPresence}_{\text{C}}\left(\mathcal{S}_{\text{phys}}(s); s\right).} \tag{36}$$

CMA is the constitutive semantic–ontological meaning-fixing axiom of universal one-common-change-stage realization. Its role is distinct from UCC: CMA governs the unity of the common cosmic change stage for the complete then-realized qualified population; UCC governs actual system-specific physical change in every realized system at that stage. Hence CMA by itself does not establish memberwise physical-change actuality. The two roles must not be collapsed, but neither may common-stage unity be switched off while the same common-stage meanings are claimed to remain fixed.

This common cosmic-stage unity does not make the systems physically identical and does not impose equal states, equal change contents, equal magnitudes, equal rates, equal mechanisms, common causal contributors, or equal observational outcomes. Nor does it require universal all-to-all interaction:

$$\text{CMA} \not\Rightarrow \forall s \in \mathcal{S}_{\text{C}}^{\text{tot}} \;\; \text{AllToAllCausalInteraction}\left(\mathcal{S}_{\text{phys}}(s)\right). \tag{37}$$

Spatial separation may affect physical interaction, signal propagation, record arrival, and observational access. It does not divide the common cosmic change stage or create different cosmic stages for spatially separated systems.

4. Universal System-Specific Physical Change

4.1 Universal Change Continuity

The governing V36/F16 ontology uses the literal full-theory role-name *common cosmic change stage* for the admitted members of the one universal cosmic extension. This designation does not define bare carrier membership and therefore does not analytically prove UCC. CSPP supplies nonempty population, CMA supplies one-common-change-stage realization for the complete then-realized qualified population, and UCC independently supplies exhaustive memberwise system-specific physical-change actuality. Their conjunction fully instantiates the governing change-stage role in every admissible V36/F16 realization, while a typed UCC-violating dependency witness remains non-admissible as a full V36/F16 realization.

Postulate 4.1 (Universal Change Continuity — UCC)**.** For every qualified physical system and every common cosmic stage at which its numerical identity is realized, that physical system realizes its own system-specific physical change:

$$\boxed{\mathrm{UCC} \Longleftrightarrow \forall A \in \mathcal{U}_{\mathrm{phys}}\ \forall s \in I_A, \quad \mathrm{PhysReal}_A^{+}(s).} \tag{38}$$

UCC is logically distinct from CMA. CMA fixes the one common stage shared by all qualified systems realized there; UCC requires change actuality in each such system throughout its own realized identity history. Their conjunction gives the intended physical picture: one chain of common cosmic change stages, all then-realized qualified physical systems at the same change stage of that chain, and each system realizing its own physical change at that same change stage.

The superscript + marks actual realized physical change. It has no evaluative, scalar, metric, or monotonic meaning. It does not mean beneficial, progressive, macroscopically increasing, differentiable, or experimentally visible change.

For each $A \in \mathcal{U}_{\mathrm{phys}}$, define the actual-change subset of its identity-realization range by

$$I_A^{\Delta} := \left\{ s \in I_A \mid \mathrm{PhysReal}_A^{+}(s) \right\}. \tag{39}$$

Let Ξ_A denote the declared carrier/type of admissible system-specific physical-change contents for the physical description of A under consideration. No equality $\Xi_A = \Xi_B$ is implied for distinct systems; any cross-system comparison requires an independently declared admissible comparison map. Declare

$$\Delta_A^{\mathrm{phys}} : I_A^{\Delta} \longrightarrow \Xi_A. \tag{40}$$

For $s \in I_A^{\Delta}$, $\Delta_A^{\mathrm{phys}}(s)$ denotes the physical-change content realized by physical system A at that common cosmic change stage. The map introduces no private change-stage succession and no universal cross-system change quantity. Under UCC,

$$\boxed{\mathrm{UCC} \Longrightarrow \forall A \in \mathcal{U}_{\mathrm{phys}}, \quad I_A^{\Delta} = I_A.} \tag{41}$$

Thus every full V36/F16 model recovers the convenient use of $\Delta_A^{\mathrm{phys}}(s)$ throughout I_A, while a formal countermodel to UCC does not assign physical-change content where no actual physical change is realized.

A physically realized change may be conspicuous, minute, sub-threshold, masked, compensated in a selected observable, or otherwise unresolved by the available observation. Under UCC, Equation (41) permits $\Delta_A^{\mathrm{phys}}(s)$ to be used throughout I_A. Thus, for arbitrary $A \in \mathcal{U}_{\mathrm{phys}}$, arbitrary $s \in I_A$, and any declared observational protocol P and model M,

$$\left[\mathrm{UCC} \wedge \neg\, \mathrm{Detected}_{P,M}\left(\Delta_A^{\mathrm{phys}}(s)\right)\right] \not\Rightarrow \neg\, \mathrm{PhysReal}_A^{+}(s). \tag{42}$$

Thus absence of detection is not physical stasis. Because UCC is universally quantified, no finite collection of positive observations deductively confirms it for every qualified physical system and every common cosmic change stage within its realized identity range. A scientifically warranted case of complete physical non-change for one qualified system at one $s \in I_A$ would contradict UCC; a null or unresolved record does not establish that contrary. Likewise,

$$\mathrm{UCC} \not\Rightarrow \forall A \in \mathcal{U}_{\mathrm{phys}}\ \forall s \in I_A\ \ \mathrm{BeneficialChange}_A(s), \tag{43}$$

and

$$\mathrm{UCC} \not\Rightarrow \forall A \in \mathcal{U}_{\mathrm{phys}}\ \forall s \in I_A\ \ \mathrm{HarmfulChange}_A(s). \tag{44}$$

At a formation boundary f_A, $\mathrm{PhysReal}_A^+(f_A)$ states the physically realized formation change constitutive of the newly realized numerical identity; it does not presuppose an earlier state of that same identity.

For the map declared in Equation (40), the governing typing condition is explicit:

$$s \in I_A^{\Delta} \Longrightarrow \Delta_A^{\mathrm{phys}}(s) \in \Xi_A. \tag{45}$$

Thus $\Delta_A^{\mathrm{phys}}(s)$ is used only on actual-change pairs unless UCC has already supplied $I_A^{\Delta} = I_A$.

4.2 System specificity

UCC requires actual system-specific physical change in every realized physical system. For numerically distinct physical systems, the physical-change realizations are system-distinct because each change is realized by and attributed to its own numerical physical-system identity. Equality of a selected mapped observable or comparison value does not merge two system-specific physical changes into one.

For distinct systems A and B realized at the same common cosmic change stage,

$$A, B \in \mathcal{S}_{\mathrm{phys}}(s) \wedge \mathrm{UCC} \Longrightarrow \mathrm{PhysReal}_A^+(s) \wedge \mathrm{PhysReal}_B^+(s). \tag{46}$$

UCC does not impose one common change-content type:

$$\mathrm{UCC} \not\Rightarrow \Xi_A = \Xi_B. \tag{47}$$

Where an application supplies admissible maps into a common comparison space, equal mapped values, if realized, do not identify the underlying physical changes. This system-level distinction does not require all underlying physical processes, interactions, or contributors to be disjoint across scientifically warranted nested, overlapping, or composite system boundaries.

Nor does UCC require equality of any independently declared cross-system physical measure. Whenever the displayed magnitudes or rates are defined in a common comparison codomain,

$$\mathrm{UCC} \not\Rightarrow \begin{bmatrix} \mathrm{Magnitude}_A(s) = \mathrm{Magnitude}_B(s) \\ \vee \\ \mathrm{Rate}_A(s) = \mathrm{Rate}_B(s) \end{bmatrix}. \tag{48}$$

A realized change may therefore be physically minute, macroscopically conspicuous, identity-forming, identity-ending, or observationally unresolved. Its physical content, magnitude, mechanism, consequence, and observability remain system-specific.

4.3 Uninterrupted change excludes system stasis without imposing metric continuity

UCC does not describe a completed collective change occurring once across the universe. For each realized physical-system identity, change is realized at every common cosmic change stage belonging to its identity range:

$$\mathrm{UCC} \Longrightarrow \forall A \in \mathcal{U}_{\mathrm{phys}}\ \forall s \in I_A, \quad \mathrm{PhysReal}^{+}_{A}(s). \tag{49}$$

There is therefore no realized change stage in I_A at which A is in complete physical non-change. Physical change is not completed once and then suspended; no physically idle break is inserted within the realized identity history. It remains actual at every later common cosmic change stage belonging to that history for as long as the numerical identity remains realized.

This statement does not entail mathematical continuity:

$$\mathrm{UCC} \not\Rightarrow \forall A \in \mathcal{U}_{\mathrm{phys}}, \quad \mathrm{MathematicalContinuity}\left(\Delta^{\mathrm{phys}}_{A}\right). \tag{50}$$

Nor does UCC require differentiability, density, adjacency, equal increments, infinitesimal change, equal change-stage spacing, or a universal physical-change parameter.

4.4 Change stage and realized physical change

For any actual-change pair (A, s) with $A \in \mathcal{U}_{\mathrm{phys}}$ and $s \in I^{\Delta}_{A}$, a common cosmic change stage and that system's particular physical-change content are not numerically identical objects:

$$s \not\equiv_{\mathrm{type}} \Delta^{\mathrm{phys}}_{A}(s). \tag{51}$$

For the same qualified pair,

$$T_{\mathrm{ITOF}} \not\equiv_{\mathrm{type}} \mathrm{PhysReal}^{+}_{A}(s). \tag{52}$$

This type distinction preserves the governing relation fixed above. Under the full CSPP–CMA–UCC architecture, the common cosmic change stage is the one common stage at that ordered position, while the physical systems supply the plurality of system-specific physical-change contents realized there. No numerical identity between s and any one system's particular physical-change content is asserted.

4.5 Integrated CSPP–CMA–UCC architecture

The three commitments have distinct governing roles:

$$\mathrm{CSPP} \Longleftrightarrow \forall s \in \mathcal{S}^{\mathrm{tot}}_{\mathrm{C}}, \quad \mathcal{S}_{\mathrm{phys}}(s) \neq \varnothing, \tag{53}$$

$$\mathrm{CMA} \Longleftrightarrow \forall s \in \mathcal{S}^{\mathrm{tot}}_{\mathrm{C}}, \quad \mathrm{CosmicCoPresence}_{\mathrm{C}}\left(\mathcal{S}_{\mathrm{phys}}(s); s\right), \tag{54}$$

$$\mathrm{UCC} \Longleftrightarrow \forall A \in \mathcal{U}_{\mathrm{phys}}\ \forall s \in I_A, \quad \mathrm{PhysReal}^{+}_{A}(s). \tag{55}$$

Integrated common cosmic change-stage realization

$$\boxed{\begin{aligned}\forall s \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \quad \Big[&\mathcal{S}_{\mathrm{phys}}(s) \neq \varnothing \\ &\wedge\ \mathrm{CosmicCoPresence}_{\mathrm{C}}\left(\mathcal{S}_{\mathrm{phys}}(s); s\right) \\ &\wedge\ \forall A \in \mathcal{S}_{\mathrm{phys}}(s),\ \mathrm{PhysReal}_A^{+}(s)\Big].\end{aligned}} \tag{56}$$

At each member of the one cosmic change-stage succession, the complete qualified then-realized physical-system population shares that same one common change stage, and each member realizes its own system-specific physical change there.

Equation (56) is the joint consequence of three separate roles: CSPP supplies nonemptiness, CMA supplies universal common cosmic-stage co-realization, and UCC supplies universal memberwise physical-change actuality. None is a restatement of either of the others.

From CSPP and UCC,

$$\boxed{\{\mathrm{CSPP}, \mathrm{UCC}\} \vdash \forall s \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}\ \exists A \in \mathcal{S}_{\mathrm{phys}}(s), \quad \mathrm{PhysReal}_A^{+}(s).} \tag{57}$$

Indeed UCC gives the stronger memberwise statement for every member of $\mathcal{S}_{\mathrm{phys}}(s)$, while CSPP ensures that the population is nonempty. Hence no admitted common cosmic stage is population-empty or physically change-empty under those two commitments, and no qualified system realized there is in complete physical stasis. Adding CMA supplies literal common-stage unity and therefore completes the full-theory common cosmic change-stage role.

The architecture can be summarized without adding a new commitment:

$$\boxed{\begin{array}{c}\text{one common cosmic succession whose admitted stages bear the full-theory change-stage role;} \\ \text{one and the same common stage for all qualified systems realized there;} \\ \text{each realized physical system undergoes its own physical change at that stage.}\end{array}} \tag{58}$$

The first line names the already-defined common cosmic succession under the joint realization architecture; non-interruption remains governed separately by $\mathrm{NoInterruption}_{\mathrm{C}}$. The second line records CMA's common-stage unity, and the third records UCC's memberwise physical-change actuality. No additional temporal layer, physical quantity, causal source, or universal change content is introduced.

5. Complete-Population Change Coverage and the Foundational Stage-to-Change Bridge

5.1 System-level consequences of the CMA–UCC architecture

CMA and UCC govern different but complementary facts. CMA fixes one common cosmic stage for the complete qualified population realized there. UCC fixes system-specific physical-change actuality for every member throughout its realized identity history. Their conjunction therefore yields one-common-stage unity together with memberwise change multiplicity, without identifying the common change stage with one collective change substance:

$$\boxed{\begin{array}{c}\text{the realized population may comprise physically distinct system identities,}\\ \text{the common cosmic change stage is one,}\\ \text{and every realized system undergoes its own physical change there.}\end{array}} \tag{59}$$

The memberwise distribution in the third line is supplied by UCC; it is not a claim that change is transmitted from a central source or partitioned from one collective quantity.

5.2 The change-realizing physical-system population

For each $s \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}$, define

Definition 5.1 (Change-realizing physical-system population)**.**

$$\boxed{\mathcal{B}_{\Delta}(s) := \left\{ A \in \mathcal{S}_{\mathrm{phys}}(s) \mid \mathrm{PhysReal}_A^{+}(s) \right\}.} \tag{60}$$

This is not a second population; it selects from the already defined then-realized population those systems in which physical change is actual at s.

Proposition 5.2 (Complete-population change-coverage equivalence)**.** Under the governing definitions of I_A, $\mathcal{S}_{\mathrm{phys}}(s)$, and $\mathcal{B}_{\Delta}(s)$,

$$\boxed{\mathrm{UCC} \iff \forall s \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \quad \mathcal{B}_{\Delta}(s) = \mathcal{S}_{\mathrm{phys}}(s).} \tag{61}$$

Proof. If UCC holds and $A \in \mathcal{S}_{\mathrm{phys}}(s)$, then $s \in I_A$, hence $\mathrm{PhysReal}_A^{+}(s)$ and $A \in \mathcal{B}_{\Delta}(s)$. Together with the definitional inclusion $\mathcal{B}_{\Delta}(s) \subseteq \mathcal{S}_{\mathrm{phys}}(s)$, equality follows. Conversely, if the equality holds for every s, then any $A \in \mathcal{U}_{\mathrm{phys}}$ and $s \in I_A$ satisfy $A \in \mathcal{S}_{\mathrm{phys}}(s) = \mathcal{B}_{\Delta}(s)$, hence $\mathrm{PhysReal}_A^{+}(s)$. Thus UCC holds.

With CSPP,

$$\boxed{\{\mathrm{CSPP}, \mathrm{UCC}\} \vdash \forall s \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \quad \mathcal{B}_{\Delta}(s) = \mathcal{S}_{\mathrm{phys}}(s) \neq \varnothing.} \tag{62}$$

Thus every admitted common cosmic stage has a nonempty qualified physical-system population and every qualified physical system realized there undergoes its own physical change under CSPP and UCC. No member of the governed common cosmic-stage carrier is therefore population-empty or physically change-empty under those two commitments. CMA adds the distinct governing fact that the complete qualified population is realized at literally that same one common cosmic stage; the full CSPP–CMA–UCC conjunction then supplies the common cosmic change-stage role.

5.3 Exclusion of complete stasis

For diagnostic use at a multiply populated common cosmic stage, define

$$\begin{aligned}\mathrm{MixedChangeStasisViolationAt}(s) \iff \exists A, B \in \mathcal{S}_{\mathrm{phys}}(s)\ \Big[&A \neq B \\ &\wedge\ \mathrm{PhysReal}_A^{+}(s) \\ &\wedge\ \neg\,\mathrm{PhysReal}_B^{+}(s)\Big].\end{aligned} \tag{63}$$

UCC excludes this condition and, more generally, every memberwise complete-stasis violation:

$$\boxed{\mathrm{UCC} \vdash \forall s \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \quad \neg\,\mathrm{MixedChangeStasisViolationAt}(s).} \tag{64}$$

The mixed change/stasis predicate is only a subclass of the full contrary condition. The exhaustive stage-relative violation is

$$\exists A \in \mathcal{S}_{\mathrm{phys}}(s) : \neg\,\mathrm{PhysReal}_A^{+}(s).$$

A singly populated carrier member can violate UCC without satisfying the mixed change/stasis predicate, and criterion-relative stability or failure of an instrument to resolve change does not establish this physical contrary.

5.4 The common-stage system-change profile

Each qualified system retains its own change-content type Ξ_A and map $\Delta_A^{\mathrm{phys}} : I_A^{\Delta} \to \Xi_A$. Since every $A \in \mathcal{B}_{\Delta}(s)$ satisfies $\mathrm{PhysReal}_A^{+}(s)$, the profile below is well typed on actual-change pairs. Define the dependent system-indexed profile

Definition 5.3 (Common-stage system-change profile)**.**

$$\boxed{\mathfrak{D}_{\mathrm{C}}(s) := \Big(A \mapsto \Delta_A^{\mathrm{phys}}(s)\Big)_{A \in \mathcal{B}_{\Delta}(s)} \in \prod_{A \in \mathcal{B}_{\Delta}(s)} \Xi_A.} \tag{65}$$

By Equation (61), UCC is equivalent to the profile ranging over the complete then-realized population at every common cosmic stage. No universal change codomain is introduced. For distinct co-realized systems,

$$A, B \in \mathcal{S}_{\mathrm{phys}}(s) \wedge A \neq B \not\Rightarrow \Xi_A = \Xi_B. \tag{66}$$

Any cross-system comparison therefore requires independently supplied admissible comparison maps. A population aggregate cannot replace UCC's memberwise requirement.

5.5 The foundational stage-to-change bridge

The bridge records, in one defined statement, CMA's common-stage unity together with UCC's complete-population physical-change coverage:

Definition 5.4 (Foundational stage-to-change bridge)**.**

$$\boxed{\mathrm{StageChangeBridge}_{\mathrm{C}}(s) \iff \mathrm{CosmicCoPresence}_{\mathrm{C}}\left(\mathcal{S}_{\mathrm{phys}}(s); s\right) \wedge \left[\mathcal{B}_{\Delta}(s) = \mathcal{S}_{\mathrm{phys}}(s)\right].} \tag{67}$$

The bridge is a conservative defined conjunction, not a new axiom, postulate, causal mechanism, observational association, measurement rule, prediction law, or independent satisfiability requirement. Under the governing definitions,

Proposition 5.5 (Joint CMA–UCC equivalence of the foundational bridge)**.**

$$\boxed{(\mathrm{CMA} \wedge \mathrm{UCC}) \Longleftrightarrow \forall s \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \quad \mathrm{StageChangeBridge}_{\mathrm{C}}(s).} \tag{68}$$

The first component of the bridge is exactly CMA's common-stage co-realization; the second is equivalent to UCC by Equation (61). Neither component is created by the bridge.

With CSPP added,

$$\boxed{\{\mathrm{CSPP}, \mathrm{CMA}, \mathrm{UCC}\} \vdash \forall s \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \quad [\mathcal{S}_{\mathrm{phys}}(s) \neq \varnothing \wedge \mathrm{StageChangeBridge}_{\mathrm{C}}(s)]\,.} \tag{69}$$

The governing distinction is therefore

$$\boxed{\begin{array}{c}\text{unity belongs to the common cosmic change stage;}\\ \text{multiplicity belongs to the physical systems and their own physical changes.}\end{array}} \tag{70}$$

5.6 The bridge is non-causal and non-operational

Equation (67) does not introduce the causal implication

$$\mathrm{CommonCosmicChangeStage}(s) \Longrightarrow \mathrm{CommonCosmicChangeStageCausesPhysicalChange}(s). \tag{71}$$

Under the joint governing architecture, the common change stage is the one stage at one position in the cosmic succession; concrete physical change is realized in physical systems and receives its causal account from the separately governed physical causal architecture. The bridge therefore neither produces nor transmits physical change and does not require all-to-all interaction.

Likewise,

$$\mathcal{B}_{\Delta}(s) = \mathcal{S}_{\mathrm{phys}}(s) \tag{72}$$

is the formal coverage expression equivalent to UCC, not a detector-defined classification. Hence

$$\left[\mathrm{UCC} \wedge A \in \mathcal{S}_{\mathrm{phys}}(s) \wedge \neg\, \mathrm{Detected}_{P,M}\left(\Delta_A^{\mathrm{phys}}(s)\right)\right] \Longrightarrow A \in \mathcal{B}_{\Delta}(s)\,. \tag{73}$$

Under UCC, $A \in \mathcal{S}_{\mathrm{phys}}(s)$ gives $s \in I_A = I_A^{\Delta}$, so $\Delta_A^{\mathrm{phys}}(s)$ is well typed. Nondetection therefore does not alter the derived actual-change membership of a qualified realized system: $\mathcal{B}_{\Delta}(s)$ is defined by physical-change actuality, not by detector success. A scientifically warranted counterexample to UCC requires positive warrant for complete physical non-change in a qualified system at a change stage belonging to its identity history; a null or unresolved record is insufficient.

CMA and UCC are universal foundational commitments with explicit contrary conditions. No finite set of positive observations deductively confirms either universal quantifier. Empirical support or challenge therefore requires independently warranted physical characterization at the application level; this scientific-status boundary does not weaken the formal commitments.

5.7 Cross-scale illustration

If a human organism H and a stellar system S are both qualified members of $\mathcal{S}_{\mathrm{phys}}(s)$, CMA requires both to be realized at literally the same common cosmic stage s, while UCC requires

$$H, S \in \mathcal{B}_{\Delta}(s)\,, \qquad \mathrm{PhysReal}^{+}_{H}(s) \wedge \mathrm{PhysReal}^{+}_{S}(s). \tag{74}$$

System specificity does not require a common change-content type:

$$H \neq S \nRightarrow \Xi_H = \Xi_S. \tag{75}$$

Spatial separation does not split s into private change stages. The example is illustrative only; it is not an evidential premise for CMA or UCC.

5.8 Foundational bridge versus empirical discrimination bridge

The foundational bridge is not an observational association or clock-response model:

$$\begin{aligned} &\mathrm{StageChangeBridge}_{\mathrm{C}}(s) \not\equiv_{\mathrm{def}} \mathrm{DeclaredPhysicalAssociationBridge}_{P,M}\,,\\ &\mathrm{StageChangeBridge}_{\mathrm{C}}(s) \not\equiv_{\mathrm{def}} \mathrm{ClockResponseModel}_{P,M}\,. \end{aligned} \tag{76}$$

An application may independently introduce empirical association models that produce discriminating observables; their success does not transfer temporal identity to the operational quantity used.

5.9 Integrated V36/F16 common-change-stage/system-change statement

The architecture can be displayed without adding a new primitive commitment:

$$\boxed{\begin{aligned} \forall s \in \mathcal{S}^{\mathrm{tot}}_{\mathrm{C}}, \quad & \mathcal{S}_{\mathrm{phys}}(s) \neq \varnothing,\\ & \mathrm{CosmicCoPresence}_{\mathrm{C}}\left(\mathcal{S}_{\mathrm{phys}}(s); s\right),\\ & \mathcal{B}_{\Delta}(s) = \mathcal{S}_{\mathrm{phys}}(s),\\ & \mathfrak{D}_{\mathrm{C}}(s) = \Big(A \mapsto \Delta^{\mathrm{phys}}_{A}(s)\Big)_{A \in \mathcal{B}_{\Delta}(s)} \in \prod_{A \in \mathcal{B}_{\Delta}(s)} \Xi_A. \end{aligned}} \tag{77}$$

The four lines are supplied respectively by CSPP, CMA, UCC through the coverage equivalence, and the dependent profile definition. They state one common change stage and complete system-specific change coverage without introducing private system times, one universal change content, or a causal action of the change stage.

6. Physical Causation

6.1 Change actuality and causal realization

Universal Change Continuity separately requires memberwise system-specific physical-change actuality across identity histories, while CMA explicitly governs universal common cosmic-stage unity. Neither CMA nor UCC identifies the concrete physical contributors responsible for any particular realized change. Causal realization therefore has a separate logical status.

For every $A \in \mathcal{U}_{\text{phys}}$ and $s \in I_A$, the physical system A is the system in which $\mathrm{PhysReal}_A^{+}(s)$ is realized. The physical contributors to that change may arise from the internal physical constitution of A, from other physical systems, from external physical factors that are not independently classified as physical-system identities, or from an admissible combination of those sources.

Causal realization does not require deterministic necessitation of one unique outcome. A system-specific physical account may include deterministic, probabilistic, or stochastic laws, interactions, boundary conditions, environmental couplings, constitutive relations, or other physically specified mechanisms. The foundational requirement is that realized physical change possess a nonempty actual physical causal basis.

6.2 Three physical causal-source classes

For $A \in \mathcal{U}_{\text{phys}}$ and $s \in I_A$, define the causal profile

$$\mathfrak{C}_A(s) := \left(\mathcal{C}_A^{\text{int}}(s), \mathcal{C}_A^{\text{ext-sys}}(s), \mathcal{C}_A^{\text{ext-fac}}(s)\right). \tag{78}$$

The three components have distinct roles.

(i) $\mathcal{C}_A^{\text{int}}(s)$ contains operative internal physical contributors arising from the constitution, organization, properties, relations, retained physical conditions, and internal processes of A.

(ii) $\mathcal{C}_A^{\text{ext-sys}}(s)$ contains other physical systems whose physically realized interactions, couplings, transfers, contacts, emissions, constraints, or other established influences contribute to the change realized in A.

(iii) $\mathcal{C}_A^{\text{ext-fac}}(s)$ contains operative external physical factors that contribute to the realized change but are not independently classified as physical-system identities under the applicable identity criterion.

Let

$$\mathcal{F}_{\text{phys}}(s) \tag{79}$$

denote the class of physically realized factors at s that are not independently classified as members of $\mathcal{U}_{\text{phys}}$. The causal-source typing is

$$\mathcal{C}_A^{\text{int}}(s) \subseteq \mathrm{InternalPhysicalBasis}(A; s), \tag{80}$$

$$\mathcal{C}_A^{\text{ext-sys}}(s) \subseteq \{B \in \mathcal{S}_{\text{phys}}(s) \setminus \{A\} \mid \mathrm{ExternalTo}(B, A; s)\}, \tag{81}$$

$$\mathcal{C}_A^{\text{ext-fac}}(s) \subseteq \{f \in \mathcal{F}_{\text{phys}}(s) \mid \mathrm{ExternalTo}(f, A; s)\}, \qquad \mathcal{F}_{\text{phys}}(s) \cap \mathcal{U}_{\text{phys}} = \varnothing. \tag{82}$$

For one declared system boundary and one causal attribution, the three source classes are role-distinct:

$$\mathrm{PairwiseDisjoint}\left(\mathcal{C}_A^{\text{int}}(s), \mathcal{C}_A^{\text{ext-sys}}(s), \mathcal{C}_A^{\text{ext-fac}}(s)\right). \tag{83}$$

Classification follows physical status and the declared boundary of A rather than terminology.

An independently identified constituent lying within that boundary is treated through the internal physical basis for this attribution; an independently realized system external to that boundary may enter $\mathcal{C}_A^{\text{ext-sys}}(s)$. A field, medium, radiation contribution, environmental condition, boundary condition, or other physical contributor belongs to the external-system class only where an independently warranted physical-system identity is realized and is external to A; otherwise an external contribution is classified within the applicable non-system physical-factor class. The same contributor is not counted simultaneously in more than one class under one causal attribution.

Define the complete actual causal-source set by

$$\mathcal{C}_A^{\text{act}}(s) := \mathcal{C}_A^{\text{int}}(s) \cup \mathcal{C}_A^{\text{ext-sys}}(s) \cup \mathcal{C}_A^{\text{ext-fac}}(s). \tag{84}$$

6.3 Actual physical contribution

Let

$$\text{PhysicallyContributes}(c; \Xi) \tag{85}$$

state that physically admissible contributor c makes an actual physical contribution to the realized physical change or transformation designated by Ξ.

The target of physical contribution is the typed physical-change content or physical transformation itself, not the truth value of an actuality predicate. For an actual-change pair (A, s) with $s \in I_A^{\Delta}$, membership in the actual causal set is therefore fixed by

$$c \in \mathcal{C}_A^{\text{act}}(s) \iff \text{PhysicallyContributes}\left(c; \Delta_A^{\text{phys}}(s)\right). \tag{86}$$

The relation PhysicallyContributes does not by itself assert that one contributor is sufficient, exclusive, deterministic, temporally prior in every physical model, or a complete causal account.

6.4 Causal Realization Principle

Principle 6.1 (Causal Realization Principle)**.** Every actually realized system-specific physical change has a nonempty actual physical causal set:

$$\text{CRP} \iff \forall A \in \mathcal{U}_{\text{phys}}\ \forall s \in I_A, \quad \text{PhysReal}_A^{+}(s) \implies \mathcal{C}_A^{\text{act}}(s) \neq \varnothing. \tag{87}$$

Equivalently, for every applicable A, s,

$$\mathcal{C}_A^{\text{act}}(s) \neq \varnothing \iff \mathfrak{C}_A(s) \neq (\varnothing, \varnothing, \varnothing). \tag{88}$$

The logical roles of UCC and CRP remain distinct:

$$\text{UCC} \implies \forall A \in \mathcal{U}_{\text{phys}}\ \forall s \in I_A, \quad \text{PhysReal}_A^{+}(s), \tag{89}$$

$$\text{CRP} \implies \forall A \in \mathcal{U}_{\text{phys}}\ \forall s \in I_A, \quad \text{PhysReal}_A^{+}(s) \implies \mathcal{C}_A^{\text{act}}(s) \neq \varnothing. \tag{90}$$

Thus UCC supplies universal memberwise physical-change actuality, CMA supplies universal common cosmic-stage unity, and CRP governs the physical causal realization of each such change. None of these statements is itself a physical causal contributor.

Together,

$$\{\mathrm{UCC}, \mathrm{CRP}\} \vdash \forall A \in \mathcal{U}_{\mathrm{phys}}\ \forall s \in I_A, \quad \mathrm{PhysReal}_A^{+}(s) \wedge \mathcal{C}_A^{\mathrm{act}}(s) \neq \varnothing. \tag{91}$$

6.5 Causal-source closure

The causal-source taxonomy contains exactly the three declared physical classes of Equation (78). A realized change does not acquire a fourth causal-source class merely because its detailed mechanism or contributors remain incompletely known.

Accordingly,

$$\mathrm{UnresolvedResult}(A; s) \wedge \mathrm{UnspecifiedCause}(A; s) \not\Rightarrow \mathrm{CausalExplanation}(A; s). \tag{92}$$

Incomplete causal knowledge therefore remains incomplete knowledge. It is not converted into an unrestricted causal term.

6.6 Common cosmic-stage realization is not universal causal interaction

The Cosmic Moment Axiom states common cosmic-stage co-realization of the complete then-existing population. It does not state that every system physically causes change in every other system.

For $A, B \in \mathcal{S}_{\mathrm{phys}}(s)$,

$$\mathrm{CMA} \wedge A, B \in \mathcal{S}_{\mathrm{phys}}(s) \not\Rightarrow B \in \mathcal{C}_A^{\text{ext-sys}}(s). \tag{93}$$

Likewise, external causal influence need not be symmetric:

$$B \in \mathcal{C}_A^{\text{ext-sys}}(s) \not\Rightarrow A \in \mathcal{C}_B^{\text{ext-sys}}(s). \tag{94}$$

CMA governs common cosmic-stage unity. UCC separately governs memberwise system-specific physical-change actuality throughout each identity-realization range, while the causal profile governs which physical contributors actually participate in a particular realized change.

6.7 Shared contributor does not imply identical change

A physical contributor may participate in changes realized in more than one physical system without imposing one common change-content type on those systems. Where an application independently supplies admissible comparison maps into a common comparison space, shared contributor membership does not identify the mapped change-content values; and even if selected mapped values coincide, the system-indexed physical-change realizations remain necessarily distinct because they are realized by and attributed to numerically distinct physical-system identities. This necessary system-level distinction does not require every underlying physical process, interaction, or contributor to be disjoint across nested, overlapping, composite, or otherwise scientifically warranted system boundaries. System-specific realized outcomes are governed by the physical-system identity, constitution, organization, state, spatial relation, coupling, internal condition, and other system-specific physical properties.

This distinction is consistent with the conjunction of CMA and UCC: systems share the same common cosmic change stage while each realizes its own necessarily system-distinct physical change under its own necessarily system-distinct causal profile. The causal profiles are necessarily distinct as system-indexed physical attributions even where one or more contributing sources or physical processes are shared across system boundaries; shared participation does not merge the physical systems, their changes, or their causal profiles.

6.8 Time, common cosmic change stage, and order are not physical causes

The common cosmic change stage identifies the shared location in the universal ordering at which the relevant physical systems are realized and each realizes its own system-specific physical change. It is not a physical causal contributor.

For every $A \in \mathcal{U}_{\text{phys}}$ and $s \in I_A$,

$$T_{\text{ITOF}} \not\equiv_{\text{type}} \text{PhysicalCausalContributor}, \tag{95}$$

$$s \not\equiv_{\text{type}} \text{PhysicalCausalContributor}\,. \tag{96}$$

Likewise,

$$\prec_{\text{C}} \not\equiv_{\text{type}} \text{PhysicalCause}\,. \tag{97}$$

Earlier position in the cosmic ordering is not by itself sufficient for causal attribution:

$$r \prec_{\text{C}} s \not\Rightarrow \text{CauseOf}(r, s). \tag{98}$$

A physically warranted causal connection is required in addition to order.

The same exclusion applies to CMA and UCC:

$$\text{CMA} \not\equiv_{\text{type}} \text{PhysicalCause}, \qquad \text{UCC} \not\equiv_{\text{type}} \text{PhysicalCause}\,. \tag{99}$$

They govern physical commitments about common realization and universal change; they do not physically produce those changes.

7. Physical-System Identity

7.1 Numerical physical-system identity

Unless explicitly stated otherwise, identity in V36/F16 means numerical physical-system identity: the same physical system itself.

Identity is not defined by resemblance, continuity of name, common function, common location, or partial material continuity.

Accordingly,

$$\mathrm{Similar}_{\Gamma}(A, B) \not\Rightarrow A = B, \tag{100}$$

$$\mathrm{SameFunction}_{\Gamma}(A, B) \not\Rightarrow A = B, \tag{101}$$

and

$$\mathrm{SharedMaterial}(A, B) \not\Rightarrow A = B. \tag{102}$$

A physical system may undergo constituent replacement, internal reorganization, repair, deformation, growth, environmental interaction, damage, functional variation, or criterion-relative stability while remaining the same numerical physical system. Persistence depends on the physical identity conditions applicable to the system class.

7.2 Physical identity and scientific warrant

Physical-system identity is a physical fact. Scientific warrant for attributing that identity is epistemically distinct from the identity itself.

For protocol P and model M,

$$\mathrm{PhysicalSystem}(A) \not\equiv_{\mathrm{def}} \mathrm{Warrant}_{P,M}\left[\mathrm{PhysicalSystem}(A)\right]. \tag{103}$$

Scientific warrant may depend on observations, records, class-specific identity criteria, model assumptions, and declared uncertainty. Those elements may justify attribution of a physical-system identity but do not create that identity.

7.3 Scientific identity criteria

For physical-system class κ, let

$$\Gamma_{\kappa}^{\mathrm{id}} \tag{104}$$

denote a declared scientific identity criterion.

A valid criterion shall state, within its applicable physical domain:

(a) the physical-system class to which the criterion applies;

(b) the physical boundary, organization, or other physically meaningful conditions distinguishing one system identity;

(c) the conditions under which the identity becomes physically realized;

(d) the conditions required for persistence of the same identity through physical change;

(e) the conditions under which the identity ceases;

(f) the treatment of constituent replacement, internal reorganization, division, fusion, absorption, merger, and other relevant transformations;

(g) the distinction between functional failure and identity ending;

(h) the observational resolution, uncertainty, and physical domain within which the criterion is scientifically applicable.

Its validity is represented by

$$\mathrm{ValidIdentityCriterion}\left(\Gamma_\kappa^{\mathrm{id}}\right). \tag{105}$$

A test involving identity persistence or identity ending must declare the applicable identity criterion independently of the evaluation outcome. An observed outcome may test that criterion; it does not retrospectively redefine it.

7.4 Identity realization and continuation

The identity-realization range I_A was defined in Equation (26) by

$$I_A = \left\{s \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}} \mid \mathrm{ExistsAs}(A, s)\right\}. \tag{106}$$

Hence,

$$\mathrm{ExistsAs}(A, s) \Longleftrightarrow s \in I_A. \tag{107}$$

No physical state, change, formation, history, or ending is attributed to numerical physical-system identity A outside I_A.

For convenience define the non-strict cosmic ordering by

$$r \preceq_{\mathrm{C}} s \Longleftrightarrow (r = s \vee r \prec_{\mathrm{C}} s). \tag{108}$$

Continuation of the same physical-system identity is represented by

$$\mathrm{SameSystemThrough}_A(r, s) \Longleftrightarrow A \in \mathcal{U}_{\mathrm{phys}} \wedge r, s \in I_A \wedge r \preceq_{\mathrm{C}} s. \tag{109}$$

The relation states identity continuation through the common cosmic ordering. It does not imply that the system has remained physically unchanged.

For protocol P and model M, scientific identity warrant may be represented by

$$\mathrm{IdentityWarrant}_{P,M}\left[\mathrm{SameSystemThrough}_A(r, s)\right]. \tag{110}$$

The epistemic warrant remains type-distinct from the physical identity relation:

$$\mathrm{IdentityWarrant}_{P,M}\left[\mathrm{SameSystemThrough}_A(r, s)\right] \not\equiv_{\mathrm{type}} \mathrm{SameSystemThrough}_A(r, s). \tag{111}$$

7.5 Identity-Realization Convexity

Principle 7.1 (Identity-Realization Convexity)**.** For all $r, s, t \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}$, if numerical physical-system identity A is realized at r and t, and s lies strictly between them under the common cosmic ordering, then that same identity is realized at s:

$$\forall r, s, t \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \quad r \in I_A \wedge t \in I_A \wedge r \prec_{\mathrm{C}} s \wedge s \prec_{\mathrm{C}} t \Longrightarrow s \in I_A. \tag{112}$$

The principle excludes an internal gap in one numerical identity:

$$r, t \in I_A \wedge r \prec_{\mathrm{C}} s \wedge s \prec_{\mathrm{C}} t \Longrightarrow \neg\,(s \notin I_A)\,. \tag{113}$$

A later physical system may resemble an earlier system, inherit material from it, replace its function, occupy a similar spatial region, or arise through transformation of its constituents without becoming the same numerical physical-system identity.

Identity-Realization Convexity concerns persistence of numerical identity within I_A. It does not impose a metric duration, a numerical count of common cosmic change stages, or equality of physical state across that range.

7.6 Actual Formation Boundary

Every actually realized physical-system identity has one unique earliest common cosmic change stage at which that identity is realized.

Postulate 7.2 (Actual Formation Boundary — AFB)**.**

$$\mathrm{AFB} \Longleftrightarrow \forall A \in \mathcal{U}_{\mathrm{phys}}\ \exists! f \in I_A\,[\nexists r \in I_A\,(r \prec_{\mathrm{C}} f)]\,. \tag{114}$$

Let f_A denote the unique least member of I_A. The formation map is

$$f : \mathcal{U}_{\mathrm{phys}} \longrightarrow \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \qquad f(A) = f_A. \tag{115}$$

The formation boundary is a boundary of numerical physical-system identity. It does not by itself establish an origin common cosmic change stage for the universe; that question belongs to the independent Cosmic Origin commitment and its relevant population conditions.

Formation change is defined by

$$\mathrm{FormationChange}_A(s) \Longleftrightarrow s = f_A \wedge \mathrm{PhysReal}_A^{+}(s). \tag{116}$$

From AFB and UCC,

$$\{\mathrm{AFB}, \mathrm{UCC}\} \vdash \forall A \in \mathcal{U}_{\mathrm{phys}}, \quad \mathrm{FormationChange}_A(f_A) \wedge \nexists r \in I_A\,(r \prec_{\mathrm{C}} f_A)\,. \tag{117}$$

Formation does not require an earlier state of A, an already existing identity waiting to become active, or a static interval between nonexistence and existence. Physical contributors from which A forms may themselves possess earlier physical histories, but those contributors are not earlier states of the newly formed identity A.

For every $r \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}$,

$$r \prec_{\mathrm{C}} f_A \Longrightarrow \neg\,\mathrm{ExistsAs}(A, r). \tag{118}$$

The realization of change at f_A does not assign a metric instantaneous duration to formation. It states that once the new identity is physically realized at its formation boundary, it is already subject to UCC.

7.7 Causal realization at formation

Because formation change is actual physical change, the Causal Realization Principle applies at the formation boundary:

$$\{\mathrm{AFB}, \mathrm{UCC}, \mathrm{CRP}\} \vdash \forall A \in \mathcal{U}_{\mathrm{phys}}, \quad \mathcal{C}_A^{\mathrm{act}}(f_A) \neq \varnothing. \tag{119}$$

Thus physical-system formation is neither caused by time nor caused by the common cosmic change stage. Its causal realization remains within the same three physical causal-source classes established for all realized system-specific physical change.

7.8 Formation under the optional Cosmic Origin commitment

If the independent Cosmic Origin postulate is adopted, every system belonging to the population realized at the least common cosmic stage has its formation boundary there:

$$\{\mathrm{CosmicOrigin}, \mathrm{AFB}\} \vdash \forall A \in \mathcal{S}_{\mathrm{phys}}(s_{\mathrm{C}}^{0}), \quad f_A = s_{\mathrm{C}}^{0}. \tag{120}$$

With CSPP,

$$\{\mathrm{CosmicOrigin}, \mathrm{CSPP}\} \vdash \mathcal{S}_{\mathrm{phys}}(s_{\mathrm{C}}^{0}) \neq \varnothing. \tag{121}$$

With UCC and causal realization,

$$\begin{aligned} \{\mathrm{CosmicOrigin}, \mathrm{CSPP}, \mathrm{AFB}, \mathrm{UCC}, \mathrm{CRP}\} \vdash \forall A \in \mathcal{S}_{\mathrm{phys}}(s_{\mathrm{C}}^{0}), \\ \mathrm{FormationChange}_A(s_{\mathrm{C}}^{0}) \wedge \mathcal{C}_A^{\mathrm{act}}(s_{\mathrm{C}}^{0}) \neq \varnothing. \end{aligned} \tag{122}$$

The causal relation used by V36/F16 is not defined as a universal requirement that every physical contributor occupy a strictly earlier common cosmic stage than the realized change to which it contributes. Consequently, if Cosmic Origin is adopted, causal realization at s_{C}^{0} does not require a pre-cosmic stage or a pre-existing temporal layer. The admissible causal basis is the physically realized constitutive, relational, interactional, or non-system physical contribution applicable to the formation boundary itself.

This statement introduces no causal agency for s_{C}^{0}, T_{ITOF}, $\prec_{\mathrm{C}}$, CMA, or UCC.

8. Identity-Bounded Physical History

8.1 Physical state and physical-change-content maps

For each $A \in \mathcal{U}_{\text{phys}}$, let Ω_A be a declared state space adequate to the physical description under consideration. The system-specific change-content type Ξ_A, the actual-change subset I_A^{Δ}, and the map $\Delta_A^{\text{phys}} : I_A^{\Delta} \to \Xi_A$ were declared in Equations (39)–(40). Under UCC, Equation (41) identifies I_A^{Δ} with the full realized identity range I_A.

Define the state map

$$X_A : I_A \longrightarrow \Omega_A \tag{123}$$

For $s \in I_A$, $X_A(s)$ denotes the physical state of A realized at the corresponding common cosmic change stage. Because this subsection concerns a governing V36/F16 realization, UCC gives $I_A^{\Delta} = I_A$, so $\Delta_A^{\text{phys}}(s)$ is well typed throughout the same identity range and denotes the system-specific physical-change content realized there.

The common cosmic change stage s and the state $X_A(s)$ retain different types:

$$s \not\equiv_{\text{type}} X_A(s). \tag{124}$$

Likewise, under the governing UCC condition $s \in I_A = I_A^{\Delta}$,

$$s \not\equiv_{\text{type}} \Delta_A^{\text{phys}}(s). \tag{125}$$

The common cosmic change stage is universal. The state and physical-change content are system-specific.

The earlier statement concerning continuation of identity can now be made explicit:

$$\text{SameSystemThrough}_A(r, s) \not\Rightarrow X_A(r) = X_A(s). \tag{126}$$

Numerical identity therefore does not require physical-state invariance.

8.2 Formal representation of the physical history

Each numerical physical-system identity has its own actual physical history throughout the range in which that identity is realized. In every governing V36/F16 realization, UCC gives $I_A^{\Delta} = I_A$; therefore the system-specific physical-change-content map is well typed on the full realized identity range.

Represent that history formally by

$$\mathcal{H}_A := \left(I_A, \prec_{\mathrm{C}}|_{I_A}, X_A, \Delta_A^{\text{phys}}\right). \tag{127}$$

The symbol $\mathcal{H}_A$ is a formal representation of the actual physical history of A. It is not the actual physical history itself.

The history belongs to the physical-system identity A. The common cosmic change stages do not themselves constitute one physical history shared by all systems.

Different systems may therefore possess different physical histories while sharing the same common cosmic change stages whenever their identity-realization ranges overlap.

For $A, B \in \mathcal{U}_{\text{phys}}$,

$$A \neq B \nRightarrow \mathcal{H}_A = \mathcal{H}_B. \tag{128}$$

The component domains and maps of distinct systems are system-specific and may differ; no universal inequality among corresponding components is imposed. Even where selected formal components happen to coincide, numerical distinction between physical systems is not erased by representational similarity.

8.3 History is not time

The physical history of a system and the entity denoted by time are type-distinct:

$$\mathcal{H}_A \not\equiv_{\text{type}} T_{\text{ITOF}}. \tag{129}$$

The ordering used within the history is not a private order:

$$\prec_{\text{C}}|_{I_A} \subseteq \prec_{\text{C}} . \tag{130}$$

Thus $\mathcal{H}_A$ does not introduce a system-specific time, a second cosmic ordering, or a private change stage succession. It represents the physical states and system-specific change of A across those members of the one common cosmic change-stage totality at which its identity is realized.

8.4 Formal restrictions of one history

For any order-defined $J \subseteq I_A$, define the restriction

$$\mathcal{H}_A|_J := \left(J, \prec_{\text{C}}|_J, X_A|_J, \Delta_A^{\text{phys}}\Big|_J\right). \tag{131}$$

This is a restriction of the formal representation of the same physical history. It does not create a second physical history, an independent physical segment, a new temporal succession, or a discrete sequence of completed changes.

Order restriction therefore has a representational function only.

8.5 Physical development

Physical development is not introduced as an additional entity or second process. It denotes the same system-specific physical change considered in its extended realization throughout the physical history of the system.

Accordingly, the physical development of A is governed by

$$\text{UCC} \Longrightarrow \forall s \in I_A, \quad \text{PhysReal}_A^{+}(s), \tag{132}$$

together with the order relation inherited from $\prec_{\text{C}}$.

A statement that some physical development is realized at common cosmic change stage s

therefore identifies a location in the universal ordering at which the continuing physical change of A is realized. It does not divide the entire physical development into isolated change-stage-sized physical units.

No equation of the form

$$\mathrm{PhysicalDevelopment}_A = \sum_{s \in I_A^{\Delta}} \Delta_A^{\mathrm{phys}}(s) \tag{133}$$

is adopted by V36/F16.

The displayed expression is specifically not a governing definition. No universal arithmetic sum, change-stage count, or common scalar measure of physical development is introduced.

8.6 Causal realization throughout physical history

The causal profile is evaluated at members of the same identity-realization range but does not constitute a second history:

$$\mathfrak{C}_A : I_A \longrightarrow \mathfrak{C}_A, \tag{134}$$

where $\mathfrak{C}_A$ denotes the admissible typed space of causal profiles for A.

Under the separately adopted UCC commitment together with the Causal Realization Principle,

$$\{\mathrm{UCC}, \mathrm{CRP}\} \vdash \forall A \in \mathcal{U}_{\mathrm{phys}}\ \forall s \in I_A, \quad \mathrm{PhysReal}_A^{+}(s) \wedge \mathfrak{C}_A(s) \neq (\varnothing, \varnothing, \varnothing). \tag{135}$$

The causal profile and physical history therefore concern the same physical system but answer different questions. The history represents what states and system-specific changes are physically realized across the identity range. The causal profile identifies the physically operative contributors to the change realized at a particular common cosmic change stage.

Neither relation creates a new temporal succession.

8.7 Identity, change, and history without private change stages

For any $A, B \in \mathcal{S}_{\mathrm{phys}}(s)$,

$$s \in I_A \cap I_B \tag{136}$$

while their identity ranges and state maps remain system-specific and may coincide in selected formal features or differ. Their change-content maps remain system-specific, and the physical changes realized by numerically distinct systems are necessarily distinct as system-specific physical-change realizations even where selected mapped values coincide. No universal equality or inequality among the formal identity-range or state-map components is imposed merely by common cosmic change-stage membership; shared membership in the same common cosmic change stage does not erase system-specific physical distinction.

The governing point is instead:

$$\text{distinct physical histories} \quad \not\Rightarrow \quad \text{distinct common cosmic change-stage successions.} \tag{137}$$

The common cosmic change-stage succession is one and universally shared. Identity, state, physical change, development, causal profile, and physical history remain specific to each physical system.

8.8 Integrated Causal, Identity, Formation, and History Status

The architecture established so far is

$$T_{\mathrm{ITOF}} = \left(\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \prec_{\mathrm{C}}\right), \tag{138}$$

$$\mathrm{CSPP} \wedge \mathrm{CMA} \wedge \mathrm{UCC}, \tag{139}$$

$$\mathrm{CRP}, \tag{140}$$

$$I_A = \left\{s \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}} \mid \mathrm{ExistsAs}(A, s)\right\}, \tag{141}$$

$$\mathrm{AFB}, \tag{142}$$

and

$$\mathcal{H}_A = \left(I_A, \prec_{\mathrm{C}}|_{I_A}, X_A, \Delta_A^{\mathrm{phys}}\right). \tag{143}$$

These statements complete the causal, identity, formation, and physical-history architecture. Historical physical accumulation, the present cumulative physical resultant, identity ending, ending-specific causal attribution, universal lifecycle claims, and successor relations are not required to define time, common cosmic change-stage realization, UCC, causal realization, formation, or the physical history itself.

Foundational identity lock. The following compact statement fixes the identity-preserving interpretation of V36/F16. It introduces no additional axiom, postulate, causal source, temporal succession, or physical entity. It only gathers consequences and type boundaries already established above.

There is one universal common cosmic change-stage totality and one governing cosmic ordering. Every physical-system identity is realized only over a restriction $I_A \subseteq \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}$ of that same common cosmic change-stage totality and inherits no ordering other than $\prec_{\mathrm{C}}|_{I_A}$. The common cosmic change stage is therefore universally shared, whereas state, physical-change content, causal profile, development, and actual physical history remain system-specific. Distinct physical histories do not create distinct times or private cosmic change-stage sequences, and common cosmic change-stage realization does not collapse those histories into one universal physical history. CMA supplies explicit common cosmic-stage realization, while UCC separately supplies memberwise system-specific physical-change actuality throughout each realized identity history. Where an identity ending is governed by the full lifecycle commitments, that ending remains within the same uninterrupted system-specific physical development that extends from the nonempty strict pre-ending identity history through the ending change stage itself.

9. Historical Physical Accumulation and the Present Cumulative Physical Resultant

9.1 Earlier realized physical history

For $A \in \mathcal{U}_{\text{phys}}$ and $s \in I_A$, define the strictly earlier identity-realization range by

$$I_A^{<s} := \{r \in I_A \mid r \prec_{\text{C}} s\} . \tag{144}$$

Where $I_A^{<s} \neq \varnothing$, define the corresponding formal restriction of the physical-history representation by

$$\mathcal{H}_A^{<s} := \mathcal{H}_A|_{I_A^{<s}} . \tag{145}$$

The restriction $\mathcal{H}_A^{<s}$ is a formal representation of the earlier portion of the same identity-bounded physical history. It is not an additional physical history, a stored physical object, a causal source, or a collection that exists independently of the physical system.

Because UCC applies at every member of I_A,

$$I_A^{<s} \neq \varnothing \wedge \text{UCC} \Longrightarrow \forall r \in I_A^{<s}, \quad \text{PhysReal}_A^{+}(r). \tag{146}$$

Thus an earlier realized identity history contains actual earlier system-specific physical change. The statement does not assign a numerical count, common magnitude, or metric duration to that earlier change.

9.2 Historical physical accumulation

Definition 9.1 (Historical Physical Accumulation)**.** For $A \in \mathcal{U}_{\text{phys}}$ and $s \in I_A$ satisfying $I_A^{<s} \neq \varnothing$, the expression

$$\text{HistoricalPhysicalAccumulation}_A^{<s} \tag{147}$$

designates the totality of system-specific physical change actually realized strictly earlier than s in the physical history of A.

Historical physical accumulation is therefore historical in status. It concerns what actually occurred in the physical past of the numerical identity A before s.

It is not defined as an arithmetic sum:

$$\text{HistoricalPhysicalAccumulation}_A^{<s} \not\equiv_{\text{def}} \sum_{r \in I_A^{<s} \cap I_A^{\Delta}} \Delta_A^{\text{phys}}(r). \tag{148}$$

No universal addition operation on system-specific physical-change content is assumed.

Historical physical accumulation is also not identical to the formal earlier-history restriction:

$$\text{HistoricalPhysicalAccumulation}_A^{<s} \not\equiv_{\text{def}} \mathcal{H}_A^{<s}. \tag{149}$$

The former designates earlier actually realized physical change. The latter is a formal representation of an earlier portion of the physical history.

Historical physical accumulation is not a present physical object:

$$\text{HistoricalPhysicalAccumulation}_A^{<s} \not\equiv_{\text{type}} \text{PresentPhysicalObject}(A; s). \tag{150}$$

It is not a fourth causal-source class:

$$\text{HistoricalPhysicalAccumulation}_A^{<s} \not\equiv_{\text{type}} \text{PhysicalCausalContributor}\,. \tag{151}$$

The historical designation is therefore not itself eligible as a present physical causal contributor in $\mathcal{C}_A^{\text{act}}(s)$. This exclusion does not deny that earlier physical change can alter the later physical condition of the system. It states that an earlier change considered as a past historical fact does not act at s as an additional causal source outside the three physical causal-source classes.

9.3 Persistence and transformation of earlier effects

An effect produced during earlier physical change may persist, transform, combine with other effects, diminish, intensify, be compensated, or cease to remain physically embodied.

The historical actuality of earlier change is independent of whether its former effects remain present at a later common cosmic change stage.

Accordingly,

$$\text{EarlierChangeOccurred}(A; r) \wedge r \prec_{\text{C}} s \not\Rightarrow \text{EarlierEffectStillEmbodied}(A; r; s). \tag{152}$$

Conversely, where an earlier effect remains physically embodied at s, that embodiment belongs to the present physical condition of the system rather than to a past object acting from an earlier common cosmic change stage.

If such a retained or transformed effect is causally operative in the current system, its causal role is classified within the present causal architecture established in Section 6. An internally embodied operative effect therefore belongs to the applicable present internal physical basis represented within $\mathcal{C}_A^{\text{int}}(s)$. No historical causal class is added.

9.4 Present cumulative physical resultant

Historical physical accumulation and the present cumulative physical resultant answer different questions.

Historical physical accumulation asks what physical change was actually realized earlier in the history of A.

The present cumulative physical resultant states whether retained or transformed effects of earlier realized change remain physically embodied in the current developed condition $X_A(s)$.

For $s \in I_A$ with $I_A^{<s} \neq \varnothing$, let

$$\mathrm{EmbodiedEarlierEffects}_A\left(X_A(s); s\right) \tag{153}$$

state that one or more retained or transformed effects originating in earlier realized physical change remain physically embodied in $X_A(s)$ at s.

Definition 9.2 (Present Cumulative Physical Resultant)**.**

$$\mathrm{CumulativePhysicalResultThrough}_A(s) \iff \mathrm{EmbodiedEarlierEffects}_A\left(X_A(s); s\right). \tag{154}$$

Equation (154) defines a truth-valued present-resultant predicate evaluated from the developed physical condition $X_A(s)$. The symbol $\mathrm{CumulativePhysicalResultThrough}_A(s)$ does not denote or introduce a separate physical object, vector, aggregate, causal source, or additional state variable beyond the presently embodied physical condition represented in $X_A(s)$. It does not assert that every earlier change leaves a presently retained effect.

Therefore,

$$\mathrm{CumulativePhysicalResultThrough}_A(s) \not\Rightarrow \forall r \in I_A^{<s}, \quad \mathrm{EarlierEffectStillEmbodied}(A; r; s). \tag{155}$$

A fully cancelled or ceased effect does not remain part of the present cumulative physical resultant as that effect, even though the earlier physical change that produced it remains part of the actual physical history.

The two cumulative notions remain definitionally distinct:

$$\mathrm{HistoricalPhysicalAccumulation}_A^{<s} \not\equiv_{\mathrm{def}} \mathrm{CumulativePhysicalResultThrough}_A(s). \tag{156}$$

Likewise,

$$\mathrm{PairwiseDefDistinct}\begin{pmatrix} \mathcal{H}_A^{<s} \\ \mathrm{HistoricalPhysicalAccumulation}_A^{<s} \\ \mathrm{CumulativePhysicalResultThrough}_A(s) \end{pmatrix}. \tag{157}$$

The three expressions respectively concern a formal history restriction, earlier actually realized physical change, and a present statement about effects still embodied in the developed current physical condition.

9.5 UCC does not entail a retained-effect resultant

UCC establishes realized system-specific physical change at every member of I_A. It does not establish that any specified effect of that change must persist.

Accordingly,

$$I_A^{<s} \neq \varnothing \wedge \mathrm{UCC} \not\Rightarrow \mathrm{CumulativePhysicalResultThrough}_A(s). \tag{158}$$

Nor does UCC imply monotonic growth of a cumulative physical quantity:

$$\mathrm{UCC} \not\Rightarrow \mathrm{MonotonicCumulativeGrowth}(A). \tag{159}$$

No universal scalar accumulation law, cumulative magnitude, cross-system ranking, or common physical accumulation unit is introduced.

Where a physical model independently supplies a valid quantitative measure of some aspect of the present condition, that measure remains system- and model-specific.

9.6 No universal cumulative threshold

Neither historical physical accumulation nor the present cumulative physical resultant establishes a universal threshold at which a physical-system identity must end.

Thus,

$$I_A^{<s} \neq \varnothing \not\Rightarrow \mathrm{End}_A(s). \tag{160}$$

and

$$\mathrm{CumulativePhysicalResultThrough}_A(s) \not\Rightarrow \mathrm{End}_A(s). \tag{161}$$

Historical physical accumulation is not assigned a universal scalarization. Even where an application independently defines a scalar historical measure $M_A^{\mathrm{hist}}(s)$, V36/F16 adopts no universal threshold law of the form

$$M_A^{\mathrm{hist}}(s) \geq \Theta_{\mathrm{end}} \Longrightarrow \mathrm{End}_A(s). \tag{162}$$

Any such scalar measure and threshold would require an independently justified system- and model-specific physical definition.

Identity ending is governed by the physical identity criterion, the actual identity-ending transformation, and ending-specific physical causation. It is not caused by accumulation as an independent entity.

10. Identity Ending and Ending-Specific Physical Causation

10.1 Identity-ending transformation

Let

$$\mathrm{IdentityEndingTransformation}(A; e) \tag{163}$$

denote the local primitive physical classification that the transformation physically realized in system A at common cosmic change stage e satisfies the applicable numerical-identity-ending criterion at that boundary. The predicate does not itself quantify over later common cosmic change stages or assert the global later absence of A; that later-change-stage condition belongs to $\mathrm{End}_A(e)$.

The predicate identifies a physical identity-boundary transformation. It does not mean functional failure, last observation, loss of a selected property, destruction of one component, or cessation of one operational role unless the applicable physical identity criterion establishes that the numerical identity itself ends at that boundary.

10.2 Definition of identity ending

Definition 10.1 (Physical-System Identity Ending)**.** For $A \in \mathcal{U}_{\mathrm{phys}}$ and $e \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}$,

$$\mathrm{End}_A(e) \Longleftrightarrow e \in I_A \wedge \mathrm{IdentityEndingTransformation}(A; e) \wedge \forall t \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}} \left(e \prec_{\mathrm{C}} t \Longrightarrow t \notin I_A\right). \tag{164}$$

The ending change stage e is the final common cosmic change stage at which the numerical identity A remains physically realized.

Its finality is specific to the identity-realization range I_A. It does not make e a private change stage, does not terminate the common cosmic succession, and does not create a system-specific temporal order.

From the ending definition,

$$\mathrm{End}_A(e) \Longrightarrow e \in I_A. \tag{165}$$

Therefore UCC applies at the ending change stage:

$$\{\mathrm{End}_A(e), \mathrm{UCC}\} \Longrightarrow \mathrm{PhysReal}_A^{+}(e). \tag{166}$$

The physical change realized at the ending change stage is thus not an additional change introduced after the system's development has already stopped.

10.3 Uniqueness of an actual ending

Under strict total ordering, two distinct ending members of the same numerical identity are impossible.

Proposition 10.2 (Uniqueness of Identity Ending)**.**

$$\mathrm{StrictTotalOrder}\left(\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \prec_{\mathrm{C}}\right) \vdash \forall A \in \mathcal{U}_{\mathrm{phys}}, \quad \forall e_1, e_2 \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \left[\mathrm{End}_A(e_1) \wedge \mathrm{End}_A(e_2) \Longrightarrow e_1 = e_2\right]. \tag{167}$$

If $e_1 \neq e_2$, totality orders one before the other. The ending condition associated with the earlier member then excludes realization of the same numerical identity at the later member, contradicting the assumption that both belong to I_A.

10.4 Terminal ending-change content

For every actual ending in a governing V36/F16 realization, $\mathrm{End}_A(e)$ places $e \in I_A$, and UCC gives $e \in I_A^{\Delta}$. The terminal ending-change content is therefore well typed and is defined by

$$\Delta_A^{\mathrm{end}}(e) := \Delta_A^{\mathrm{phys}}(e), \qquad \text{when } \mathrm{End}_A(e) \wedge \mathrm{UCC}\,. \tag{168}$$

The superscript end is an identity-boundary classification of the system-specific physical-change content realized at e.

It does not define a separate kind of physical change, a newly initiated final process, or a fourth causal mechanism.

Consequently,

$$\Delta_A^{\mathrm{end}}(e) \not\equiv_{\mathrm{type}} \mathrm{IndependentFinalCause}\,. \tag{169}$$

A terminal ending change may be minute in one system-relative physical description or very large and decisive in another. V36/F16 imposes no universal magnitude, rate, mechanism, or duration for identity-ending change.

10.5 Uninterrupted physical development through ending

The ending boundary occurs within the same UCC-governed physical development of the system, realized at common cosmic stages whose universal unity is governed by CMA; under the joint realization architecture those stages bear the full-theory change-stage role.

For any actual ending,

$$\mathrm{End}_A(e) \wedge \mathrm{UCC} \Longrightarrow \mathrm{PhysReal}_A^+(e). \tag{170}$$

Where earlier identity history exists,

$$I_A^{<e} \neq \varnothing \wedge \mathrm{End}_A(e) \wedge \mathrm{UCC} \Longrightarrow \left[\forall r \in I_A^{<e}, \mathrm{PhysReal}_A^+(r)\right] \wedge \mathrm{PhysReal}_A^+(e). \tag{171}$$

Together with Identity-Realization Convexity, this states that the system does not pass through an internal identity gap or any common cosmic change stage at which that system is in complete physical stasis between its earlier realized history and the ending boundary.

The earlier realized physical change and the change classified as terminal are therefore parts of one uninterrupted identity-bounded physical development, expressed history-relatively by the UCC.

This does not convert uninterrupted physical change into mathematical continuity, differentiability, infinitesimal change, or a metric trajectory.

The terminal designation also does not imply that all development relevant to the ending occurs only at e. The developed physical condition at e may embody retained or transformed effects of earlier realized change, while the actual ending is realized through the physical change and causal contributions operative at e.

10.6 Historical accumulation and the ending boundary

For an actual ending satisfying $\mathrm{End}_A(e) \wedge \mathrm{UCC}$, UCC gives $e \in I_A^{\Delta}$. If $I_A^{<e} \neq \varnothing$, then

$$\mathrm{HistoricalPhysicalAccumulation}_A^{<e} \tag{172}$$

designates the physical change actually realized before the ending change stage.

At the same ending change stage, the developed physical condition is

$$X_A(e), \tag{173}$$

and the terminal ending-change content is

$$\mathrm{End}_A(e) \wedge \mathrm{UCC} \Longrightarrow \Delta_A^{\mathrm{end}}(e) = \Delta_A^{\mathrm{phys}}(e). \tag{174}$$

These three roles must not be collapsed.

Historical physical accumulation is strictly historical relative to e.

The present cumulative physical resultant, where applicable, is evaluated from $X_A(e)$.

The terminal ending change is the system-specific physical-change content realized at e.

Accordingly,

$$\mathrm{PairwiseDefDistinct}\begin{pmatrix} \mathrm{HistoricalPhysicalAccumulation}_A^{<e} \\ \mathrm{CumulativePhysicalResultThrough}_A(e) \\ \Delta_A^{\mathrm{end}}(e) \end{pmatrix}. \tag{175}$$

Their distinction does not imply a physical discontinuity among earlier development, present developed condition, and ending realization.

Rather, UCC requires physical change throughout the entire identity-realization range, including e.

10.7 Ending configuration

For an actual ending, define the analytical ending configuration

$$\mathfrak{K}_A^{\mathrm{end}}(e) := \left(X_A(e), \Delta_A^{\mathrm{end}}(e), \mathfrak{C}_A(e)\right). \tag{176}$$

This tuple organizes three aspects of one physically realized ending condition:

(i) the developed physical condition of the ending system;

(ii) the system-specific physical-change content classified as terminal relative to the identity boundary;

(iii) the actual causal profile operative in the change realized at that boundary.

Equation (176) is not a chronological sequence. It does not state that $X_A(e)$ occurs first, that $\Delta_A^{\mathrm{end}}(e)$ is subsequently added, and that the causal profile then acts afterward.

All three terms concern one ending change stage and are distinguished analytically by function and type.

Historical physical accumulation is deliberately not inserted as a fourth member of the causal profile.

10.8 Physical Identity-Ending Causation Principle

The general Causal Realization Principle establishes that the physical change realized at e has a nonempty causal set. It does not by itself identify any particular contributor as physically contributing specifically to the identity-ending transformation.

V36/F16 therefore retains an ending-specific causal principle in reduced form.

Principle 10.3 (Physical Identity-Ending Causation Principle — PIECP)**.** Every actual physical-system identity ending has at least one physically admissible contributor from the already governed actual causal set at the ending change stage that physically contributes to the identity-ending transformation:

$$\begin{aligned}\mathrm{PIECP} \iff \forall A \in \mathcal{U}_{\mathrm{phys}}\ \forall e \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \\ \mathrm{End}_A(e) \implies \exists c \in \mathcal{C}_A^{\mathrm{act}}(e) : \\ \mathrm{PhysicallyContributes}\left(c; \mathrm{IdentityEndingTransformation}(A; e)\right).\end{aligned} \tag{177}$$

PIECP does not reassert that physical change continues through the ending change stage. That consequence already follows from UCC together with $e \in I_A$.

Its independent role is ending-specific causal attribution.

Thus,

$$\mathrm{CRP} \wedge \mathrm{End}_A(e) \not\Rightarrow \exists c \in \mathcal{C}_A^{\mathrm{act}}(e)\ \ \mathrm{PhysicallyContributes}\left(c; \mathrm{IdentityEndingTransformation}(A; e)\right) \tag{178}$$

without the additional PIECP commitment.

The Causal Realization Principle states that some physical contributor causes or contributes to the realized physical change. PIECP requires that at least one contributor be physically implicated specifically in the transformation that ends the numerical identity.

PIECP introduces no new causal-source class:

$$\mathrm{PIECP} \not\Rightarrow \mathrm{FourthCausalSourceClass}\,. \tag{179}$$

All ending-specific causal contributors remain members of

$$\mathcal{C}_A^{\mathrm{int}}(e) \cup \mathcal{C}_A^{\mathrm{ext\text{-}sys}}(e) \cup \mathcal{C}_A^{\mathrm{ext\text{-}fac}}(e). \tag{180}$$

10.9 Accumulation does not cause ending by itself

Neither historical accumulation nor the present cumulative physical resultant substitutes for PIECP.

Therefore,

$$\begin{aligned} &I_A^{<e} \neq \varnothing \\ &\not\Rightarrow \exists c \in \mathcal{C}_A^{\mathrm{act}}(e) : \\ &\mathrm{PhysicallyContributes}\left(c; \mathrm{IdentityEndingTransformation}(A; e)\right). \end{aligned} \tag{181}$$

and

$$\mathrm{CumulativePhysicalResultThrough}_A(e) \not\Rightarrow \mathrm{IdentityEndingTransformation}(A; e). \tag{182}$$

The historical development of the system may be physically relevant to the condition in which ending becomes realized. Where effects of earlier change remain physically embodied at e, they belong to $X_A(e)$ and, where causally operative, to the appropriate present causal-source class.

The explanatory chain is therefore not

$$\mathrm{HistoricalPhysicalAccumulation} \longrightarrow \mathrm{IndependentAccumulationCause} \longrightarrow \mathrm{End}\,. \tag{183}$$

V36/F16 adopts no such causal chain.

The governing interpretation is that uninterrupted system-specific physical development produces a changing developed physical condition throughout the identity history. At the ending boundary, the system remains within that same development, and the identity-ending transformation is physically realized through the physical change and operative causal contributors at that boundary.

10.10 Functional failure is not identity ending

Let

$$\mathrm{FunctionalFailure}_\Gamma(A; s) \tag{184}$$

state that system A fails a declared functional criterion Γ at s.

Then

$$\mathrm{FunctionalFailure}_\Gamma(A; s) \not\Rightarrow \mathrm{End}_A(s). \tag{185}$$

A damaged, inactive, diseased, inefficient, or non-operational system may remain the same numerical physical system.

Conversely,

$$\mathrm{End}_A(e) \not\Rightarrow \mathrm{FunctionalFailure}_\Gamma(A; e) \tag{186}$$

for an arbitrary functional criterion Γ.

An identity may end through transformation, division, absorption, merger, dissolution, reorganization, or another physically warranted identity-ending pathway without a prior or separately identifiable common cosmic change stage of functional failure.

11. Universal Lifecycle Commitment and Conditional Successor Attribution

11.1 Completed physical-system identity

Define the completed-identity predicate by

$$\mathrm{HistoryComplete}(A) \iff \exists e \in I_A \ \mathrm{End}_A(e). \tag{187}$$

The set of physical-system identities for which an ending has been realized is

$$\mathcal{U}_{\mathrm{phys}}^{\mathrm{end}} := \{A \in \mathcal{U}_{\mathrm{phys}} \mid \mathrm{HistoryComplete}(A)\}\,. \tag{188}$$

For $A \in \mathcal{U}_{\mathrm{phys}}^{\mathrm{end}}$, ending uniqueness allows the partial ending map

$$e : \mathcal{U}_{\mathrm{phys}}^{\mathrm{end}} \longrightarrow \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \qquad e(A) = e_A. \tag{189}$$

The map is partial relative to $\mathcal{U}_{\mathrm{phys}}$ unless the independent universal lifecycle postulate below is adopted.

11.2 Universal Eventual Identity Ending as a separate lifecycle postulate

The definition of time, strict cosmic ordering, non-terminating cosmic succession, CSPP, CMA, UCC, CRP, identity convexity, AFB, and the physical-history representation do not by themselves entail that every numerical physical-system identity must eventually end.

V36/F16 therefore assigns universal eventual ending a separate lifecycle status.

Postulate 11.1 (Universal Eventual Identity Ending — UEIE)**.**

$$\boxed{\mathrm{UEIE} \iff \forall A \in \mathcal{U}_{\mathrm{phys}}\ \exists e_A \in I_A \left[\mathrm{End}_A(e_A) \wedge \exists r_A \in I_A \left(r_A \prec_{\mathrm{C}} e_A\right)\right].} \tag{190}$$

UEIE is not part of the definition of time and is not required to establish the common cosmic-stage totality, the cosmic ordering, CMA, UCC, or the non-termination of cosmic succession.

In particular,

$$\mathrm{UCC} \nRightarrow \mathrm{UEIE}\,. \tag{191}$$

A formal model may satisfy UCC for an identity that remains realized through an unbounded identity range unless UEIE is separately adopted.

Likewise,

$$[\exists A \in \mathcal{U}_{\text{phys}}\ \exists s \in I_A : I_A^{<s} \neq \varnothing] \not\Rightarrow \text{UEIE}\,. \tag{192}$$

and

$$[\exists A \in \mathcal{U}_{\text{phys}}\ \exists s \in I_A : \text{CumulativePhysicalResultThrough}_A(s)] \not\Rightarrow \text{UEIE}\,. \tag{193}$$

UEIE states eventual identity ending together with a nonempty strict pre-ending identity history. It supplies no universal ending mechanism, exact change-stage predictor, pathway, observational signature, cumulative threshold, ending-change magnitude, metric duration, or numerical change-stage count.

11.3 UEIE requires prior identity history without imposing a prior-history length

The UEIE requirement of at least one strictly earlier identity member is qualitative and order-theoretic. It requires a nonempty strict pre-ending identity history, but it does not prescribe how many earlier common cosmic change stages belong to that history, any metric duration between formation and ending, or any cumulative magnitude.

Accordingly, the governing postulate entails

$$\text{UEIE} \Longrightarrow \forall A \in \mathcal{U}_{\text{phys}}\ \exists e_A \in I_A \left[\text{End}_A(e_A) \wedge I_A^{<e_A} \neq \varnothing\right]. \tag{194}$$

The historical-accumulation and uninterrupted-development relations developed in Section 9 therefore apply to the universal ending witness supplied by UEIE. This does not turn historical physical accumulation into an ending criterion or causal source, and it does not make the local predicate $\text{End}_A(e)$ itself definitionally dependent on a prior-history condition. A locally specified ending can be discussed without UEIE; the stronger universal lifecycle postulate requires that its universally quantified ending witness have a nonempty strict pre-ending identity history.

Corollary 11.2 (UEIE excludes a one-member identity history)**.** The prior-member clause is substantive lifecycle content. Under UEIE, no physical-system identity can have its ending member as its only member:

$$\boxed{\text{UEIE} \Longrightarrow \neg\exists A \in \mathcal{U}_{\text{phys}}\ \exists e \in I_A\,[\text{End}_A(e) \wedge I_A = \{e\}]\,.} \tag{195}$$

This exclusion is not derived from UCC, AFB, or the local definition of ending; it is carried specifically by the stronger UEIE lifecycle postulate. A future revision that permits a one-member physical-system identity while retaining local identity ending would therefore require revision of UEIE rather than a reinterpretation of UCC.

11.4 Ending map under UEIE

Under UEIE,

$$\mathcal{U}_{\text{phys}}^{\text{end}} = \mathcal{U}_{\text{phys}}. \tag{196}$$

Hence the ending map becomes total:

$$e : \mathcal{U}_{\mathrm{phys}} \longrightarrow \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}. \tag{197}$$

Strict total ordering and the ending definition supply uniqueness; UEIE supplies existence.

11.5 Physical ending remains within uninterrupted system development

The logical independence of UEIE does not make an actual ending physically detached from the system's development.

For any actual ending,

$$\{\mathrm{UCC}, \mathrm{End}_A(e)\} \Longrightarrow \mathrm{PhysReal}_A^+(e). \tag{198}$$

Where earlier history exists,

$$\{\mathrm{UCC}, \mathrm{End}_A(e), I_A^{<e} \neq \varnothing\} \Longrightarrow \left[\forall r \in I_A^{<e}, \mathrm{PhysReal}_A^+(r)\right] \wedge \mathrm{PhysReal}_A^+(e). \tag{199}$$

Thus UEIE bounds numerical identity and requires its universal ending witness to possess a nonempty strict pre-ending identity history. It does not introduce a cessation of physical change immediately before the ending change stage or a separate terminal process disconnected from the earlier physical development. The local ending predicate remains independently defined, so the prior-history requirement belongs to UEIE rather than to the definition of every locally considered ending.

11.6 Direct successor relation

Some identity-ending transformations physically produce one or more genuinely new physical-system identities. V36/F16 retains a precise relation for such cases without requiring that every ending satisfy it.

For $A, B \in \mathcal{U}_{\mathrm{phys}}$ and $e \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}$, define

$$\mathrm{SuccAt}(A, B; e) \Longleftrightarrow \mathrm{End}_A(e) \wedge A \neq B \wedge f_B = e \wedge \mathrm{PhysicalProductionLink}(A, B; e). \tag{200}$$

Here $\mathrm{PhysicalProductionLink}(A, B; e)$ states that the physical transformation ending A at e physically produces the newly realized identity B.

Because $f_B = e$, a direct successor under Equation (200) is a newly formed numerical physical-system identity.

A system that already existed before e does not become a direct successor merely because it interacts with A, receives matter or energy from A, absorbs constituents of A, or continues after the ending of A.

If a transformation instead forms a genuinely new composite or reorganized identity B at e, and the physical-production relation is satisfied, then B may qualify as a direct successor.

11.7 No universal successor-closure postulate

V36/F16 does not adopt the universal implication

$$\mathrm{End}_A(e) \Longrightarrow \exists B \in \mathcal{U}_{\mathrm{phys}}\ \mathrm{SuccAt}(A, B; e) \tag{201}$$

as a foundational postulate.

Accordingly,

$$\mathrm{End}_A(e) \not\Rightarrow \exists B \in \mathcal{U}_{\mathrm{phys}}\ \mathrm{SuccAt}(A, B; e) \tag{202}$$

within the V36/F16 architecture.

This non-entailment does not deny successor production where it is physically realized. It rejects only the stronger universal requirement that every possible identity-ending transformation must produce a newly formed numerical physical-system identity.

The ending of A may therefore be analyzed independently of whether the physical outcome includes a new successor identity, transformation into several new identities, absorption into a pre-existing system, or another physically warranted outcome compatible with the declared identity criteria.

11.8 Successor identity and its own physical history

Where

$$\mathrm{SuccAt}(A, B; e) \tag{203}$$

holds, AFB gives

$$f_B = e. \tag{204}$$

The successor possesses its own identity-realization range

$$I_B = \left\{ s \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}} \mid \mathrm{ExistsAs}(B, s) \right\}, \tag{205}$$

and, under the separately adopted UCC commitment, $I_B^{\Delta} = I_B$, so its own physical history may be represented by

$$\mathcal{H}_B = \left(I_B, \prec_{\mathrm{C}}|_{I_B}, X_B, \Delta_B^{\mathrm{phys}} \right). \tag{206}$$

Under that same UCC commitment,

$$\mathrm{SuccAt}(A, B; e) \wedge \mathrm{UCC} \Longrightarrow \forall s \in I_B, \quad \mathrm{PhysReal}_B^{+}(s). \tag{207}$$

Corollary 11.3 (No same-common cosmic change-stage ending of a direct successor under the full lifecycle commitments)**.** Under AFB, UEIE, and the strict total cosmic ordering, a direct successor formed at the predecessor ending boundary has its own ending strictly later than that formation boundary:

$$\Big\{\mathrm{AFB}, \mathrm{UEIE}, \mathrm{StrictTotalOrder}(\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \prec_{\mathrm{C}})\Big\} \wedge \mathrm{SuccAt}(A, B; e) \Longrightarrow f_B = e \prec_{\mathrm{C}} e_B. \tag{208}$$

The result follows because $\mathrm{SuccAt}(A, B; e)$ gives $f_B = e$, while UEIE supplies an ending witness e_B with at least one strictly earlier member of I_B. Since AFB makes f_B the least member of I_B, strict total ordering gives $f_B \prec_{\mathrm{C}} e_B$. Thus a direct successor cannot itself end at the same common cosmic change stage at which it is formed under the full lifecycle commitments. This safeguard does not reintroduce universal successor closure; it applies only where $\mathrm{SuccAt}(A, B; e)$ is independently physically satisfied.

The physical change of B is not the numerical continuation of the physical change of A as though one physical system transferred its identity-bound change to another physical system.

The predecessor and successor have distinct numerical identities and distinct physical histories within the same common cosmic succession.

11.9 Global continuation does not depend on successor production

The non-termination of the common cosmic succession was established independently by $\mathrm{NoTerminalStage}_{\mathrm{C}}$.

Thus, if A ends at e,

$$\mathrm{End}_A(e) \wedge \mathrm{NoTerminalStage}_{\mathrm{C}} \Longrightarrow \exists t \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}} \, (e \prec_{\mathrm{C}} t) \, . \tag{209}$$

By CSPP,

$$e \prec_{\mathrm{C}} t \Longrightarrow \mathcal{S}_{\mathrm{phys}}(t) \neq \varnothing. \tag{210}$$

By UCC,

$$e \prec_{\mathrm{C}} t \wedge B \in \mathcal{S}_{\mathrm{phys}}(t) \Longrightarrow \mathrm{PhysReal}_B^{+}(t). \tag{211}$$

Consequently,

$$\begin{aligned} \{\mathrm{NoTerminalStage}_{\mathrm{C}}, \mathrm{CSPP}, \mathrm{UCC}\} \vdash \forall A \in \mathcal{U}_{\mathrm{phys}} \; \forall e \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \\ \mathrm{End}_A(e) \Longrightarrow \exists t \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}} \; \exists B \in \mathcal{S}_{\mathrm{phys}}(t) \\ \Big[e \prec_{\mathrm{C}} t \wedge \mathrm{PhysReal}_B^{+}(t)\Big] \, . \end{aligned} \tag{212}$$

The continuation of cosmic succession and physical change after the ending of a particular identity therefore does not depend logically on a universal successor-closure principle.

This separates two different claims:

$$\mathrm{CosmicSuccessionContinues} \not\equiv_{\mathrm{def}} \mathrm{NewSuccessorProducedByEveryEnding} \, . \tag{213}$$

The first belongs to the cosmic-succession architecture. The second is a physical transformation claim that must be established for the particular ending under consideration.

11.10 Ending does not terminate physical totality

For an actual ending e, the numerical identity A is absent at every later common cosmic change stage:

$$\mathrm{End}_A(e) \Longrightarrow \forall t \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \quad e \prec_{\mathrm{C}} t \Longrightarrow A \notin \mathcal{S}_{\mathrm{phys}}(t). \tag{214}$$

However, CSPP and non-termination jointly require later populated common cosmic stages:

$$\{\mathrm{NoTerminalStage}_{\mathrm{C}}, \mathrm{CSPP}\} \vdash \forall e \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \quad \exists t \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}} \left[e \prec_{\mathrm{C}} t \wedge \mathcal{S}_{\mathrm{phys}}(t) \neq \varnothing\right]. \tag{215}$$

Identity ending therefore concerns the numerical identity of the particular physical system. It is not a cessation of the common cosmic succession or a universal cessation of physical-system realization.

Corollary 11.4 (Infinitely many physical-system identities under the full non-terminal lifecycle commitments)**.** If non-terminal cosmic succession, CSPP, UEIE, and strict total ordering are jointly adopted, then the total physical-system identity-realization range cannot be finite:

$$\boxed{\left\{\mathrm{NoTerminalStage}_{\mathrm{C}}, \mathrm{CSPP}, \mathrm{UEIE}, \mathrm{StrictTotalOrder}(\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \prec_{\mathrm{C}})\right\} \Longrightarrow \mathrm{Infinite}(\mathcal{U}_{\mathrm{phys}}).} \tag{216}$$

Proof. Assume instead that $\mathcal{U}_{\mathrm{phys}}$ is finite. UEIE assigns to every $A \in \mathcal{U}_{\mathrm{phys}}$ an ending stage e_A. Because the finite set of ending stages is strictly totally ordered, it has a greatest member $e_{\max}$. Non-terminal cosmic succession supplies some $t \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}$ with $e_{\max} \prec_{\mathrm{C}} t$. For every $A \in \mathcal{U}_{\mathrm{phys}}$, we have $e_A \preceq_{\mathrm{C}} e_{\max} \prec_{\mathrm{C}} t$; the definition of identity ending therefore gives $t \notin I_A$. Hence $\mathcal{S}_{\mathrm{phys}}(t) = \varnothing$, contradicting CSPP. Thus $\mathcal{U}_{\mathrm{phys}}$ is infinite.

This result concerns the totality of physical-system identities realized across the full common cosmic succession. It does not assert that infinitely many systems are co-present at any one common cosmic stage, does not require every ending to produce a direct successor, and does not identify a mechanism by which later identities form. It states only the logical consequence of combining universal eventual ending, perpetual populated cosmic succession, and strict total ordering.

11.11 Integrated ending architecture

The V36/F16 ending architecture must preserve the different logical types of earlier history, present embodied effects, developed condition, and ending-change-stage change. For an actual ending with a nonempty strict pre-ending identity history,

$$\begin{aligned} &\mathrm{End}_A(e) \wedge \mathrm{UCC} \wedge I_A^{<e} \neq \varnothing \\ &\Longrightarrow \begin{cases} \mathcal{H}_A^{<e} : \mathsf{FormalEarlierHistory}, \\ \mathrm{HistoricalPhysicalAccumulation}_A^{<e} : \mathsf{EarlierRealizedChange}, \\ X_A(e) : \mathsf{DevelopedEndingCondition}, \\ \Delta_A^{\mathrm{end}}(e) = \Delta_A^{\mathrm{phys}}(e). \end{cases} \end{aligned} \tag{217}$$

The present cumulative physical resultant is not inserted as an automatically true intermediate term in Equation (217). Where retained or transformed earlier effects remain physically embodied at the ending change stage, its truth value is evaluated from the developed condition according to

$$\mathrm{CumulativePhysicalResultThrough}_A(e) \iff \mathrm{EmbodiedEarlierEffects}_A\left(X_A(e); e\right). \tag{218}$$

Thus the truth-valued present-resultant predicate may hold or fail according to $X_A(e)$; neither the actual earlier history nor UCC by itself entails retained-effect content. The relations above organize different aspects of one uninterrupted physical development and do not constitute a causal chain among independent entities.

Physical causal attribution remains governed by

$$\mathfrak{C}_A(e) = \left(\mathcal{C}_A^{\mathrm{int}}(e), \mathcal{C}_A^{\mathrm{ext\text{-}sys}}(e), \mathcal{C}_A^{\mathrm{ext\text{-}fac}}(e)\right) \tag{219}$$

and, for the identity-ending transformation specifically, by PIECP:

$$\mathrm{End}_A(e) \Longrightarrow \exists c \in \mathcal{C}_A^{\mathrm{act}}(e)\ \ \mathrm{PhysicallyContributes}\left(c; \mathrm{IdentityEndingTransformation}(A; e)\right). \tag{220}$$

Where $I_A^{<e} \neq \varnothing$, the resulting distinctions are

$$\mathrm{PairwiseDefDistinct}\begin{pmatrix} \mathrm{HistoricalPhysicalAccumulation}_A^{<e} \\ \mathrm{CumulativePhysicalResultThrough}_A(e) \\ \Delta_A^{\mathrm{end}}(e) \\ \mathfrak{C}_A(e) \end{pmatrix} \tag{221}$$

No term in this distinction represents a break in the system's physical development.

Historical accumulation concerns what change was realized earlier.

The present cumulative resultant concerns what earlier effects remain physically embodied in $X_A(e)$.

Accordingly, the earlier realized physical history is not present at e as a stored object, accumulated causal agent, or second physical entity. Continuity means that the same system-specific physical development extends from the earlier realized history through the ending change stage. An earlier effect belongs to the present cumulative resultant at e only insofar as it is physically embodied in the developed condition $X_A(e)$. Where an earlier effect is causally operative at e, its operative status is classified within the already governed present causal-source classes rather than as historical accumulation acting from the past; under $\mathrm{End}_A(e) \wedge \mathrm{UCC}$, the terminal change $\Delta_A^{\mathrm{end}}(e) = \Delta_A^{\mathrm{phys}}(e)$ is realized at that same identity boundary. Historical continuity and ending-change-stage co-realization therefore do not convert historical physical accumulation into a present object or an independent cause.

The terminal ending-change term classifies the physical-change content realized at the identity boundary.

The causal profile identifies the physically operative contributors at that boundary.

11.12 Integrated Lifecycle Status

The current V36/F16 architecture now separates four foundational levels.

The temporal and cosmic level contains distinct definitional, ordering, succession, population, and common-stage commitments:

$$
\begin{gathered}
T_{\mathrm{ITOF}} = \left(\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \prec_{\mathrm{C}}\right), \qquad \mathcal{E}_{\mathrm{C}} := \left(\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \prec_{\mathrm{C}}\right), \\
\mathrm{StrictTotalOrder}\left(\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \prec_{\mathrm{C}}\right), \qquad \mathrm{NoInterruption}_{\mathrm{C}}, \qquad \mathrm{NoTerminalStage}_{\mathrm{C}}, \\
\mathrm{CSPP}, \qquad \mathrm{CMA}\,.
\end{gathered} \tag{222}
$$

These entries retain their declared logical statuses and are not a new compound axiom.

At the physical-change and causal level, UCC separately governs memberwise system-specific physical change across identity histories, while CRP governs the physical causal realization of each such change:

$$
\mathrm{UCC}, \qquad \mathrm{CRP}\,. \tag{223}
$$

The identity-history level is governed by

$$
\begin{gathered}
I_A, \qquad \mathrm{AFB}, \qquad \mathcal{H}_A, \\
\mathrm{HistoricalPhysicalAccumulation}_A^{<s}, \qquad \mathrm{CumulativePhysicalResultThrough}_A(s).
\end{gathered} \tag{224}
$$

The lifecycle and ending level is governed by

$$
\begin{gathered}
\mathrm{End}_A(e), \qquad \Delta_A^{\mathrm{end}}(e), \qquad \mathrm{PIECP}, \\
\mathrm{UEIE}, \qquad \mathrm{SuccAt}(A, B; e).
\end{gathered} \tag{225}
$$

The successor relation applies where physically warranted.

These levels remain connected without exchanging logical status.

In particular,

$$
\mathrm{PairwiseDefDistinct}(\mathrm{CosmicNonTermination}, \mathrm{UniversalIdentityEnding}, \mathrm{SuccessorProduction})\,. \tag{226}
$$

The common cosmic succession continues independently of the ending history of any particular numerical physical-system identity. Each system realizes its own uninterrupted physical change while that identity exists. Where an ending is realized, the terminal change remains part of the same identity-bounded physical development, and its causal realization remains entirely within the physical causal architecture already established.

12. Observation, Measurement, and Physical Records

12.1 Physical actuality and epistemic access

Physical actuality and observational access have different logical statuses. A physical change may be actually realized in a system whether or not a declared observational protocol detects a manifestation of that change.

For $A \in \mathcal{U}_{\text{phys}}$, $s \in I_A$, physical manifestation χ, record r, observational protocol P, model M, and decision or sensitivity threshold ε,

$$\text{PairwiseTypeDistinct}\begin{pmatrix} \text{PhysReal}_A^+(s) \\ \text{ManifestationAt}(A, \chi; s) \\ \text{Detected}_{P,M,\varepsilon}(A, \chi; r) \end{pmatrix}. \tag{227}$$

The first expression states actual system-specific physical change. The second states that a selected physical manifestation is realized at a common cosmic change stage. The third states a protocol- and model-conditioned detection relation.

Actual change does not require detection:

$$\text{PhysReal}_A^+(s) \not\Rightarrow \text{Detected}_{P,M,\varepsilon}(A, \chi; r). \tag{228}$$

Conversely, absence of detection does not establish absence of physical change:

$$\neg\,\text{Detected}_{P,M,\varepsilon}(A, \chi; r) \not\Rightarrow \neg\,\text{PhysReal}_A^+(s). \tag{229}$$

A selected manifestation may remain unresolved because its physical expression is below the declared sensitivity, distributed across several components, masked by noise, excluded from the selected observables, inaccessible to the chosen interaction channel, transformed before record production, or otherwise outside the discriminating capacity of the declared protocol.

These possibilities concern observational access. They do not alter the physical actuality asserted by UCC.

12.2 Observation as physical interaction

Observation occurs within the same physical totality and the same common cosmic succession as every other physical interaction. No observer, apparatus, detector, reference system, or record-bearing system occupies an external or changeless temporal standpoint.

Let the principal physical systems participating in an observational arrangement be represented by

$$\mathcal{L}_P^{\text{core}} := \{A_{\text{target}}, A_{\text{apparatus}}, A_{\text{detector}}, A_{\text{record}}, A_{\text{observer}}, A_{\text{reference}}\}. \tag{230}$$

Let $\mathcal{E}_P^{\text{sys}}$ contain additional environmental, communication, calibration, support, or processing systems physically involved in the production, transmission, preservation, or interpretation of the record.

Define

$$\mathcal{L}_P := \mathcal{L}_P^{\mathrm{core}} \cup \mathcal{E}_P^{\mathrm{sys}}. \tag{231}$$

For every $X \in \mathcal{L}_P$ and every $s \in I_X$,

$$\mathrm{UCC} \Longrightarrow \mathrm{PhysReal}_X^{+}(s). \tag{232}$$

Hence an observational relation does not compare a changing target with an absolutely unchanging physical reference.

The observer remains a physical system:

$$\mathrm{Observer}(X) \wedge X \in \mathcal{S}_{\mathrm{phys}}(s) \wedge \mathrm{UCC} \Longrightarrow \mathrm{PhysReal}_X^{+}(s). \tag{233}$$

The measuring apparatus likewise remains subject to system-specific physical change:

$$\mathrm{MeasuringApparatus}(X) \wedge X \in \mathcal{S}_{\mathrm{phys}}(s) \wedge \mathrm{UCC} \Longrightarrow \mathrm{PhysReal}_X^{+}(s). \tag{234}$$

The same applies to detector, record-bearing, reference, calibration, and environmental systems while their identities are realized.

12.3 Physical manifestation

Let

$$\mathrm{ManifestationAt}(A, \chi; s) \tag{235}$$

state that physical manifestation χ, attributed to physical system A, is physically realized at common cosmic change stage $s \in I_A$.

The relation is physically change-stage-expressive: the manifestation is realized somewhere in the one actual common cosmic succession.

It is not an exact-change-stage measurement rule:

$$\mathrm{ManifestationAt}(A, \chi; s) \not\equiv_{\mathrm{def}} \mathrm{ExactCosmicChangeStageMeasurement}(A, \chi; s). \tag{236}$$

Nor is it a coordinate assignment:

$$\mathrm{ManifestationAt}(A, \chi; s) \not\equiv_{\mathrm{type}} \mathrm{CoordinateAssignment}(A, \chi). \tag{237}$$

A manifestation may therefore be physically real at a definite common cosmic change stage even where observation does not identify that change stage.

12.4 Source, access, detection, and record

A physical observation generally involves a chain of physically distinct steps of interaction and representation:

$$\begin{aligned}\text{SourceManifestation} &\rightsquigarrow_{\text{phys}} \text{AccessiblePhysicalEffect} \\ &\rightsquigarrow_{\text{phys}} \text{DetectorInteraction} \rightsquigarrow_{\text{phys}} \text{RecordFormation}\,.\end{aligned} \tag{238}$$

A subsequent reading and scientific conclusion are relations to the produced record:

$$\text{RecordFormation} \longrightarrow \text{Reading} \longrightarrow \text{RestrictedScientificConclusion}\,. \tag{239}$$

The physical arrows in Equation (238) denote physically realized transmission or causal contribution. The arrows in Equation (239) denote reading and inferential use. No arrow expresses identity between adjacent terms.

For record r physically embodied in record-bearing system B_r,

$$\text{Record}(r, B_r) \not\Rightarrow r = \text{SourceManifestation}\,. \tag{240}$$

A record is likewise not a common cosmic change stage:

$$r \not\equiv_{\text{type}} s. \tag{241}$$

Nor is a record time:

$$r \not\equiv_{\text{type}} T_{\text{ITOF}}. \tag{242}$$

A physical record may carry physically warranted information about a source manifestation. This information relation does not convert the record into the source, the source change, the common cosmic change stage, or time.

12.5 Physical support of a record

Let $\mathfrak{R}_P$ denote the physical record domain associated with protocol P.

For $r \in \mathfrak{R}_P$, define the physical acquisition support by

$$J_r^{\text{phys}} := \Big\{ s \in \mathcal{S}_{\text{C}}^{\text{tot}} \mid \exists X \in \mathcal{L}_P \ \text{ContributesToRecord}\,(X_A(s), r) \Big\}\,, \tag{243}$$

with the understanding that the state symbol in the contribution relation is typed to the relevant contributing system.

More generally,

$$J_r^{\text{phys}} := \Big\{ s \in \mathcal{S}_{\text{C}}^{\text{tot}} \mid \exists X \in \mathcal{L}_P \ \text{PhysicalContributionToRecord}(X, s; r) \Big\}\,. \tag{244}$$

Equation (244) is the governing form.

A physically produced record has nonempty physical support:

$$\text{PhysicallyProducedRecord}(r) \Longrightarrow J_r^{\text{phys}} \neq \varnothing. \tag{245}$$

The support need not be a singleton:

$$\left|J_r^{\mathrm{phys}}\right| > 1 \tag{246}$$

is admissible.

A record may integrate or transform physical contributions realized across more than one common cosmic change stage without observationally identifying the members of that support.

Accordingly,

$$\mathrm{ReadableAt}(r; s_d) \not\Rightarrow J_r^{\mathrm{phys}} = \{s_d\}. \tag{247}$$

The common cosmic change stage at which a record becomes readable is not necessarily the only common cosmic change stage physically contributing to the record.

12.6 Measurement output

Let Q_A be a declared physical quantity or property attributed to system A.

A measurement-output map may be represented by

$$\widehat{Q}_{A;P,M} : \mathfrak{R}_P \longrightarrow \mathbb{V}_{Q,P}, \tag{248}$$

where $\mathbb{V}_{Q,P}$ is the declared output codomain.

For $r \in \mathfrak{R}_P$,

$$\widehat{q} = \widehat{Q}_{A;P,M}(r) \tag{249}$$

is a protocol- and model-conditioned result.

The output is not the complete state of the physical system:

$$\widehat{Q}_{A;P,M}(r) \not\equiv_{\mathrm{type}} X_A(s). \tag{250}$$

It is not a common cosmic change stage:

$$\widehat{Q}_{A;P,M}(r) \not\equiv_{\mathrm{type}} s. \tag{251}$$

It is not time:

$$\widehat{Q}_{A;P,M}(r) \not\equiv_{\mathrm{type}} T_{\mathrm{ITOF}}. \tag{252}$$

Greater numerical precision or instrumental resolution refines distinctions within the declared output domain. It does not change the logical type of the output.

13. Positive Observational Content

13.1 Positive manifestation witness

A valid observation has positive physical content where the record is physically attributable to the investigated system and a physical source–record connection is established.

Define

$$\begin{aligned}\mathrm{PositiveManifestationWitness}_{A;P,M,\varepsilon}(\chi;r) \iff\ & \mathrm{Detected}_{P,M,\varepsilon}(A,\chi;r)\\ & \wedge \mathrm{ValidSystemAttribution}_{P,M}(r;A)\\ & \wedge \mathrm{PhysicalSourceRecordLink}_{P,M}(A,\chi;r)\\ & \wedge \mathrm{AcceptedDifference}_{P,M,\varepsilon}(r).\end{aligned} \tag{253}$$

A positive manifestation witness warrants that the relevant manifestation belongs to the actual physical history of A:

$$\begin{aligned}&\mathrm{PositiveManifestationWitness}_{A;P,M,\varepsilon}(\chi;r)\\ &\quad\Longrightarrow \mathrm{Warrant}_{P,M}\left[\exists s \in I_A \left(\mathrm{ManifestationAt}(A,\chi;s) \wedge \mathrm{PhysReal}^{+}_{A}(s)\right)\right].\end{aligned} \tag{254}$$

The existentially quantified common cosmic change stage is physically actual. The observational warrant does not thereby identify which member of I_A it is.

Therefore,

$$\mathrm{PositiveManifestationWitness}_{A;P,M,\varepsilon}(\chi;r) \nRightarrow \mathrm{ExactCosmicChangeStageIdentified}_{P,M}(A,\chi). \tag{255}$$

The positive and restrictive conclusions are compatible:

$$\begin{aligned}&\mathrm{OccurrenceAtSomeCommonCosmicChangeStageWarranted} \not\equiv_{\mathrm{def}}\\ &\qquad \mathrm{ExactCommonCosmicChangeStageIdentified}\,.\end{aligned} \tag{256}$$

13.2 Observed relative development

Two observational records may support a conclusion about relative physical development only where a physically warranted bridge connects record order to source-development order.

Let

$$r_1 \prec_P r_2 \tag{257}$$

denote an order relation in a declared record domain.

Record order alone does not establish cosmic or source order:

$$r_1 \prec_P r_2 \not\Rightarrow \mathrm{SourceDevelopmentEarlier}\left(A, \chi_1, \chi_2\right). \tag{258}$$

Let

$$\mathrm{OrderBridge}_{A;P,M}\left(r_1, r_2; \chi_1, \chi_2\right) \tag{259}$$

state a physically warranted source-order bridge.

Then

$$\begin{aligned} &\mathrm{ObservedDifference}_{A;P,M}(r_1, r_2) \\ &\quad \wedge \mathrm{OrderBridge}_{A;P,M}\left(r_1, r_2; \chi_1, \chi_2\right) \\ &\quad \Longrightarrow \mathrm{Warrant}_{P,M}\left[\begin{array}{c} \exists s_1, s_2 \in I_A, \quad s_1 \prec_{\mathrm{C}} s_2, \\ \mathrm{ManifestationAt}(A, \chi_1; s_1) \wedge \mathrm{ManifestationAt}(A, \chi_2; s_2) \end{array}\right]. \end{aligned} \tag{260}$$

This supports ordered development without identifying the exact common cosmic change stages:

$$\begin{aligned} &\mathrm{Warrant}_{P,M}\left[\exists s_1, s_2 \in I_A \left(s_1 \prec_{\mathrm{C}} s_2 \wedge \mathrm{ManifestationAt}(A, \chi_1; s_1) \wedge \mathrm{ManifestationAt}(A, \chi_2; s_2)\right)\right] \\ &\quad \not\Rightarrow \mathrm{ExactCosmicChangeStagePairIdentified}_{P,M}\left(A, \chi_1, \chi_2\right). \end{aligned} \tag{261}$$

Here $\mathrm{ExactCosmicChangeStagePairIdentified}_{P,M}(A, \chi_1, \chi_2)$ denotes identification of the exact pair of common cosmic stage witnesses associated with the two manifestations under the declared protocol and model. The predicate is written without free occurrence of the existential witness variables s_1, s_2. Relative order and exact cosmic change-stage identity are therefore distinct observational claims.

13.3 Measured physical change without exact change-stage identification

The observational architecture directly separates empirical access to system-specific physical change from identification of the exact member of $\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}$ at which the relevant physical development is realized. Equation (254) allows a positive manifestation witness to warrant actual physical change at some objective common cosmic change stage in I_A, while Equation (255) blocks the stronger inference that the observation thereby identifies which member of I_A that change stage is. Failure to identify the exact common cosmic change stage is therefore not failure to observe or quantitatively measure an associated physical manifestation or difference, nor failure to warrant physical change.

Proposition 13.1 (Empirical change-access separation)**.** Under a declared physical protocol and model, exact common cosmic change-stage identification is not a prerequisite for physically warranted inference about system-specific physical change or for quantitative measurement of an associated physical manifestation or difference. A valid physical record may support such a warrant while the exact common cosmic change stage remains observationally unidentified.

Proof. A positive manifestation witness supplies the existential physical warrant in Equation (254) without supplying the exact-stage conclusion excluded by Equation (255). Independently, the measurement map in Equation (248) assigns a protocol- and model-conditioned physical output to a record, while Equations (251) and (252) keep that output type-distinct from both the common cosmic change stage and T_{ITOF}. Hence quantitative physical access does not require the instrument to output, enumerate, or invert to an exact member of $\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}$.

This separation is especially important for threshold-dependent noticeability. A physical change may be conspicuous, minute, sub-threshold, masked, or unresolved; accordingly, Equations (228) and (229) prevent detectability from being treated as the definition of physical actuality. Under UCC, change continues throughout the realized identity range, including before and during the physical production of a noticeable record. The target, apparatus, detector, record carrier, observer, reference systems, and environment remain changing physical systems during acquisition. A first visible or otherwise resolved manifestation is therefore an observational threshold under the declared protocol, not the beginning of physical change and not an exact locator of one common cosmic change stage or its position in the universal ordering.

This conclusion does not claim that UCC alone proves the logical impossibility of exact change-stage identification. Exact-Change-Stage Restraint also depends on the source–record distinction, finite physical access, changing acquisition systems, record support, and the type distinction between a record and a common cosmic stage. The common cosmic change stage is likewise neither the system-specific physical-change content nor a cause of that change. Under the full governing architecture, it is the common ordered stage at which the system-specific physical changes are realized. Requiring exact identification of that stage as a precondition for measuring physical change would therefore conflate the temporal ordering member with the physical manifestation or quantity being measured.

Positive measurements across accessible physical-system classes may consequently provide empirical instances of measurable physical manifestations or differences associated with change and may exclude specific complete-stasis hypotheses within their warranted domains. They do not, as a finite collection, deductively confirm UCC for every qualified physical system and every common cosmic change stage in its realized identity range.

14. Exact-Change-Stage Restraint

14.1 Objective common cosmic change stage and observational identification

The fixed cosmic ordering and every actual common cosmic change stage are objective commitments of ITOF. Epistemic restraint does not make either the common cosmic change stage or its ordering indeterminate in physical reality.

For a manifestation physically realized at some $s \in I_A$,

$$\mathrm{ManifestationAt}(A, \chi; s) \Longrightarrow s \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}. \tag{262}$$

The objective existence of that common cosmic change stage does not entail its exact observational identification:

$$s \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}} \not\Rightarrow \mathrm{ExactCosmicChangeStageObservationallyIdentified}(s). \tag{263}$$

This distinction is epistemic rather than ontological.

14.2 No record-to-common cosmic change-stage identity

A physical record and a common cosmic change stage belong to different logical types. Even a highly resolved record does not become the common cosmic change stage at which its own physical record formation is realized:

$$r \not\equiv_{\text{type}} s. \tag{264}$$

A selected model may possess an inverse mapping on a restricted state or parameter domain:

$$\text{InvertibleOnSelectedStateDomain}\left(\mathcal{M}_{P,M}\right). \tag{265}$$

That does not entail a physically warranted inverse from the record domain to the exact common cosmic change stage:

$$\text{InvertibleOnSelectedStateDomain}\left(\mathcal{M}_{P,M}\right) \not\Rightarrow \text{RecordToCosmicChangeStageInverseExists}_{P,M}. \tag{266}$$

Similarly,

$$\text{UniqueSelectedStateReconstruction}_{P,M}(A;r) \not\Rightarrow \text{ExactCosmicChangeStageIdentified}_{P,M}(A;r). \tag{267}$$

A unique reconstruction of selected physical variables under a declared model is not an identification of the exact member of the universal common cosmic change-stage totality.

14.3 Exact-Change-Stage Restraint

Principle 14.1 (Exact-Change-Stage Restraint)**.** A valid physical observation may warrant that an actual manifestation, physical difference, threshold crossing, recurrence, formation-related manifestation, ending-related manifestation, or ordered physical development is realized at some common cosmic change stage in a physical-system history. The observation does not thereby identify that exact common cosmic change stage or its exact position in the complete universal ordering.

Formally,

$$\text{ValidObservedManifestation}_{A;P,M,\varepsilon}(\chi;\mathbf{r}) \Longrightarrow \text{Warrant}_{P,M}\left[\exists s \in I_A\ \text{ManifestationAt}(A,\chi;s)\right], \tag{268}$$

while

$$\text{ValidObservedManifestation}_{A;P,M,\varepsilon}(\chi;\mathbf{r}) \not\Rightarrow \text{ExactCosmicChangeStageIdentified}_{P,M}(A,\chi), \tag{269}$$

and

$$\text{ValidObservedManifestation}_{A;P,M,\varepsilon}(\chi;\mathbf{r}) \not\Rightarrow \text{ExactCosmicOrderPositionIdentified}_{P,M}(A,\chi). \tag{270}$$

The principle restricts observational warrant; it does not deny that the manifestation is physically realized at an objective common cosmic change stage with an objective place in the fixed cosmic ordering.

The restraint is especially important when a physical change becomes conspicuous or crosses an observational threshold. Under UCC, physical change did not begin merely because it became visible: throughout the realized identity range, earlier common cosmic change stages already carried actual system-specific physical change. The target and the physical acquisition chain—instrument, detector, record carrier, observer, reference systems, and environment—also continue to change during observation. A noticeable or otherwise resolved manifestation is therefore located within continuing change rather than at a privileged changeless-to-change boundary. It cannot, merely by being noticeable, identify the exact common cosmic stage or the exact position of that stage in $(\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \prec_{\mathrm{C}})$.

Thus

$$\mathrm{ObservedOrResolvedChange}_{P,M,\varepsilon}(A;r) \not\Rightarrow \mathrm{PhysicalChangeBeganAtRecord}(A;r), \tag{271}$$

and

$$\mathrm{ObservedOrResolvedChange}_{P,M,\varepsilon}(A;r) \not\Rightarrow \mathrm{ExactCosmicOrderPositionIdentified}_{P,M}(A;r). \tag{272}$$

Exact-Change-Stage Restraint is not a theorem of UCC alone:

$$\mathrm{UCC} \not\Rightarrow \mathrm{ExactChangeStageNonidentifiabilityAsLogicalTheorem}\,. \tag{273}$$

UCC supplies uninterrupted system-specific physical change; the epistemic restraint additionally depends on source–record separation, finite physical access, changing acquisition systems, record support, and the type distinction between a record and a common cosmic change stage.

14.4 Exact change-stage identity and exact order position

Identifying a particular common cosmic change stage and determining its exact placement relative to the entire ordered common cosmic change-stage totality are distinct epistemic claims:

$$\mathrm{ExactCosmicChangeStageIdentified}_{P,M}(s) \not\equiv_{\mathrm{def}} \mathrm{ExactCosmicOrderPositionIdentified}_{P,M}(s). \tag{274}$$

An exact order position would require warranted placement relative to $(\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \prec_{\mathrm{C}})$. No numerical change-stage index is implied by this concept.

Record count does not enumerate common cosmic change stages:

$$|\mathbf{r}| = n \not\Rightarrow |\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}| = n. \tag{275}$$

Nor does a record index become a cosmic change-stage position:

$$\mathrm{RecordIndex}(r_k) = k \not\Rightarrow \mathrm{CosmicChangeStageIndex}(s) = k. \tag{276}$$

Sampling index, event number, frame number, calendar label, clock reading, sequence number, and file position remain operational or representational labels.

15. Noticeability and Thresholds

15.1 Noticeability as an access condition

For manifestation χ, define

$$\mathrm{Manifested}_\chi(A) \iff \exists s \in I_A \ \mathrm{ManifestationAt}(A, \chi; s). \tag{277}$$

Noticeability depends on physical manifestation, accessibility, response, and a declared observational criterion:

$$\begin{aligned} \mathrm{Noticeable}_{P,M,\varepsilon}(A, \chi; r) \iff & \ \mathrm{Manifested}_\chi(A) \\ & \wedge \mathrm{AccessibleThrough}_P(A, \chi; r) \\ & \wedge \mathrm{Response}_{P,M}(r) \geq \varepsilon. \end{aligned} \tag{278}$$

Noticeability is not physical change itself:

$$\mathrm{Noticeable}_{P,M,\varepsilon}(A, \chi; r) \not\equiv_{\mathrm{def}} \mathrm{PhysReal}^+_A(s). \tag{279}$$

A change may therefore remain physically realized while being minute, sub-threshold, masked, or otherwise unresolved.

15.2 First accepted detection

Let

$$\mathrm{FirstAcceptedDetection}_{P,M,\varepsilon}(A, \chi; r_d) \tag{280}$$

state that r_d is the earliest record satisfying the declared detection and acceptance conditions in the record order. Its status as *first* is strictly operational. It does not identify an exact common cosmic change stage merely because that record is the first accepted notice of the manifestation:

$$\mathrm{FirstAcceptedDetection}_{P,M,\varepsilon}(A, \chi; r_d) \not\Rightarrow \mathrm{ExactNoticeabilityChangeStageKnown}_{P,M}(A, \chi). \tag{281}$$

Nor does it establish the beginning of physical change:

$$\mathrm{FirstAcceptedDetection}_{P,M,\varepsilon}(A, \chi; r_d) \not\Rightarrow \mathrm{BeginningOfPhysicalChange}(A, \chi; r_d). \tag{282}$$

If the numerical identity of A was realized before the physical support of r_d, UCC already applies at those earlier common cosmic change stages. Hence, for appropriate $r, s \in I_A$,

$$r \prec_{\mathrm{C}} s \wedge s \in J^{\mathrm{phys}}_{r_d} \wedge \mathrm{UCC} \Longrightarrow \mathrm{PhysReal}^+_A(r) \wedge \mathrm{PhysReal}^+_A(s). \tag{283}$$

First accepted detection is therefore a boundary in observational acceptance, not a boundary between physical stasis and physical change.

15.3 First detection is not formation or ending

A record and a formation boundary have different types:

$$r_d \not\equiv_{\mathrm{type}} f_A. \tag{284}$$

Thus,

$$\text{FirstAcceptedDetection}_{P,M,\varepsilon}(A,\chi;r_d) \nRightarrow \text{FormationBoundaryIdentified}_{P,M}(A). \tag{285}$$

Likewise, where an actual identity ending exists,

$$r_d \not\equiv_{\text{type}} e_A, \tag{286}$$

and

$$\text{LastAcceptedPersistenceRecord}_{P,M,\varepsilon}(A;r_d) \nRightarrow \text{ExactEndingChangeStageIdentified}_{P,M}(A). \tag{287}$$

Formation and ending are physical identity boundaries; record acceptance is an epistemic relation.

15.4 Threshold crossing

Let $Y_{P,M}(r)$ be a declared observational output and θ a declared threshold. A threshold crossing satisfies

$$Y_{P,M}(r_d) \geq \theta. \tag{288}$$

This establishes a relation in the selected output domain. It does not identify one common cosmic change stage at which all physically relevant development occurred:

$$Y_{P,M}(r_d) \geq \theta \nRightarrow \exists! s \in I_A \ \text{EntireRelevantDevelopmentAt}(A,\chi;s). \tag{289}$$

Nor does sub-threshold output establish previous physical stasis:

$$Y_{P,M}(r_i) < \theta \quad \forall r_i \prec_P r_d \nRightarrow \text{CompletePhysicalStasisBeforeDetection}(A). \tag{290}$$

The threshold marks a declared observational criterion, not an ontological transition from no change to change and not an exact common cosmic change-stage locator.

15.5 Noticeability and historical development

Where a manifestation depends on retained or transformed effects of earlier physical development, later noticeability remains distinct from historical physical accumulation and from the present cumulative physical resultant. Thus,

$$\text{Noticeable}_{P,M,\varepsilon}(A,\chi;r) \nRightarrow \text{AllRelevantHistoricalChangeBeganAt}(A,\chi;r), \tag{291}$$

and

$$\text{Noticeable}_{P,M,\varepsilon}(A,\chi;r) \nRightarrow \text{NoEarlierRelevantPhysicalDevelopment}(A,\chi). \tag{292}$$

The first noticeable or resolved manifestation therefore supplies no warrant for absence of earlier realized physical change and no warrant for an exact order position of the relevant common cosmic change stage. UCC remains in force independently of the detection threshold.

16. Operational Non-Detection and Criterion-Relative Stability

16.1 Operational non-detection

For accepted outputs $O(r_i)$ and $O(r_j)$, let $d_{P,M}$ be a declared discrepancy relation and $\varepsilon_{P,M}$ the corresponding resolution or decision threshold.

Define criterion-relative non-detection by

$$d_{P,M}\left(O(r_i), O(r_j)\right) \leq \varepsilon_{P,M}. \tag{293}$$

The warranted conclusion is

$$d_{P,M}\left(O(r_i), O(r_j)\right) \leq \varepsilon_{P,M} \Longrightarrow \mathrm{NoResolvedDifference}_{P,M,\varepsilon}(r_i, r_j). \tag{294}$$

This is a statement about the declared observables and resolution.

It does not establish complete physical stasis:

$$\mathrm{NoResolvedDifference}_{P,M,\varepsilon}(r_i, r_j) \not\Rightarrow \mathrm{CompletePhysicalStasis}(A). \tag{295}$$

Nor does it establish equality of complete physical states:

$$\mathrm{NoResolvedDifference}_{P,M,\varepsilon}(r_i, r_j) \not\Rightarrow X_A(s_i) = X_A(s_j). \tag{296}$$

A null observational result is therefore not by itself a counterinstance to UCC.

A physical counterinstance to UCC would require positive warrant for

$$A \in \mathcal{U}_{\mathrm{phys}} \wedge s \in I_A \wedge \neg\, \mathrm{PhysReal}_A^{+}(s). \tag{297}$$

Operational non-detection does not establish Equation (297).

16.2 Criterion-relative stability

Let Q_A be a selected physical property and Γ a declared stability criterion over nonempty $J \subseteq I_A$.

Criterion-relative stability may be represented by

$$\mathrm{Stable}_{Q,\Gamma}(A; J). \tag{298}$$

This does not imply complete physical stasis:

$$\mathrm{Stable}_{Q,\Gamma}(A; J) \not\Rightarrow \forall s \in J\, \neg\, \mathrm{PhysReal}_A^{+}(s). \tag{299}$$

Under the separately adopted UCC commitment,

$$\mathrm{Stable}_{Q,\Gamma}(A; J) \wedge \mathrm{UCC} \Longrightarrow \forall s \in J\ \mathrm{PhysReal}_A^{+}(s). \tag{300}$$

Stability therefore concerns invariance or bounded variation under a selected criterion while other physical properties or sub-threshold changes remain physically realized.

16.3 Stable record content

A record-bearing physical system may preserve selected content while itself continuing to change. For record-bearing system B_r, represented content q, criterion Γ, and nonempty $J \subseteq I_{B_r}$,

$$\mathrm{StableRecordContent}_{q,\Gamma}(B_r; J) \not\Rightarrow \mathrm{CompletePhysicalStasis}(B_r; J). \tag{301}$$

For arbitrary $s_1, s_2 \in J$, if

$$q_\Gamma(B_r; s_1) = q_\Gamma(B_r; s_2), \tag{302}$$

it does not follow that

$$X_{B_r}(s_1) = X_{B_r}(s_2). \tag{303}$$

Preservation of represented content and complete physical-state invariance are different claims.

17. Recurrence Without Reversal

17.1 Criterion-relative recurrence

A later physical condition may resemble or equal an earlier selected condition without reversing the cosmic ordering.

For $r, s \in I_A$ with

$$r \prec_{\mathrm{C}} s, \tag{304}$$

a selected state criterion may satisfy

$$Q_A(r) = Q_A(s). \tag{305}$$

Nevertheless,

$$r \prec_{\mathrm{C}} s \Longrightarrow \neg(s \prec_{\mathrm{C}} r). \tag{306}$$

Hence

$$Q_A(r) = Q_A(s) \not\Rightarrow r = s. \tag{307}$$

and

$$Q_A(r) = Q_A(s) \not\Rightarrow \mathrm{PhysicalHistoryReversed}(A). \tag{308}$$

The physical history already realized between r and s remains actual even if a selected later condition resembles an earlier one.

17.2 Recurrence and cumulative physical result

Recurrence under one declared criterion does not imply that all retained physical consequences of the earlier history have disappeared or that the complete physical state has returned identically.

Thus,

$$Q_A(r) = Q_A(s) \not\Rightarrow X_A(r) = X_A(s). \tag{309}$$

Where some earlier effects have been compensated or cancelled, their absence from the later present cumulative physical resultant does not erase the earlier change from the actual physical history.

18. Formation, Ending, and Observational Windows

18.1 Formation-window restraint

Observational records may constrain a formation boundary without becoming that boundary.

Let

$$\mathcal{W}^f_{A;P,M} \subseteq \mathfrak{R}_P \tag{310}$$

denote a record-domain formation constraint.

Then

$$\mathcal{W}^f_{A;P,M} \not\equiv_{\text{type}} I_A. \tag{311}$$

A multi-record window does not imply several actual formation boundaries:

$$|\mathcal{W}^f_{A;P,M}| > 1 \not\Rightarrow \exists f_1 \neq f_2 \left[\text{FormationChange}_A(f_1) \wedge \text{FormationChange}_A(f_2)\right]. \tag{312}$$

AFB continues to require one unique physical formation boundary.

18.2 Ending-window restraint

Similarly, let

$$\mathcal{W}^e_{A;P,M} \subseteq \mathfrak{R}_P \tag{313}$$

denote a record-domain constraint on an ending.

Then

$$\mathcal{W}^e_{A;P,M} \not\equiv_{\text{type}} I_A. \tag{314}$$

A broad observational window does not imply multiple actual identity endings:

$$|\mathcal{W}^{e}_{A;P,M}| > 1 \nRightarrow \exists e_1 \neq e_2 \left[\mathrm{End}_A(e_1) \wedge \mathrm{End}_A(e_2)\right]. \tag{315}$$

Observational uncertainty concerns epistemic resolution. It does not multiply a physically unique boundary.

18.3 Phase and condition onset

Let Φ denote a declared physical phase or condition and let

$$\mathrm{FirstAcceptedPhaseRecord}_{P,M,\varepsilon}(A, \Phi; r_\Phi) \tag{316}$$

denote the first accepted record of that condition.

Then

$$\mathrm{FirstAcceptedPhaseRecord}_{P,M,\varepsilon}(A, \Phi; r_\Phi) \nRightarrow \mathrm{ExactPhaseOnsetChangeStageKnown}_{P,M}(A, \Phi), \tag{317}$$

and

$$\mathrm{FirstAcceptedPhaseRecord}_{P,M,\varepsilon}(A, \Phi; r_\Phi) \nRightarrow \mathrm{ExactPhaseOnsetOrderPositionKnown}_{P,M}(A, \Phi). \tag{318}$$

Where Φ occurs within a continuing numerical identity, UCC already governs physical change before, during, and after its detectable manifestation.

Where Φ constitutes formation of a new physical-system identity, AFB supplies the unique physical formation boundary; the first accepted phase record remains a record and does not become that boundary.

19. Observation Across Continuing Physical Change

19.1 Change before, during, and after observation

Let

$$\mathcal{J}^{\mathrm{obs}}_{P} \subseteq \mathcal{S}^{\mathrm{tot}}_{\mathrm{C}} \tag{319}$$

denote the actual common cosmic change-stage support over which an observational process is physically realized.

For all $X \in \mathcal{L}_P$,

$$s \in \mathcal{J}^{\mathrm{obs}}_{P} \cap I_X \wedge \mathrm{UCC} \Longrightarrow \mathrm{PhysReal}^{+}_{X}(s). \tag{320}$$

If X existed at an earlier common cosmic change stage r,

$$r \in I_X \wedge r \prec_{\mathrm{C}} s \wedge s \in \mathcal{J}_P^{\mathrm{obs}} \wedge \mathrm{UCC} \Longrightarrow \mathrm{PhysReal}_X^+(r) \wedge \mathrm{PhysReal}_X^+(s). \tag{321}$$

If the same identity continues at a later common cosmic change stage u,

$$s \in \mathcal{J}_P^{\mathrm{obs}} \wedge s \prec_{\mathrm{C}} u \wedge u \in I_X \wedge \mathrm{UCC} \Longrightarrow \mathrm{PhysReal}_X^+(s) \wedge \mathrm{PhysReal}_X^+(u). \tag{322}$$

Completion of record acquisition therefore does not constitute a physical-stasis boundary:

$$\mathrm{ObservationCompleted}_P(r) \not\Rightarrow \mathrm{PhysicalChangeStopped}(X). \tag{323}$$

19.2 No privileged observer

No observer receives a different cosmic change stage because of observational status.

For any observer O and target A belonging to the same common cosmic change-stage population,

$$O, A \in \mathcal{S}_{\mathrm{phys}}(s) \Longrightarrow s \in I_O \cap I_A. \tag{324}$$

By CMA, both belong to the complete population cosmically realized at that same s.

By UCC,

$$O, A \in \mathcal{S}_{\mathrm{phys}}(s) \wedge \mathrm{UCC} \Longrightarrow \mathrm{PhysReal}_O^+(s) \wedge \mathrm{PhysReal}_A^+(s). \tag{325}$$

Observation does not split the common cosmic change stage into an observer change stage and a target change stage.

Signal propagation, detector response, processing, memory, and later reading may affect observational access and record order. They do not multiply the common cosmic change stage itself.

20. Illustrative Physical Cases

20.1 Material system with no visible alteration

For a material physical system A_{mat}, absence of visible alteration under protocol P does not establish complete physical stasis:

$$\neg\, \mathrm{VisibleAlteration}_{P,M,\varepsilon}(A_{\mathrm{mat}}; r_1, r_2) \not\Rightarrow \mathrm{CompletePhysicalStasis}(A_{\mathrm{mat}}). \tag{326}$$

A later visible crack, deformation, chemical alteration, surface change, structural transformation, or other manifestation may have a physical history extending before its first accepted detection.

Thus,

$$\mathrm{LaterVisibleManifestation}(A_{\mathrm{mat}}, \chi; r_d) \not\Rightarrow \mathrm{EntireDevelopmentAtOneChangeStage}(A_{\mathrm{mat}}, \chi). \tag{327}$$

The first visible record is evidence of a manifestation, not evidence that all earlier physical change was absent.

20.2 Biological and genetic manifestation

A detected biological, cellular, molecular, or genetic difference may warrant actual physical development in the attributed physical-system history.

For a genetic manifestation χ_{gen},

$$\begin{aligned}&\text{PositiveManifestationWitness}_{A;P,M,\varepsilon}(\chi_{\text{gen}};r)\\&\quad\Longrightarrow \text{Warrant}_{P,M}\left[\exists s\in I_A\ \text{ManifestationAt}(A,\chi_{\text{gen}};s)\right].\end{aligned} \tag{328}$$

But

$$\begin{aligned}&\text{GeneticDifferenceDetected}_{P,M}(A;r)\not\Rightarrow\\&\qquad\qquad\text{ExactGeneticChangeCosmicStageKnown}_{P,M}(A).\end{aligned} \tag{329}$$

A detected difference may reflect a physical history involving replication, repair, mutation, recombination, selection, cellular transformation, sampling composition, lineage development, environmental contribution, or other physically warranted mechanisms.

The identity of the organism, tissue, cell, cell population, molecule, and record-bearing system must remain separately typed where those systems are distinguished.

20.3 Record preservation

A stored record may remain usable while its physical carrier continues changing.

If represented content q remains stable under criterion Γ,

$$\text{StableRecordContent}_{q,\Gamma}(B_r;J)\wedge\text{UCC}\Longrightarrow\forall s\in J\ \text{PhysReal}^{+}_{B_r}(s). \tag{330}$$

Later physical degradation, copying, alteration, corruption, or destruction of the record-bearing system belongs to its own physical history. Such later alteration does not retroactively alter the source manifestation that physically contributed to the original record formation.

21. Integrated Observational Statement

A valid observation in ITOF has positive physical content without becoming an exact identifier of the common cosmic change stage.

The governing observational relation is

$$
\begin{aligned}
&\mathrm{ValidObservedManifestation}_{A;P,M,\varepsilon}(\chi;\mathbf{r}) \Longrightarrow \mathrm{Warrant}_{P,M}\left[\exists s \in I_A\ \mathrm{ManifestationAt}(A,\chi;s)\right],\\
&\mathrm{ValidObservedManifestation}_{A;P,M,\varepsilon}(\chi;\mathbf{r}) \not\Rightarrow \mathrm{ExactCosmicChangeStageIdentified}_{P,M}(A,\chi),\\
&\mathrm{ValidObservedManifestation}_{A;P,M,\varepsilon}(\chi;\mathbf{r}) \not\Rightarrow \mathrm{ExactCosmicOrderPositionIdentified}_{P,M}(A,\chi).
\end{aligned}
\tag{331}
$$

The first implication establishes the positive physical meaning of a valid observation: a manifestation belongs to the actual identity-bounded physical history of the investigated system and is realized at an actual common cosmic change stage.

The two non-entailments delimit what the same observation does not establish: neither the exact identity of that common cosmic change stage nor its exact position in the full cosmic ordering follows merely from the observational record.

The result is consistent with the foundational architecture

$$
\mathrm{CMA} \wedge \mathrm{UCC} \wedge \mathrm{CRP}\,. \tag{332}
$$

CMA retains one universally common cosmic stage for the complete then-existing population. UCC separately requires memberwise system-specific physical-change actuality throughout each identity history. The Causal Realization Principle requires nonempty physical causal realization of each such change.

Observation, detection, record formation, measurement output, and scientific inference occur inside that physical setting. None replaces it.

The resulting type distinctions are

$$
\mathrm{PairwiseTypeDistinct}\Big(T_{\mathrm{ITOF}}, s, r, \widehat{Q}_{A;P,M}(r)\Big)\,, \tag{333}
$$

with s a member of the common cosmic-stage carrier entering the definition of T_{ITOF}. Under the full CSPP–CMA–UCC architecture that member bears the change-stage role, but it is not an entity identical with the ordered pair itself.

More explicitly,

$$
s \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \qquad r \in \mathfrak{R}_P, \qquad \widehat{Q}_{A;P,M}(r) \in \mathbb{V}_{Q,P}, \tag{334}
$$

and these type-set distinctions are not removed by numerical agreement, calibration, synchronization, inversion, or increased precision.

A physical record can establish a manifestation without becoming the common cosmic change stage at which that manifestation is realized. A sequence of records can support warranted relative physical development without becoming the cosmic ordering itself. First noticeability can identify an observational threshold crossing without becoming the beginning of physical change. Non-detection can establish absence of a resolved difference under a declared criterion without establishing physical stasis.

Accordingly,

$$\boxed{\begin{array}{c}\text{physical actuality} \not\equiv_{\text{def}} \text{ observational accessibility} \\ \not\equiv_{\text{def}} \text{record output} \not\equiv_{\text{def}} \text{ exact cosmic change-stage identification.}\end{array}} \tag{335}$$

22. Clocks as Physical Systems and Operational Standards

22.1 Physical status of a clock

A clock is a physical system selected because some sufficiently stable, reproducible, or controllable part of its physical operation can produce ordered records and standardized numerical outputs.

$$\mathrm{Clock}(C) \Longrightarrow \mathrm{PhysicalSystem}(C). \tag{336}$$

The clock therefore possesses the same general physical status as every other admitted physical system. Its identity is realized over

$$I_C = \left\{ s \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}} \mid \mathrm{ExistsAs}(C, s) \right\}, \tag{337}$$

and its physical history is represented by

$$\mathcal{H}_C = \left(I_C, \prec_{\mathrm{C}}|_{I_C}, X_C, \Delta_C^{\mathrm{phys}} \right). \tag{338}$$

At every common cosmic change stage at which the clock identity exists,

$$C \in \mathcal{S}_{\mathrm{phys}}(s) \wedge \mathrm{UCC} \Longrightarrow \mathrm{PhysReal}_C^{+}(s). \tag{339}$$

By the Causal Realization Principle,

$$\mathrm{PhysReal}_C^{+}(s) \Longrightarrow \mathcal{C}_C^{\mathrm{act}}(s) \neq \varnothing. \tag{340}$$

Selection of a clock as a standard does not exempt it from physical change:

$$\mathrm{ClockStandard}(C) \not\Rightarrow \mathrm{CompletePhysicalStasis}(C). \tag{341}$$

A selected transition, oscillator, phase relation, cycle count, or output may satisfy a stringent stability criterion while the clock system continues to undergo other physical changes.

22.2 Clock system and clock components

A modern clock may contain several independently identifiable physical systems. Depending on the clock class, these may include a transition-bearing system, local oscillator or interrogation source, control or servo system, detector, electronics, record-bearing system, communication apparatus, environmental support systems, and physical reference systems.

For clock C_i, define the principal physical family

$$\mathcal{L}_i^{\mathrm{core}} := \{A_i, L_i, S_i, D_i, B_i\}\,, \tag{342}$$

where A_i is the transition- or oscillator-bearing physical system, L_i is the interrogation source or local oscillator, S_i is the control system, D_i is the detector, and B_i is the record-bearing physical system.

The enlarged physical family is

$$\mathcal{L}_i := \mathcal{L}_i^{\mathrm{core}} \cup \{E_i, Q_i, R_i\}\,, \tag{343}$$

where E_i denotes relevant environmental and support systems, Q_i the comparison or communication apparatus, and R_i the physical reference systems used to characterize operating conditions.

Where a member $X \in \mathcal{L}_i$ is independently classified as a physical system,

$$X \in \mathcal{S}_{\mathrm{phys}}(s) \wedge \mathrm{UCC} \Longrightarrow \mathrm{PhysReal}_X^{+}(s). \tag{344}$$

The functional integration of these systems into one clock apparatus does not erase their distinct physical identities where such identities are physically warranted.

22.3 Clock process, record, and output

A clock process is a selected physical process. A clock record is a physical record generated through that process and its acquisition chain. A standardized reading is a numerical or classificatory representation obtained from the record.

These three levels are distinct from time:

$$\mathrm{ClockProcess} \not\equiv_{\mathrm{type}} T_{\mathrm{ITOF}}, \tag{345}$$

$$\mathrm{ClockRecord} \not\equiv_{\mathrm{type}} T_{\mathrm{ITOF}}, \tag{346}$$

and

$$\mathrm{ClockOutput} \not\equiv_{\mathrm{type}} T_{\mathrm{ITOF}}. \tag{347}$$

A clock reading may represent a cycle count, phase relation, transition-frequency ratio, accumulated oscillator output, display value, or another declared operational quantity.

It is not a member of the common cosmic change-stage totality:

$$N_{C,P}(r_C) \notin \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}. \tag{348}$$

Increased clock precision reduces uncertainty in the declared clock-output domain. It does not change the logical type of that output:

$$\mathrm{HighClockPrecision}_P(C) \not\Rightarrow \mathrm{ExactCosmicChangeStageIdentified}_P(C). \tag{349}$$

22.4 Clock-record production

Let $J \subseteq I_C$ denote a physical-history portion contributing to a clock record. Let $\Theta_{C,P}$ denote the declared clock operating and record-production conditions.

The clock-record map is

$$\mathcal{R}_{C,P} : (\mathcal{H}_C|_J, \Theta_{C,P}) \longmapsto r_C. \tag{350}$$

A more explicit physical representation is

$$R_{C,P}(J) = \mathcal{F}_{C,P}\left(\mathcal{H}_C|_J, \mathcal{G}_{C,P}|_J, \Theta_{C,P}\right), \tag{351}$$

where

$$\mathcal{G}_{C,P}|_J := \{\mathfrak{C}_C(s), X_C(s), \mathrm{ExternalRelations}_C(s)\}_{s\in J}. \tag{352}$$

The record law therefore assigns a clock output to the physical history, present conditions, interactions, and record-production chain of the clock system.

It does not require a physical rate, deformation, acceleration, or slowing of time.

22.5 Numerical clock reading

Let

$$N_{C,P} : \mathfrak{R}_{C,P} \longrightarrow \mathbb{R}_P \tag{353}$$

be a standardized numerical reading map.

For record r_C,

$$n_C = N_{C,P}(r_C). \tag{354}$$

The reading and record retain different types:

$$n_C \not\equiv_{\mathrm{type}} r_C. \tag{355}$$

Neither is a common cosmic change stage:

$$r_C \not\equiv_{\mathrm{type}} s, \qquad n_C \not\equiv_{\mathrm{type}} s. \tag{356}$$

For two clock records ordered under protocol P,

$$r_{C,1} \lhd_P r_{C,2}, \tag{357}$$

define the operational clock difference

$$\Delta N_{C,P} := N_{C,P}(r_{C,2}) - N_{C,P}(r_{C,1}). \tag{358}$$

This quantity belongs to the declared numerical clock scale:

$$\Delta N_{C,P} \in \mathbb{R}_P. \tag{359}$$

It is not defined as a magnitude of the cosmic ordering:

$$\Delta N_{C,P} \not\equiv_{\text{type}} \text{MagnitudeOf}\left(\mathcal{S}_{\text{C}}^{\text{tot}}, \prec_{\text{C}}\right). \tag{360}$$

Scientific and ordinary language may call such a quantity a duration or elapsed time. Within ITOF it remains a standardized operational quantity derived from physical clock records.

22.6 Clock counts do not count common cosmic change stages

A clock counts, accumulates, or compares a selected feature of its own physical operation. It does not enumerate the members of $\mathcal{S}_{\text{C}}^{\text{tot}}$.

Thus,

$$N_{C,P}(r_C) = n \not\Rightarrow \text{NumberOfCommonCosmicChangeStages} = n. \tag{361}$$

Likewise,

$$\Delta N_{C,P} = m \not\Rightarrow \text{NumberOfCommonCosmicChangeStagesBetween} = m. \tag{362}$$

For two clocks,

$$\Delta N_{C_1,P} > \Delta N_{C_2,P} \tag{363}$$

does not imply that C_1 traversed more common cosmic change stages than C_2:

$$\Delta N_{C_1,P} > \Delta N_{C_2,P} \not\Rightarrow \text{MoreCommonCosmicChangeStagesFor}(C_1, C_2). \tag{364}$$

Where both clock identities exist at the same common cosmic stage, CMA applies to both at that same stage independently of their numerical outputs; under the joint realization architecture it bears the full-theory change-stage role.

22.7 Operational physical rates

For selected physical quantity Q_A, define

$$\Delta_P Q_A := \widehat{Q}_{A,P}(r_{A,2}) - \widehat{Q}_{A,P}(r_{A,1}) \tag{365}$$

and

$$\Delta_P N_C := N_{C,P}(r_{C,2}) - N_{C,P}(r_{C,1}). \tag{366}$$

Where $\Delta_P N_C \neq 0$, define

$$\overline{v}^{P}_{Q_A|C} := \frac{\Delta_P Q_A}{\Delta_P N_C}. \tag{367}$$

This quantity describes physical change in Q_A relative to the declared operational clock scale. It is not a rate of time:

$$\overline{v}^{P}_{Q_A|C} \not\equiv_{\text{type}} \text{RateOfTime}\,. \tag{368}$$

A larger or smaller value describes the physical quantities, clock records, and comparison convention entering the ratio.

22.8 Comparison of clock systems

For two clock systems C_1 and C_2, let their readings be mapped into one declared comparison codomain.

For an aligned comparison record pair, define

$$d^{\text{obs}}_{12} := \Gamma_{1,12}\left(N_{C_1,P_1}(r_1)\right) - \Gamma_{2,12}\left(N_{C_2,P_2}(r_2)\right). \tag{369}$$

A nonzero difference establishes a difference between selected physical clock records:

$$d^{\text{obs}}_{12} \neq 0 \Longrightarrow \text{DifferentClockRecordOutcomes}(C_1, C_2). \tag{370}$$

It does not establish separate common cosmic change-stage totalities:

$$d^{\text{obs}}_{12} \neq 0 \not\Rightarrow \text{DifferentCosmicChangeStageTotalities}(C_1, C_2). \tag{371}$$

Nor does it establish deformation of $\prec_{\mathrm{C}}$:

$$d^{\text{obs}}_{12} \neq 0 \not\Rightarrow \text{CosmicOrderingDeformed}\,. \tag{372}$$

The physical difference is attributed through the physical response, operating conditions, causal profiles, acquisition chains, and record-production systems of the compared clocks.

22.9 Synchronization

Synchronization is an operational relation among selected clock outputs under a declared alignment convention.

For tolerance $\varepsilon_{\text{sync}}$,

$$\text{Synchronized}_{P,\varepsilon_{\text{sync}}}(C_1, C_2) \Longleftrightarrow \left|d^{\text{obs}}_{12}\right| \leq \varepsilon_{\text{sync}}. \tag{373}$$

Synchronization does not create CMA:

$$\mathrm{Synchronized}_{P,\varepsilon_{\mathrm{sync}}}(C_1, C_2) \not\Rightarrow \mathrm{CMA}\,. \tag{374}$$

Nor does it identify an exact common cosmic change stage:

$$\mathrm{Synchronized}_{P,\varepsilon_{\mathrm{sync}}}(C_1, C_2) \not\Rightarrow \mathrm{ExactCommonCosmicChangeStageIdentified}(C_1, C_2). \tag{375}$$

CMA is a foundational statement about common cosmic-stage realization. Synchronization is an operational relation among records.

22.10 Clock failure

Functional clock failure does not necessarily end the numerical identity of the physical system:

$$\mathrm{ClockFailure}_P(C; s) \not\Rightarrow \mathrm{End}_C(s). \tag{376}$$

If the clock identity continues,

$$\mathrm{ClockFailure}_P(C; s) \wedge s \in I_C \wedge \mathrm{UCC} \Longrightarrow \mathrm{PhysReal}^+_C(s). \tag{377}$$

Absence of a later clock output also does not terminate cosmic succession:

$$\mathrm{NoClockOutputAfter}_P(C; s) \not\Rightarrow \mathrm{CosmicSuccessionStopsAt}(s). \tag{378}$$

23. Physical Clock-Response Bridge

23.1 Status of the quantitative bridge

The foundational definition of time does not itself calculate clock outputs.

The quantitative bridge therefore has application-level status. It connects declared physical conditions and physical clock mechanisms to predicted records.

The distinction is

$$\mathrm{TemporalTypeClaim} \not\equiv_{\mathrm{def}} \mathrm{QuantitativeClockModel}\,. \tag{379}$$

A quantitative model may succeed or fail independently of the logical type distinction between its clock output and T_{ITOF}.

Likewise,

$$\mathrm{SuccessfulClockPrediction} \not\Rightarrow \mathrm{ClockOutput} \equiv_{\mathrm{type}} T_{\mathrm{ITOF}}. \tag{380}$$

The purpose of the bridge is to predict physical record differences, not to assign a numerical rate to cosmic succession.

23.2 Physical response chain

For clock C_i, the application-level physical chain is

$$\mathfrak{C}_{C_i} \longrightarrow H_i^{\mathrm{eff}} \longrightarrow \nu_i^{\mathrm{phys}} \longrightarrow \mathrm{InterrogationResponse}_i \longrightarrow \mathrm{DetectorOutcome}_i \longrightarrow r_i \longrightarrow N_i. \tag{381}$$

Here H_i^{eff} is a declared effective physical model, ν_i^{phys} is the relevant transition or oscillator response, r_i is a physical clock record, and N_i is the standardized reading obtained from that record.

Each arrow requires an independently specified physical or representational relation.

No arrow changes the logical type of the output into the type of time.

23.3 Effective physical model

For an atomic, ionic, molecular, nuclear, optical, solid-state, or other transition-bearing clock system, a general effective model may be written

$$H_i^{\mathrm{eff}} = H_i^{(0)} + H_i^{\mathrm{int}} + H_i^{\mathrm{ctrl}} + H_i^{\mathrm{env}} + H_i^{\mathrm{cond}} + H_i^{\mathrm{rem}}. \tag{382}$$

The terms denote, respectively, a declared reference model, internal physical interactions, interrogation and control contributions, environmental interactions, other physical-condition contributions admitted by the model, and bounded omitted or higher-order contributions.

This is a decomposition of the physical clock model. It is not a decomposition of time.

For declared states $|a_i\rangle$ and $|b_i\rangle$,

$$\nu_i^{\mathrm{phys}} = \frac{E_{b_i}^{\mathrm{eff}} - E_{a_i}^{\mathrm{eff}}}{h}. \tag{383}$$

The physical transition quantity is not a rate of cosmic succession:

$$\nu_i^{\mathrm{phys}} \not\equiv_{\mathrm{type}} \mathrm{RateOfTime}\,. \tag{384}$$

Where perturbation theory is physically justified,

$$\delta\nu_i = \frac{1}{h}\left[\langle b_i|\delta H_i|b_i\rangle - \langle a_i|\delta H_i|a_i\rangle\right] + \epsilon_i^{\mathrm{higher}}, \tag{385}$$

with $\epsilon_i^{\mathrm{higher}}$ bounded according to the declared approximation domain.

Equation (385) supplies a physical route from interaction to clock response. It does not derive a response coefficient from the definition of time.

23.4 Clock-condition bundle

For accepted comparison index k, define

$$\mathcal{B}_{i,k} := \left(\widehat{X}_{i,k}, \widehat{\Psi}_{i,k}, \widehat{\mathbf{v}}_{i,k}, \widehat{Z}_{i,k}, \widehat{\Pi}_{i,k}\right). \tag{386}$$

Here $\widehat{X}_{i,k}$ represents the reconstructed physical state relevant to the clock model, $\widehat{\Psi}_{i,k}$ a declared gravitational-model input, $\widehat{\mathbf{v}}_{i,k}$ the kinematic condition relative to a declared physical reference system, $\widehat{Z}_{i,k}$ the remaining local physical conditions, and $\widehat{\Pi}_{i,k}$ propagation, transfer, comparison-path, and record-alignment conditions.

The local systematic bundle may include

$$\widehat{Z}_{i,k} = \begin{pmatrix} Z^{\text{thermal}}, Z^{\text{EM}}, Z^{\text{coll}}, Z^{\text{lattice}}, Z^{\text{pressure}}, Z^{\text{mechanical}}, \\ Z^{\text{vibration}}, Z^{\text{servo}}, Z^{\text{probe}}, Z^{\text{ageing}}, Z^{\text{other}} \end{pmatrix}_{i,k}. \tag{387}$$

Each retained component enters only where it is physically relevant to the declared clock class and experimental design.

The reconstructed quantities in $\mathcal{B}_{i,k}$ are physical-model variables. They are not common cosmic change-stage coordinates.

23.5 Normalized physical response

Let $\nu_{i,0}$ be the declared reference transition quantity. Define

$$\Xi_{i,M}\left(\mathcal{B}_{i,k};\theta_i\right) := \frac{\nu_i^{\text{phys}}\left(\mathcal{B}_{i,k};\theta_i\right)}{\nu_{i,0}}. \tag{388}$$

At declared reference bundle $\mathcal{B}_{i,0}$,

$$\Xi_{i,M}\left(\mathcal{B}_{i,0};\theta_i\right) = 1. \tag{389}$$

A local first-order physical response may take the form

$$\begin{aligned}\Xi_{i,M}\left(\mathcal{B}_{i,k};\theta_i\right) \simeq 1 &+ \boldsymbol{\gamma}_{i,M}^{\mathsf{T}}\left(\widehat{X}_{i,k} - X_{i,0}\right) \\ &+ \alpha_{i,M}^{\text{g}}\frac{\widehat{\Psi}_{i,k} - \Psi_{i,0}}{c^2} \\ &- \alpha_{i,M}^{\text{v}}\frac{\|\widehat{\mathbf{v}}_{i,k}\|^2 - \|\mathbf{v}_{i,0}\|^2}{2c^2} \\ &+ \boldsymbol{\beta}_{i,M}^{\mathsf{T}}\left(\widehat{Z}_{i,k} - Z_{i,0}\right) + \xi_{i,M}\left(\widehat{\Pi}_{i,k}\right) + \epsilon_{i,k}^{\text{rem}}.\end{aligned} \tag{390}$$

The coefficients in Equation (390) describe physical response of the clock system:

$$\boldsymbol{\gamma}_{i,M}, \alpha_{i,M}^{\text{g}}, \alpha_{i,M}^{\text{v}}, \boldsymbol{\beta}_{i,M} \not\equiv_{\text{type}} \text{PropertiesOfTime}\,. \tag{391}$$

The framework does not infer

$$\alpha_{i,M}^{\text{g}} = 1 \tag{392}$$

or

$$\alpha_{i,M}^{\text{v}} = 1 \tag{393}$$

from the definition of time, CMA, UCC, or system specificity.

Any such value requires an independently specified physical model, an independent physical constraint, or an explicitly declared benchmark specialization.

23.6 Parameter provenance

Let

$$\theta_i = (\theta_{i,1}, \ldots, \theta_{i,p_i}) \tag{394}$$

be the parameter vector of the physical response model.

Each parameter has declared provenance:

$$\mathrm{Prov}\left(\theta_{i,j}\right) = \mathcal{P}_{i,j}. \tag{395}$$

Admissible provenance may include independent microscopic derivation, independent measurement, construction specification, separate calibration, external constraint, or estimation on a declared derivation domain.

A value assigned only to reproduce a benchmark has recovery status but not independent predictive status:

$$\mathrm{Prov}(\theta) = \mathrm{BenchmarkAssigned} \not\Rightarrow \mathrm{IndependentPrediction}(\theta). \tag{396}$$

A value selected from the evaluation outcome cannot independently predict that same outcome:

$$\theta = \Theta\left(D_{\mathrm{eval}}\right) \not\Rightarrow \mathrm{IndependentPrediction}\left(D_{\mathrm{eval}}\right). \tag{397}$$

23.7 Pairwise physical clock prediction

For clocks C_i and C_j, let

$$\rho_{ij}^0 := \frac{\nu_{i,0}}{\nu_{j,0}} \tag{398}$$

be the declared reference ratio.

A physical pairwise prediction may be written

$$\widehat{\rho}_{ij,k}^M = \rho_{ij}^0 \frac{\Xi_{i,M}\left(\mathcal{B}_{i,k};\theta_i\right)}{\Xi_{j,M}\left(\mathcal{B}_{j,k};\theta_j\right)} \Lambda_{ij,M,k}, \tag{399}$$

where $\Lambda_{ij,M,k}$ contains the independently specified comparison-link and transfer contributions.

Define the predicted fractional record difference by

$$\widehat{\delta}_{ij,k}^M := \frac{\widehat{\rho}_{ij,k}^M}{\rho_{ij}^0} - 1. \tag{400}$$

Equation (400) predicts a difference between physical record-producing systems.

It does not assign different rates to time.

23.8 Observed residual

For observed fractional difference $\delta_{ij,k}^{\mathrm{obs}}$, define

$$r_{ij,k}^{M} := \delta_{ij,k}^{\mathrm{obs}} - \widehat{\delta}_{ij,k}^{M}. \tag{401}$$

A physically resolved residual account may contain contributions from model approximation, acquisition, transfer, detector response, record production, calibration, and other independently identified sources.

It does not permit arbitrary residual terms chosen after inspection of the result.

Every retained uncertainty or bias term must possess a declared physical or statistical origin, domain, and bound.

23.9 Covariance

For stacked observations, let

$$\Sigma_D \tag{402}$$

be the declared covariance matrix on domain D.

It contains warranted correlations among clock response, acquisition, environmental conditions, calibration, transport, transfer, record production, shared parameters, and model uncertainty.

Independence is not assumed merely because two terms have different names:

$$\mathrm{DistinctUncertaintyLabels} \not\Rightarrow \mathrm{ZeroCovariance}\,. \tag{403}$$

24. Predeclared Empirical Test Architecture

24.1 Four inferential levels

Quantitative assessment distinguishes four levels:

$$\mathrm{Recovery} \longrightarrow \mathrm{AdvancePrediction} \longrightarrow \mathrm{ModelDiscrimination} \longrightarrow \mathrm{FoundationalAssessment}\,. \tag{404}$$

The arrows indicate increasing inferential demand, not automatic implication.

Recovery asks whether a declared physical response model reproduces or adequately predicts accepted records within a stated domain.

Advance prediction requires the relevant model form, coefficients, controls, uncertainty structure, and acceptance conditions to be fixed independently before the evaluation outcome is known.

Model discrimination requires competing predictions to differ sufficiently that the declared experiment can distinguish them.

Foundational assessment asks whether a successful or failed application-level prediction has any direct logical consequence for a foundational commitment.

The four levels are not interchangeable.

24.2 Protocol freeze

A quantitative test is governed by a predeclared protocol

$$\mathfrak{P}^{\star} := (\mathcal{S}, \mathcal{B}, \mathcal{Q}, \mathcal{M}, \Theta, \mathcal{C}, \Sigma, \mathcal{E}, \mathcal{A}, \mathcal{F}, \mathcal{R}) \,, \tag{405}$$

where the terms specify, respectively,

(i) the physical systems and carrier classes;

(ii) their physical-system boundaries and identity criteria;

(iii) the controlled and measured physical-condition bundles;

(iv) the application model and declared rival models;

(v) model form and parameter provenance;

(vi) positive controls and null-control channels;

(vii) covariance, uncertainty, and bounded remainder structure;

(viii) exclusion and data-quality rules;

(ix) acceptance criteria;

(x) failure criteria;

(xi) and the independent replication specification.

The protocol has predictive status only where these elements are fixed independently of the evaluation outcome:

$$\mathrm{ProtocolFrozen}\,(\mathfrak{P}^{\star}) \Longrightarrow \mathrm{NoEvaluationOutcomeDependence}\,(\mathfrak{P}^{\star})\,. \tag{406}$$

This requirement applies not only to model coefficients but also to preprocessing rules, exclusions, covariance construction, null channels, significance thresholds, remainder bounds, and model-selection criteria.

24.3 Derivation and evaluation domains

Let D_{der} be the domain used to determine model form or parameters and D_{eval} the independent evaluation domain.

Require

$$D_{\mathrm{der}} \cap D_{\mathrm{eval}} = \varnothing. \tag{407}$$

Disjoint records are necessary but do not by themselves guarantee inferential independence.

Accordingly,

$$D_{\mathrm{der}} \cap D_{\mathrm{eval}} = \varnothing \nRightarrow \mathrm{NoEvaluationLeakage}\,. \tag{408}$$

Inferential independence additionally requires

$$\begin{gathered}\mathrm{NoEvaluationLeakage} \Longleftrightarrow \\ \neg\,\mathrm{EvaluationInfluence}\left(\begin{array}{c}\text{model form, parameters, preprocessing,}\\ \text{exclusions, covariance, thresholds, controls,}\\ \text{remainder bounds, or model-selection rules}\end{array}\right).\end{gathered} \tag{409}$$

Shared calibrations and shared physical systematic information need not be discarded; their dependence must instead be represented explicitly in the covariance and provenance structure.

Methodological predicate notation.

When a concrete protocol or evaluation context is named, the methodological predicates are written with that context explicitly. Thus $\mathrm{ProtocolFrozen}(P)$ denotes protocol freeze for declared protocol P, and $\mathrm{NoEvaluationLeakage}(P, D)$ denotes absence of outcome-sensitive leakage for protocol P over the declared evaluation context D. The corresponding bare predicates used in summary conjunctions abbreviate these conditions for the currently declared protocol and evaluation context; they do not introduce predicates of a different arity. Likewise, $\mathrm{IndependentParameterProvenance}(M)$ is the model-indexed instantiation of the parameter-provenance condition, while the bare form abbreviates that condition for the application model under discussion.

24.4 Blind evaluation

Where the physical design permits it, evaluation labels or outcome information may remain blinded until all outcome-sensitive analysis choices have been fixed.

Define

$$\mathrm{BlindedEvaluation}\left(D_{\mathrm{eval}}\right) \tag{410}$$

as the condition that the information needed to distinguish the evaluated physical conditions or model-favoured outcome remains unavailable to the relevant outcome-sensitive analysis step until the protocol-defined choices are fixed.

Blinding is a methodological protection against outcome-dependent analysis. It is not a foundational ITOF commitment and is required only where physically and experimentally meaningful.

24.5 Out-of-sample prediction

Let

$$\widehat{\theta} = \Theta\left(D_{\mathrm{der}}\right). \tag{411}$$

The evaluation prediction is

$$\widehat{\boldsymbol{y}}_{\text{eval}}^{M} = \mathcal{Q}_M\left(\widehat{\theta}, \widehat{\mathcal{B}}_{\text{eval}}\right). \tag{412}$$

Predictive independence requires

$$\widehat{\theta} \not\equiv_{\text{def}} \Theta\left(D_{\text{der}}, \boldsymbol{y}_{\text{eval}}^{\text{obs}}\right). \tag{413}$$

Thus an outcome reproduced by retuning parameters after observation remains a fitted recovery result rather than an advance prediction.

24.6 Identifiability

For parameter vector θ and evaluation or derivation domain D, define the local sensitivity matrix

$$\mathsf{J}_D := \left[\frac{\partial \widehat{y}_k^M}{\partial \theta_j}\right]_{k \in D}. \tag{414}$$

For positive-definite covariance Σ_D, let

$$\mathsf{W}_D^{\mathsf{T}} \mathsf{W}_D = \Sigma_D^{-1} \tag{415}$$

and

$$\mathsf{X}_D := \mathsf{W}_D \mathsf{J}_D. \tag{416}$$

A locally identifiable and acceptably conditioned model requires

$$\text{Identifiable}_D(M) \iff \operatorname{rank}(\mathsf{X}_D) = p_M \wedge \kappa_2(\mathsf{X}_D) \le \kappa_{\max}. \tag{417}$$

The bound $\kappa_{\max}$ is part of the predeclared protocol.

A model whose parameters are not identifiable does not acquire predictive strength merely because one fitted curve follows the observations.

24.7 Recovery

Let

$$\boldsymbol{r}_D^M := \boldsymbol{y}_D^{\text{obs}} - \widehat{\boldsymbol{y}}_D^M. \tag{418}$$

For a declared covariance model define

$$Q_D^M := \left(\boldsymbol{r}_D^M\right)^{\mathsf{T}} \Sigma_D^{-1} \boldsymbol{r}_D^M. \tag{419}$$

Where a multivariate Gaussian residual model is warranted, an executable acceptance criterion may be written

$$\mathrm{FitAccepted}_D(M) \iff \mathrm{ValidCovariance}_D \wedge \mathrm{ResidualDiagnosticsPassed}_D \wedge Q_D^M \le \chi^2_{\nu_D,1-\alpha_{\mathrm{test}}}. \tag{420}$$

Where that residual distribution is not warranted, a distribution-appropriate discrepancy and threshold are used instead and are fixed before evaluation.

Recovery requires more than a small residual:

$$\begin{aligned}\mathrm{Recovered}_D(M) \iff\ & \mathrm{IndependentParameterProvenance}(M)\\ & \wedge \mathrm{ValidPhysicalSystemBoundaries}(M)\\ & \wedge \mathrm{ValidAcquisitionSupport}(M)\\ & \wedge \mathrm{ValidRecordAttribution}(M)\\ & \wedge \mathrm{Identifiable}_D(M)\\ & \wedge \mathrm{ValidApproximationDomain}_D(M)\\ & \wedge \mathrm{FitAccepted}_D(M).\end{aligned} \tag{421}$$

A successful recovery warrants only the bounded claim

$$\mathrm{Recovered}_D(M) \Longrightarrow \mathrm{Warrant}\left[\mathrm{PhysicalRecordModelAdequateOn}(D)\right]. \tag{422}$$

It does not establish the identity of time.

25. Discriminating Multi-Carrier and Multi-Condition Tests

25.1 Local carrier-differential observable

Let A_i and A_j denote two physically distinct transition or oscillator carriers. Let q_a and q_b denote two independently characterized physical-condition bundles.

Define the local double-ratio discriminant

$$\mathfrak{D}_{ij}^{ab} := \ln\left[\frac{\overline{\nu}_i^{\mathrm{phys}}(q_b)/\overline{\nu}_j^{\mathrm{phys}}(q_b)}{\overline{\nu}_i^{\mathrm{phys}}(q_a)/\overline{\nu}_j^{\mathrm{phys}}(q_a)}\right] - \widehat{\Delta}_{ij}^{\mathrm{ctrl},ab}. \tag{423}$$

The control term contains independently specified carrier, interrogation, detector, environmental, local comparison, and other physical changes that are not part of the physical response being tested.

A local design reduces dependence on remote propagation in the leading discriminant. Any remaining transfer or communication effect remains part of the physical record and uncertainty chain.

25.2 System specificity does not predict a nonzero differential

The foundational statement that different systems may respond differently does not itself establish

$$\mathfrak{D}_{ij}^{ab} \neq 0. \tag{424}$$

A nonzero advance prediction requires an independent physical coupling model.

Thus,

$$\begin{aligned} \mathrm{AdvanceCarrierPrediction}_{ij}^{ab} \iff & \mathrm{IndependentPhysicalCouplingLaw}_{ij} \\ & \wedge \mathrm{IndependentCoefficientProvenance}_{ij} \\ & \wedge \mathrm{ValidApproximationDomain}_{ij} \\ & \wedge \mathrm{NoEvaluationFit}_{ij} . \end{aligned} \tag{425}$$

System specificity permits non-identical response. It does not manufacture non-identical coefficients.

25.3 Prediction of sign and magnitude

Where a nonzero physical response is independently derived, the prediction must specify more than the proposition that a difference may exist.

For discriminating channel k, predeclare

$$\operatorname{sgn}\left(\widehat{D}_k\right) = \sigma_k, \qquad \sigma_k \in \{-1, +1\}, \tag{426}$$

and a predicted interval

$$\widehat{D}_k \in [L_k, U_k]. \tag{427}$$

A sign failure occurs when

$$\operatorname{sgn}\left(D_k^{\mathrm{obs}}\right) \neq \sigma_k \tag{428}$$

at a resolution sufficient to determine the sign.

A magnitude failure occurs when

$$D_k^{\mathrm{obs}} \notin [L_k, U_k] \tag{429}$$

under the declared uncertainty and acceptance criterion.

The interval and sign are fixed before the evaluation result is opened.

25.4 Multi-carrier and multi-condition prediction matrix

A stronger test uses several physically different carriers and several physical-condition bundles.

Let

$$\mathcal{A} = \{A_1, \ldots, A_n\} \tag{430}$$

and

$$\mathcal{Q} = \{q_0, \ldots, q_m\}. \tag{431}$$

For admissible carrier pairs and condition pairs define

$$D_{ij}^{ab} := \mathfrak{D}_{ij}^{ab}. \tag{432}$$

Collect the predicted observables into

$$\widehat{\mathbf{D}}^M = \left(\widehat{D}_{ij}^{ab,M}\right)_{(i,j,a,b)\in\mathcal{K}}, \tag{433}$$

and the observed values into

$$\mathbf{D}^{\text{obs}} = \left(D_{ij}^{ab,\text{obs}}\right)_{(i,j,a,b)\in\mathcal{K}}. \tag{434}$$

The index set $\mathcal{K}$ is declared before evaluation.

This architecture requires a model to reproduce a pattern of carrier-dependent and condition-dependent responses rather than one isolated numerical difference.

25.5 Positive discriminating channels

Let $\mathcal{K}_+ \subseteq \mathcal{K}$ contain channels for which the model predicts a resolvable nonzero effect.

For $k \in \mathcal{K}_+$,

$$\left|\widehat{D}_k^M\right| > \varepsilon_k^{\text{sep}} \tag{435}$$

is required before the channel is classified as discriminating.

A predicted nonzero value below the declared separation threshold remains an advance prediction without adequate discriminating power.

25.6 Null-control channels

Let $\mathcal{K}_0 \subseteq \mathcal{K}$ contain channels predicted to be null within a declared bound.

For $k \in \mathcal{K}_0$,

$$\left|\widehat{D}_k^M\right| \le \varepsilon_k^{\text{null}}. \tag{436}$$

A useful design therefore contains both

$$\mathcal{K}_+ \neq \varnothing \tag{437}$$

and

$$\mathcal{K}_0 \neq \varnothing. \tag{438}$$

If a nominally common disturbance produces comparable signals in both positive and null channels, the result weakens attribution to the tested carrier-specific coupling and strengthens the case for a shared uncontrolled physical contribution.

Null controls therefore test attribution as well as detection.

25.7 Controlled perturbation

A physical condition may be varied deliberately through declared values

$$q_0, q_1, \ldots, q_m. \tag{439}$$

The response model then predicts the corresponding pattern

$$\widehat{\mathbf{D}}\left(q_0, \ldots, q_m\right). \tag{440}$$

Controlled perturbations may include gravitational-model conditions, kinematic conditions, temperature, electromagnetic environment, lattice parameters, collision conditions, mechanical stress, vibration, interrogation conditions, detector conditions, or other physically meaningful inputs.

A perturbation belongs to the test only when its physical relation to the relevant carrier response is independently specified.

25.8 Perturbation reversal

Where the declared physical coupling law predicts an odd response under reversal of a controlled perturbation,

$$\widehat{D}\left(+\Delta q\right) = -\widehat{D}\left(-\Delta q\right), \tag{441}$$

the reversal relation becomes a predeclared test condition.

Equation (441) is not a universal ITOF law. It applies only where the declared physical response model independently entails that symmetry.

Observed reversal consistent with the predicted sign pattern is more restrictive than observation of one fixed offset because many stationary systematic biases do not reproduce the required reversal structure.

25.9 Scaling-law test

Where a model predicts a local scaling law,

$$\widehat{D}(\lambda\Delta q) = f_M(\lambda)\widehat{D}(\Delta q) + \epsilon_{\text{scale}}, \tag{442}$$

the function f_M, the admissible perturbation domain, and the bound on ϵ_{scale} are fixed before evaluation.

For a first-order response,

$$f_M(\lambda) = \lambda \tag{443}$$

may apply within a declared local domain.

Agreement at several perturbation levels tests the functional response form rather than one numerical point.

A single-point recovery therefore does not imply

$$\mathrm{ScalingLawConfirmed}\,. \tag{444}$$

25.10 Model separation

Let M_I denote a declared ITOF-admissible physical application model and M_R a rival physical model.

Their predictions over discriminating domain $D_\star$ are

$$\widehat{\mathbf{D}}^{I}_{D_\star} \qquad \text{and} \qquad \widehat{\mathbf{D}}^{R}_{D_\star}. \tag{445}$$

Define their pre-evaluation separation by

$$\mathcal{S}_{D_\star} := \Delta_{D_\star}\left(\widehat{\mathbf{D}}^{I}_{D_\star}, \widehat{\mathbf{D}}^{R}_{D_\star}\right), \tag{446}$$

where $\Delta_{D_\star}$ is a declared discrepancy functional incorporating the relevant covariance and uncertainty.

A discriminating design requires

$$\mathcal{S}_{D_\star} > \varepsilon^{\mathrm{sep}}_{D_\star}. \tag{447}$$

If

$$\mathcal{S}_{D_\star} \le \varepsilon^{\mathrm{sep}}_{D_\star}, \tag{448}$$

the experiment lacks declared discriminating power even if both models individually fit the observations.

Recovery and discrimination are therefore distinct:

$$\mathrm{Recovered}(M_I) \wedge \mathrm{Recovered}(M_R) \nRightarrow \mathrm{ModelDiscriminationAchieved}\,. \tag{449}$$

25.11 Observed model preference

For observed vector $\mathbf{D}^{\mathrm{obs}}$, define

$$Q_I := \Delta_{D_\star}\left(\mathbf{D}^{\mathrm{obs}}, \widehat{\mathbf{D}}^{I}\right) \tag{450}$$

and

$$Q_R := \Delta_{D_\star}\left(\mathbf{D}^{\mathrm{obs}}, \widehat{\mathbf{D}}^{R}\right). \tag{451}$$

A predeclared preference condition may require

$$Q_I + m_\star < Q_R, \qquad m_\star > 0, \tag{452}$$

with $m_\star$ fixed before evaluation.

A model is therefore not classified as favoured merely because its discrepancy is numerically smaller by an arbitrarily small amount.

25.12 More than one rival model

A nonzero result that conflicts with one rival model does not uniquely establish an ITOF application.

Let

$$\mathfrak{M} = \{M_I, M_{R_1}, M_{R_2}, \ldots, M_{R_p}\} \tag{453}$$

be the declared model family.

Then

$$D^{\mathrm{obs}} \neq 0 \not\Rightarrow \mathrm{ITOFApplicationUniquelyEstablished}\,. \tag{454}$$

Support for M_I requires its independently derived prediction to outperform the declared physically relevant alternatives under the predeclared comparison criterion.

25.13 Independent replication

Let D_{rep} be an independent replication domain.

Require

$$D_{\mathrm{rep}} \cap D_{\mathrm{eval}} = \varnothing \tag{455}$$

and, where applicable,

$$D_{\mathrm{rep}} \cap D_{\mathrm{der}} = \varnothing. \tag{456}$$

Replication tests the persistence of the previously declared response law, sign pattern, scaling law, carrier structure, and null-control behaviour.

A strong replication criterion is

$$
\begin{aligned}
\text{ReplicationPassed} \iff\ & \text{ProtocolConsistent} \\
& \wedge \text{PredictedSignPatternRecovered} \\
& \wedge \text{PredictedMagnitudeStructureRecovered} \\
& \wedge \text{NullControlsSatisfied} \\
& \wedge \text{ScalingOrReversalSatisfiedWherePredicted} \\
& \wedge \text{FitAccepted}_{D_{\text{rep}}}(M_I).
\end{aligned}
\tag{457}
$$

A replication need not use physically identical apparatus where the model claims broader applicability, but any change of carrier, apparatus, environment, or physical domain must remain within the declared scope of the response law.

25.14 Post-evaluation model modification

A new physical contributor may legitimately be discovered after an unexpected result. That discovery can motivate a revised physical model.

It does not retroactively convert the failed original prediction into a successful advance prediction.

Therefore,

$$
\text{UnspecifiedPostHocCause} \not\Rightarrow \text{OriginalPredictionRecovered}\,. \tag{458}
$$

If a revised model M_2 introduces a new physical contribution after evaluation of M_1, then

$$
M_1 \longrightarrow \text{FailedOrIncompleteAssessment} \tag{459}
$$

remains the historical status of the original test.

The revised model requires an independent evaluation:

$$
M_2 \longrightarrow D_{\text{new}}. \tag{460}
$$

This rule prevents an unrestricted residual or unspecified physical cause from making a quantitative model immune to failure.

25.15 Application-level failure

Suppose the predeclared application model predicts

$$
\widehat{\mathbf{D}}^{I} \tag{461}
$$

and the independent evaluation fails its declared acceptance criterion.

Then

$$
\text{ApplicationBridgeFailed} \tag{462}
$$

is warranted.

The direct consequence is rejection or revision of the tested application bridge within its declared domain.

It does not automatically follow that

$$\neg\,\mathrm{CMA}, \qquad \neg\,\mathrm{UCC}, \qquad \text{or} \qquad T_{\mathrm{ITOF}} \text{ is rejected.} \tag{463}$$

Formally,

$$\mathrm{ApplicationBridgeFailed} \not\Rightarrow \mathrm{FoundationalITOFRefuted}\,. \tag{464}$$

A foundational consequence requires an observable proposition derived from the relevant foundational commitment without the failed application-specific physical premise.

25.16 Foundationally direct test condition

Let F be a foundational commitment and O an observational proposition.

A direct foundational test requires

$$F \wedge \mathcal{P}_{\mathrm{aux}} \vdash O, \tag{465}$$

where $\mathcal{P}_{\mathrm{aux}}$ contains only independently established bridge conditions necessary to connect the foundational claim to observation.

If the same observable depends essentially on an additional speculative physical coupling law L,

$$F \wedge L \vdash O, \tag{466}$$

then failure of O does not by itself distinguish failure of F from failure of L.

Accordingly,

$$\neg O \wedge (F \wedge L \vdash O) \not\Rightarrow \neg F. \tag{467}$$

This distinction prevents an application-level clock model from carrying more foundational evidential weight than its derivation permits.

For a declared protocol P and evaluation context D, a stronger claim that an experiment discriminates between a foundational commitment F and a declared alternative $F^{\star}$ requires both candidate observable consequences to be independently linked to their physical bridges and auxiliary premises, and the claimed separation must be identifiable at the foundational level. Here $\mathrm{Warrant}_{P,D}$ denotes scientific warrant relative to the declared protocol and evaluation context for this comparison claim; it introduces no additional physical relation:

$$\boxed{\begin{aligned}&\mathrm{Warrant}_{P,D}\left[\mathrm{FoundationalDiscrimination}(F,F^{\star})\right]\\&\Longrightarrow \exists B_F, B_{\star}, \mathcal{P}_F, \mathcal{P}_{\star}, O_F, O_{\star}\ \Big[F \wedge B_F \wedge \mathcal{P}_F \vdash O_F\\&\qquad \wedge\ F^{\star} \wedge B_{\star} \wedge \mathcal{P}_{\star} \vdash O_{\star}\\&\qquad \wedge\ \mathrm{OutcomeIndependentSpecification}\left(B_F, B_{\star}, \mathcal{P}_F, \mathcal{P}_{\star}; P, D\right)\\&\qquad \wedge\ \mathrm{ProtocolFrozen}(P) \wedge \mathrm{NoEvaluationLeakage}(P,D)\\&\qquad \wedge\ \mathrm{PredictionSeparationBeyondCombinedUncertainty}\left(O_F, O_{\star}; P, D\right)\\&\qquad \wedge\ \mathrm{FoundationalAttributionIdentifiable}\left(F, F^{\star}; B_F, B_{\star}, \mathcal{P}_F, \mathcal{P}_{\star}; P, D\right)\Big].\end{aligned}} \tag{468}$$

The predicate OutcomeIndependentSpecification requires the bridges and auxiliary physical premises to be fixed or independently warranted without tuning to the outcome-sensitive evaluation. It does not require the two candidate models to have mutually independent calibrations, covariance terms, or physical-systematic inputs: shared inputs are admissible where their dependence is declared and represented in the covariance and provenance structure. Foundational attribution is identifiable only where differences in the bridges or auxiliaries cannot by themselves absorb the claimed observable separation. The condition is necessary, not sufficient: where no independently derived separation exceeds combined uncertainty, or where attribution remains confounded by bridge choice, the result may discriminate application models but does not warrant a claim of foundational empirical discrimination.

25.17 Direct countercondition to UCC

A direct physical countercondition to UCC would require positive warrant for

$$A \in \mathcal{U}_{\mathrm{phys}} \wedge s \in I_A \wedge \neg\, \mathrm{PhysReal}^{+}_{A}(s). \tag{469}$$

A null clock difference does not establish this condition:

$$D^{\mathrm{obs}}_{ij} = 0 \not\Rightarrow \neg\, \mathrm{PhysReal}^{+}_{A_i}(s). \tag{470}$$

Nor does it establish absence of physical change in A_j.

The clock test may fail to resolve a selected differential while both physical systems continue to change.

25.18 Direct countercondition to CMA

CMA has one governing contrary: failure of universal common cosmic-stage co-realization for the complete qualified population then realized. A carrier-specific clock difference does not establish that contrary:

$$d^{\mathrm{obs}}_{ij} \neq 0 \not\Rightarrow \neg\, \mathrm{CMA}\,. \tag{471}$$

Complete physical non-change of a qualified realized system is instead the direct contrary to

UCC, as stated in the preceding subsection. CMA and UCC therefore have separate challenge conditions. A challenge to CMA addresses the adopted common-stage ontology; a challenge to UCC addresses memberwise physical-change actuality within that ontology. Different physical states, clock outputs, spatial separations, or signal delays establish neither failure by themselves.

25.19 Integrated quantitative test condition

A strong discriminating application-level test satisfies

$$\begin{aligned}\mathrm{StrongDiscriminatingTest} \iff\ & \mathrm{ProtocolFrozen} \\ & \wedge \mathrm{IndependentPhysicalCouplingLaw} \\ & \wedge \mathrm{IndependentParameterProvenance} \\ & \wedge \mathrm{ValidPhysicalSystemBoundaries} \\ & \wedge \mathrm{ValidAcquisitionSupport} \\ & \wedge \mathrm{ValidCovariance} \\ & \wedge \mathrm{NoEvaluationLeakage} \\ & \wedge \mathrm{IdentifiableModel} \\ & \wedge \mathrm{PositiveDiscriminatingChannels} \\ & \wedge \mathrm{NullControlChannels} \\ & \wedge \mathrm{RivalPredictionSeparation} \\ & \wedge \mathrm{IndependentEvaluation} \\ & \wedge \mathrm{IndependentReplication}\,.\end{aligned} \tag{472}$$

Where the declared physical coupling predicts reversal or scaling, the corresponding predeclared relation is included as an additional test condition.

The inferential sequence is therefore

$$\begin{aligned}\mathrm{PhysicalHypothesis} & \longrightarrow \mathrm{IndependentPhysicalDerivation} \\ & \longrightarrow \mathrm{FrozenPrediction} \longrightarrow \mathrm{ControlledObservation} \\ & \longrightarrow \mathrm{ModelDiscrimination} \longrightarrow \mathrm{IndependentReplication}\,.\end{aligned} \tag{473}$$

No step of this sequence identifies a clock output with time.

25.20 Physical meaning of successful discrimination

If an independently derived ITOF-admissible physical application model is favoured over its declared rivals under the full protocol, the warranted conclusion is

$$\mathrm{DiscriminationFavours}(M_I) \Longrightarrow \mathrm{Warrant}\left[\mathrm{PhysicalResponseModelSupportedOn}(D_\star)\right]. \tag{474}$$

The conclusion concerns the physical response model and its declared domain.

It does not become

$$\text{DiscriminationFavours}(M_I) \Longrightarrow \text{ClockOutputIsTime}\,. \tag{475}$$

Nor does it establish that a numerical clock difference is a deformation of the common cosmic ordering.

25.21 Physical meaning of failed discrimination

If the independently derived prediction fails while the protocol, records, covariance, controls, and evaluation remain valid,

$$\text{PredictionFailed}_{D_\star}(M_I) \Longrightarrow \text{PhysicalApplicationModelRejectedOrRestricted}_{D_\star}(M_I). \tag{476}$$

The failure is scientifically meaningful precisely because the prediction was fixed before the outcome was known and cannot be rescued by unrestricted post-hoc adjustment.

25.22 Historical system-condition controls and their present status

Earlier ITOF versions used deliberately simple system-condition cases—a pressure-rated diving watch, thermal and direct-solar exposure, vibration, shock, and related operating conditions—to test the category boundary between a physical clock system and the entity denoted by time. Their retained lesson is schematic:

$$\text{DeclaredCondition}(C) \rightsquigarrow_{\text{phys}} \text{PhysicalResponse}(C) \rightsquigarrow_{\text{phys}} \text{RecordOutcome}(C), \tag{477}$$

while

$$\text{DeclaredCondition}(C) \not\Rightarrow \text{AlteredTime}\,. \tag{478}$$

A pressure-rated diving watch is therefore a useful system-control and failure case, not by itself a discriminating experiment against relativity: pressure, heat, vibration, shock, and construction-dependent disturbances are already physical effects in ordinary device physics.

The empirical bridge is consequently ordered in three levels:

$$\boxed{\text{SystemConditionControl} \longrightarrow \text{BenchmarkRecordRecovery} \longrightarrow \text{AdvanceModelDiscrimination}\,.} \tag{479}$$

The first localizes record differences in physical systems and record chains; the second requires recovery of established quantitative clock and signal records; the third requires a predeclared ITOF-admissible physical prediction that differs from relevant rival models by more than the warranted combined uncertainty. V36/F16 retains this hierarchy generically and does not promote any carrier-specific coefficient or diving-watch constitutive law into the foundational core.

25.23 Empirical role of current atomic-clock records

Modern atomic-clock comparisons provide physically precise record domains in which carrier response, gravitational-condition dependence, kinematic dependence, systematic control, and differential comparison can be tested at high sensitivity [13, 14, 15, 16, 17].

Such records may be used as recovery domains, independent evaluation domains, or external comparison data only according to their actual provenance and relation to the declared model.

Existing agreement with a benchmark does not become an independent prediction merely by being redescribed in ITOF terminology.

Likewise, an existing dataset cannot establish an advance nonzero ITOF application prediction when the carrier-specific coefficient was selected after that dataset was known.

25.24 No relabelled quantitative derivation

Let $\widehat{\mathbf{D}}^{B}$ be a benchmark prediction already available from another model.

The assignment

$$\widehat{\mathbf{D}}^{I} := \widehat{\mathbf{D}}^{B} \tag{480}$$

does not constitute an independent ITOF physical derivation.

Without independently specified physical-system response laws, coefficient provenance, acquisition relations, controls, detector relations, transfer terms, and record-production structure,

$$\widehat{\mathbf{D}}^{I} := \widehat{\mathbf{D}}^{B} \nRightarrow \mathrm{IndependentITOFApplicationBridge}\,. \tag{481}$$

The same numerical expression may serve as a benchmark, recovery target, external comparator, or independently derived prediction. These roles remain logically distinct.

25.25 Final quantitative separation

The quantitative architecture preserves the following distinctions:

$$\mathrm{PairwiseDefDistinct}(\mathrm{ClockPhysicalSystem}, \mathrm{ClockRecord}, \mathrm{ClockReading})\,, \tag{482}$$

$$\mathrm{ClockReading} \not\equiv_{\mathrm{type}} T_{\mathrm{ITOF}}, \tag{483}$$

$$\mathrm{Recovery} \not\equiv_{\mathrm{def}} \mathrm{AdvancePrediction}, \tag{484}$$

$$\mathrm{AdvancePrediction} \not\equiv_{\mathrm{def}} \mathrm{ModelDiscrimination}, \tag{485}$$

and

$$\mathrm{ModelDiscrimination} \not\equiv_{\mathrm{def}} \mathrm{TemporalIdentity}\,. \tag{486}$$

The complete bridge can therefore be summarized as

$$
\begin{aligned}
&\text{physical clock system} \\
&\quad \longrightarrow \text{physical condition and causal profile} \\
&\quad \longrightarrow \text{system-specific response model} \\
&\quad \longrightarrow \text{transition or oscillator response} \\
&\quad \longrightarrow \text{detector and acquisition response} \\
&\quad \longrightarrow \text{physical record} \\
&\quad \longrightarrow \text{standardized operational output} \\
&\quad \longrightarrow \text{predeclared quantitative comparison} \\
&\quad \longrightarrow \text{bounded model-level scientific conclusion.}
\end{aligned}
\tag{487}
$$

The common cosmic ordering remains the same throughout this chain. The clock, its physical response, its records, and its numerical outputs belong to the physical and operational description of the systems. They do not become the entity denoted by time in ITOF.

26. The Non-Transfer Principle

26.1 Logical scope

A mathematical object, physical model, coordinate system, clock output, signal relation, geometrical construction, or operational quantity may be useful, accurate, predictive, or empirically successful without thereby becoming identical with the entity denoted by time in ITOF.

The distinction concerns logical type. It does not depend on whether the object under consideration is mathematically simple or sophisticated, locally useful or widely successful.

For model object or operational quantity q, let

$$
\text{MathematicallyConsistent}_M(q) \tag{488}
$$

state that q occurs within a mathematically consistent declared model M, and let

$$
\text{OperationalSuccess}_{P,M,D}(q) \tag{489}
$$

state that use of q contributes successfully to prediction, reconstruction, measurement, comparison, or calculation under protocol P, model M, and physical domain D.

Principle 26.1 (Non-Transfer Principle — NTP)**.** Mathematical consistency and operational or predictive success do not transfer temporal identity to the successful mathematical, physical, or operational object:

$$
\boxed{\text{NTP}: \quad \text{MathematicallyConsistent}_M(q) \wedge \text{OperationalSuccess}_{P,M,D}(q) \nRightarrow q \equiv_{\text{type}} T_{\text{ITOF}}.} \tag{490}
$$

The principle protects the type distinction established by the governing definition

$$T_{\mathrm{ITOF}} = \left(\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \prec_{\mathrm{C}}\right). \tag{491}$$

A clock output remains a clock output. A coordinate remains a coordinate. A metric quantity remains a metric quantity. A physical record remains a physical record. A state vector remains a state vector. Their successful use does not supply a second definition of time.

26.2 Mathematical consistency and physical actuality

Mathematical consistency alone does not establish physical existence:

$$\mathrm{MathematicallyConsistent}_M(q) \not\Rightarrow \mathrm{ActuallyPhysicallyRealized}(q). \tag{492}$$

A physically meaningful application requires an independently warranted connection to actual physical systems, physical factors, interactions, conditions, records, or observable consequences.

Even physical realization does not itself establish temporal identity:

$$\mathrm{ActuallyPhysicallyRealized}(q) \not\Rightarrow q \equiv_{\mathrm{type}} T_{\mathrm{ITOF}}. \tag{493}$$

For compact reference, the two distinct non-entailments may be displayed together:

$$\boxed{\begin{gathered}\mathrm{MathematicallyConsistent}_M(q) \not\Rightarrow \mathrm{ActuallyPhysicallyRealized}(q),\\ \mathrm{ActuallyPhysicallyRealized}(q) \not\Rightarrow q \equiv_{\mathrm{type}} T_{\mathrm{ITOF}}.\end{gathered}} \tag{494}$$

The two lines are logically independent type and evidential restraints, not a transitive inference chain. The first blocks transfer from mathematical consistency to physical actuality. The second blocks transfer from physical actuality to temporal identity. The same two-step discipline applies, as appropriate, when evaluating coordinates, geometrical constructions, higher-dimensional model objects, quantum-state representations, signals, clocks, records, and other model or operational quantities. Their warranted mathematical or physical use remains type-distinct from temporal identity.

For example, a clock is physically real and its records are physically real, but

$$\mathrm{PhysicalSystem}(C) \wedge \mathrm{ClockRecord}(r_C) \not\Rightarrow [C \equiv_{\mathrm{type}} T_{\mathrm{ITOF}} \vee r_C \equiv_{\mathrm{type}} T_{\mathrm{ITOF}}]. \tag{495}$$

26.3 Prediction is not definition

A quantity may successfully predict physical records without defining time:

$$\mathrm{PredictsPhysicalRecords}(q) \not\equiv_{\mathrm{def}} \mathrm{DefinesTime}(q). \tag{496}$$

Likewise,

$$\mathrm{QuantitativeAgreement}(q) \not\Rightarrow q \equiv_{\mathrm{type}} T_{\mathrm{ITOF}}. \tag{497}$$

This distinction is especially important where an operational quantity has historically been named with the word “time.” Terminology does not determine logical type.

$$\mathrm{NameContainsTime}(q) \not\Rightarrow q \equiv_{\mathrm{type}} T_{\mathrm{ITOF}}. \tag{498}$$

The governing question is not how the quantity is named, but what the quantity is, how it is constructed, what physical or mathematical role it performs, and whether it satisfies the definition of T_{ITOF}.

27. Direct Confrontation with Relativistic Temporal Identifications

27.1 Foundational point of disagreement

Relativistic models have demonstrated substantial calculational and predictive utility in physical applications. ITOF recognizes those results as results of the corresponding models within the domains in which they are empirically warranted. This scientific acknowledgment is stated here once and does not qualify the foundational position that follows.

ITOF rejects identification of time with relativistic coordinate time, metric interval, proper-time functional, frame-dependent simultaneity relation, spacetime metric, foliation parameter, cosmological coordinate parameter, or clock output. The disagreement is direct and foundational: it concerns the identity of time.

The confrontation therefore separates two questions:

$$\mathrm{DoesModelPredictPhysicalRecordsSuccessfully?} \tag{499}$$

and

$$\mathrm{IsModelQuantityIdenticalWithITOFTime?} \tag{500}$$

The first is quantitative and empirical. The second is definitional and ontological. An affirmative answer to the first does not entail an affirmative answer to the second.

27.2 Relativistic quantity family

Let

$$\mathcal{Q}_{\mathrm{rel}} := \left\{ \begin{array}{l} x_F^{\mu},\ t_F,\ g_{\mu\nu},\ ds^2,\ \tau[\gamma,g],\ \Sigma_\lambda,\ \sim_F,\ J^{\pm}(p), \\ \mathrm{ClockOutput},\ \mathrm{MetricAge},\ \mathrm{CosmologicalParameter} \end{array} \right\} \tag{501}$$

denote the principal relativistic quantities and representations relevant to the present confrontation [3, 4, 5, 6, 7, 8, 9, 10].

The governing ITOF position is

$$\boxed{\forall q \in \mathcal{Q}_{\mathrm{rel}}, \qquad q \not\equiv_{\mathrm{type}} T_{\mathrm{ITOF}}.} \tag{502}$$

In particular,

$$t_F \not\equiv_{\text{type}} T_{\text{ITOF}}, \tag{503}$$
$$g_{\mu\nu} \not\equiv_{\text{type}} T_{\text{ITOF}}, \tag{504}$$
$$ds^2 \not\equiv_{\text{type}} T_{\text{ITOF}}, \tag{505}$$
$$\tau[\gamma, g] \not\equiv_{\text{type}} T_{\text{ITOF}}, \tag{506}$$
$$\text{ClockOutput} \not\equiv_{\text{type}} T_{\text{ITOF}}. \tag{507}$$

No coordinate transformation, synchronization convention, metric calculation, covariance property, successful prediction, or clock agreement changes these type relations.

27.3 Non-Transfer in the relativistic case

For any $q \in \mathcal{Q}_{\text{rel}}$,

$$\text{MathematicallyConsistent}_M(q) \wedge \text{OperationalSuccess}_{P,M,D}(q) \nRightarrow q \equiv_{\text{type}} T_{\text{ITOF}}. \tag{508}$$

No empirical success condition supplies temporal identity. In particular,

$$\text{OperationalSuccess}_{P,M,D}(q) \nRightarrow q \equiv_{\text{type}} T_{\text{ITOF}}. \tag{509}$$

Empirical adequacy has the evidential force warranted for the model and tested domain; it has no defining authority over time.

27.4 Coordinate representation and physical reality

Let $\mathcal{E}_{\text{phys}}$ be a declared family of physically realized events or manifestations and

$$\chi_F : \mathcal{E}_{\text{phys}} \longrightarrow \mathbb{R}^4 \tag{510}$$

a coordinate assignment in frame or chart F.

For physical event or manifestation e,

$$e \not\equiv_{\text{type}} \chi_F(e). \tag{511}$$

The physical event is not identical with its coordinate tuple.

Likewise, the universe as physical totality is not identical with a mathematical manifold–metric representation:

$$\boxed{\mathcal{U} \not\equiv_{\text{type}} (\mathcal{M}, g).} \tag{512}$$

A coordinate model may organize and successfully calculate relations among physical systems and records. Such success does not imply

$$(\mathcal{M}, g) \equiv_{\text{type}} \mathcal{U} \tag{513}$$

or

$$x_F^0 \equiv_{\text{type}} T_{\text{ITOF}}. \tag{514}$$

The physical manifestation remains represented within ITOF by

$$\text{ManifestationAt}(A, \chi; s), \qquad s \in I_A, \tag{515}$$

without identifying s with a coordinate value.

Exact-Change-Stage Restraint remains applicable: use of a coordinate system does not by itself identify the exact member of $\mathcal{S}_{\text{C}}^{\text{tot}}$ at which the manifestation is realized.

27.5 Different meanings of invariance

The invariance asserted by ITOF concerns the fixed identity of the one universal earlier–later ordering across physical systems and admissible representational choices. Non-interruption and non-termination are additional succession commitments and are not definitions of invariance.

ITOF invariance is not Lorentz invariance and is not general covariance:

$$\text{PairwiseDefDistinct}(\text{InvariantCosmicOrdering}, \text{LorentzInvariance}, \text{GeneralCovariance})\,. \tag{516}$$

Lorentz invariance concerns transformation properties of mathematical or physical expressions under Lorentz transformations.

General covariance concerns the form of physical equations under coordinate transformations.

Neither relation defines

$$T_{\text{ITOF}} = \left(\mathcal{S}_{\text{C}}^{\text{tot}}, \prec_{\text{C}}\right). \tag{517}$$

Accordingly,

$$\text{LorentzInvariant}(q) \not\Rightarrow q \equiv_{\text{type}} T_{\text{ITOF}}, \tag{518}$$

and

$$\text{GenerallyCovariant}(M) \not\Rightarrow \text{TimeDefinedBy}(M). \tag{519}$$

27.6 Coordinate time

For two inertial coordinate systems, a special-relativistic transformation may include

$$t' = \gamma\left(t - \frac{vx}{c^2}\right), \qquad \gamma = \frac{1}{\sqrt{1 - v^2/c^2}}. \tag{520}$$

The quantities t and t' are coordinate quantities in the relativistic representation.

Their transformation does not constitute transformation of T_{ITOF}:

$$t \neq t' \not\Rightarrow \mathrm{TimeTransformed}\,. \tag{521}$$

More explicitly,

$$\mathrm{LorentzTransform}(t, x; t', x') \not\Rightarrow \mathrm{Transform}\left(\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \prec_{\mathrm{C}}\right). \tag{522}$$

Different coordinate assignments therefore do not generate different cosmic extensions.

For physical event e,

$$t_F(e) \neq t_{F'}(e) \not\Rightarrow \mathrm{DifferentTimes}(F, F'). \tag{523}$$

They are different numerical assignments under different coordinate constructions.

27.7 Metric interval

The relativistic metric relation

$$ds^2 = g_{\mu\nu}\, dx^\mu dx^\nu \tag{524}$$

defines a geometrical model quantity.

It is not the universal cosmic ordering:

$$ds^2 \not\equiv_{\mathrm{type}} T_{\mathrm{ITOF}}. \tag{525}$$

A successful metric calculation may represent or predict physical relations involving paths, propagation, gravitational conditions, motion, or clock records.

It does not establish

$$\mathrm{MetricPredictionSuccessful} \Longrightarrow ds^2 \equiv_{\mathrm{type}} T_{\mathrm{ITOF}}. \tag{526}$$

Metric variation with modeled physical conditions likewise does not imply variation of time:

$$g_{\mu\nu} = g_{\mu\nu}(x) \not\Rightarrow T_{\mathrm{ITOF}} = T_{\mathrm{ITOF}}(x). \tag{527}$$

27.8 Proper-time functional

For timelike path γ, a proper-time functional may be written, under an adopted metric signature convention, as

$$\tau[\gamma, g] = \frac{1}{c}\int_\gamma \sqrt{-g_{\mu\nu}\, dx^\mu dx^\nu}. \tag{528}$$

The quantity depends on the path and metric model:

$$\tau = \tau[\gamma, g]. \tag{529}$$

ITOF rejects its identification with time:

$$\boxed{\tau[\gamma, g] \not\equiv_{\text{type}} T_{\text{ITOF}}.} \tag{530}$$

Different path-dependent values do not establish different times:

$$\tau[\gamma_1, g] \neq \tau[\gamma_2, g] \not\Rightarrow \text{DifferentTimes}(\gamma_1, \gamma_2). \tag{531}$$

Where a proper-time calculation predicts physical clock records successfully,

$$N_{C,P} \approx K_P\left(\tau[\gamma, g]\right), \tag{532}$$

the warranted result concerns the quantitative relation between the model quantity and the physical clock output.

It does not imply

$$\tau[\gamma, g] \equiv_{\text{type}} T_{\text{ITOF}}. \tag{533}$$

Nor is proper time along a worldline identical with the restriction of the common cosmic ordering to a physical-system identity-realization range:

$$\tau[\gamma_A, g] \not\equiv_{\text{type}} \prec_{\mathrm{C}}|_{I_A}. \tag{534}$$

The latter remains a restriction of the one universal ordering, not a private time belonging to A.

27.9 Relativity of simultaneity and the Cosmic Moment Axiom

Let

$$e_1 \sim_F e_2 \tag{535}$$

denote simultaneity assigned under relativistic frame and synchronization structure F.

Different frames may assign different simultaneity relations:

$$\exists e_1, e_2, F, F', \quad e_1 \sim_F e_2 \wedge \neg\left(e_1 \sim_{F'} e_2\right). \tag{536}$$

The relation $\sim_F$ is a model- and synchronization-dependent relation.

It is not the universal common cosmic-stage co-realization asserted by CMA:

$$\sim_F \not\equiv_{\text{type}} \text{CosmicCoPresence}_{\mathrm{C}}. \tag{537}$$

CMA states

$$\mathrm{CMA} \iff \forall s \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \quad \mathrm{CosmicCoPresence}_{\mathrm{C}}\left(\mathcal{S}_{\mathrm{phys}}(s); s\right). \tag{538}$$

Its claim is that the complete population of physical systems whose identities are realized at s is realized together at one and the same common cosmic stage.

This common cosmic-stage co-realization is not created by signal synchronization, coordinate convention, or clock agreement.

Accordingly,

$$\mathrm{SynchronizationConventionChanged} \not\Rightarrow \mathrm{CosmicCoPresenceChanged}. \tag{539}$$

A relativistic interpretation that denies the existence of any frame-independent universal common cosmic-stage co-realization for the complete then-existing physical-system population directly contradicts CMA:

$$\boxed{\mathrm{CMA} \wedge \left[\exists s \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}} : \neg\, \mathrm{CosmicCoPresence}_{\mathrm{C}}\left(\mathcal{S}_{\mathrm{phys}}(s); s\right)\right] \Longrightarrow \perp.} \tag{540}$$

The conflict in Equation (540) is foundational. It is not removed by reinterpreting CMA as a synchronization convention, because CMA is not defined operationally.

Conversely, the existence of coordinate-dependent simultaneity relations within a calculation does not by itself establish the negation of CMA. A direct conflict arises when those relations are given the stronger ontological interpretation that excludes the universal common cosmic-stage realization asserted by CMA. This foundational disagreement does not by itself generate an experimentally discriminating observable. Empirical discrimination requires an independently specified physical bridge that yields a distinct observable consequence with declared parameter provenance, controls, uncertainty, and model separation.

Physical association burden.

CMA is not identified with a relativistic coordinate hypersurface, a synchronization surface, a clock-equality class, or a signal-arrival surface. A concrete application that associates event or record data with a claimed common cosmic change stage therefore bears an additional model-level burden. For protocol P and model M,

$$\mathrm{CommonCosmicChangeStageDataClaim}_{P,M} \Longrightarrow \mathrm{DeclaredPhysicalAssociationBridge}_{P,M}, \tag{541}$$

For a given application, let $\mathcal{Q}_{P,M}^{\mathrm{assoc}}$ denote the set of association components that are physically applicable to that protocol and model, drawn from source attribution, propagation or path modeling, detector or interaction modeling, reconstruction rules, calibration, and uncertainty characterization. The bridge burden is then

$$\boxed{\begin{aligned} \mathrm{DeclaredPhysicalAssociationBridge}_{P,M} \Longrightarrow\ & \mathrm{ApplicabilitySetFixedIndependently}_{P,M}\left(\mathcal{Q}_{P,M}^{\mathrm{assoc}}\right) \\ & \wedge \forall q \in \mathcal{Q}_{P,M}^{\mathrm{assoc}},\ \mathrm{DeclaredAndWarranted}_{P,M}(q). \end{aligned}} \tag{542}$$

The applicability set must be fixed before outcome-sensitive evaluation or be justified by physical information independent of that outcome. A component that is physically inapplicable need not be artificially inserted, but its inapplicability must not be used post hoc to conceal a required propagation, source, detector, reconstruction, calibration, or uncertainty assumption. Coordinate notation alone does not supply this bridge. The bridge may warrant relative source development or bounded attribution without thereby identifying an exact member of $\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}$; the Exact-Change-Stage Restraint remains applicable.

27.10 Common cosmic change-stage realization is not instantaneous causation

CMA does not imply instantaneous physical interaction.

For $A, B \in \mathcal{S}_{\mathrm{phys}}(s)$,

$$\mathrm{CosmicCoPresence}_{\mathrm{C}}\left(\mathcal{S}_{\mathrm{phys}}(s); s\right) \not\Rightarrow \mathrm{InstantaneousCausalInfluence}(A, B; s). \tag{543}$$

Nor does it imply instantaneous signal transfer:

$$\mathrm{CosmicCoPresence}_{\mathrm{C}}\left(\mathcal{S}_{\mathrm{phys}}(s); s\right) \not\Rightarrow \mathrm{InstantaneousSignalTransfer}(A, B; s). \tag{544}$$

CMA concerns common cosmic-stage realization.

Signal propagation and causal influence concern physical interactions, paths, media, fields, and system-specific causal relations.

Spatial separation can alter access, delay records, and affect physical interactions without dividing the common cosmic change stage.

27.11 Relativistic foliation

Let

$$\mathfrak{F} = \{\Sigma_\lambda\}_{\lambda \in \Lambda} \tag{545}$$

be a mathematical foliation where such a construction is defined [5, 11].

A hypersurface is not automatically a common cosmic change stage:

$$\Sigma_\lambda \not\equiv_{\mathrm{type}} s, \qquad s \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}. \tag{546}$$

The existence of a global time function or foliation in a mathematical model does not establish the physical actuality of the ITOF common cosmic change-stage totality:

$$\mathrm{GlobalFoliationExists}(M) \not\Rightarrow \mathrm{ActuallyPhysicallyRealized}\left(\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \prec_{\mathrm{C}}\right). \tag{547}$$

The converse identification also fails:

$$\mathrm{CMA} \not\Rightarrow \exists! \mathfrak{F}\ \mathrm{ExactlyRepresents}\left(\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \prec_{\mathrm{C}}\right). \tag{548}$$

ITOF does not identify one coordinate foliation as the common cosmic change-stage totality.

27.12 No automatic preferred inertial frame

The existence of one universal cosmic ordering and one common cosmic change-stage realization does not by itself introduce a measurable preferred inertial frame.

$$\mathrm{CMA} \not\Rightarrow \mathrm{PreferredInertialFrame}\,. \tag{549}$$

Likewise,

$$T_{\mathrm{ITOF}} \not\equiv_{\mathrm{type}} \mathrm{PreferredVelocityField}\,. \tag{550}$$

Any hypothesis of a preferred motion state, measurable anisotropy, altered propagation law, or preferred dynamical frame would be an additional physical claim requiring its own model and empirical consequences.

Such a claim is not inserted into T_{ITOF}, CMA, or UCC.

27.13 Relativistic time-dilation expressions

A standard special-relativistic relation may be written

$$\Delta\tau = \frac{\Delta t}{\gamma}. \tag{551}$$

Within ITOF, Equation (551) is a relation among declared relativistic model quantities.

It is not an equation describing dilation of

$$T_{\mathrm{ITOF}}\,. \tag{552}$$

Therefore,

$$\Delta\tau \neq \Delta t \not\Rightarrow \mathrm{ITOFTimeDilated}\,. \tag{553}$$

Where the expression accurately predicts different physical clock records, the physical conclusion is

$$d_{12}^{\mathrm{obs}} \neq 0 \Longrightarrow \mathrm{DifferentPhysicalClockRecords}(C_1, C_2), \tag{554}$$

subject to the record-validity and comparison conditions already defined.

It does not follow that

$$\mathrm{DifferentRatesOfTime}(C_1, C_2). \tag{555}$$

The conventional phrase "time dilation" may identify a standard class of relativistic calculations. ITOF rejects its interpretation as a literal change in the entity denoted by time.

27.14 The separated-clock case

Let clock systems C_A and C_B undergo different physical histories and later participate in a comparison.

Their histories are

$$\mathcal{H}_{C_A} = \left(I_{C_A}, \prec_{\mathrm{C}}|_{I_{C_A}}, X_{C_A}, \Delta^{\mathrm{phys}}_{C_A}\right), \tag{556}$$

$$\mathcal{H}_{C_B} = \left(I_{C_B}, \prec_{\mathrm{C}}|_{I_{C_B}}, X_{C_B}, \Delta^{\mathrm{phys}}_{C_B}\right). \tag{557}$$

Their physical conditions may differ in motion, gravitational environment, thermal conditions, electromagnetic interactions, mechanical conditions, vibration, interrogation, control, transfer, and other physically relevant respects.

A later comparison may yield

$$d^{\mathrm{obs}}_{AB} = \Gamma_A(N_A) - \Gamma_B(N_B) \neq 0. \tag{558}$$

The result establishes different physical clock records under the declared comparison.

It does not establish

$$\mathrm{LessTimeFor}(C_A) \vee \mathrm{MoreTimeFor}(C_B). \tag{559}$$

Where both identities are realized at common cosmic stage s, CMA and UCC contribute distinct conclusions. First,

$$\begin{aligned} &C_A, C_B \in \mathcal{S}_{\mathrm{phys}}(s) \wedge \mathrm{CMA} \\ &\quad \Longrightarrow \mathrm{CosmicCoPresence}_{\mathrm{C}}\left(\mathcal{S}_{\mathrm{phys}}(s); s\right). \end{aligned} \tag{560}$$

Independently,

$$\begin{aligned} &C_A, C_B \in \mathcal{S}_{\mathrm{phys}}(s) \wedge \mathrm{UCC} \\ &\quad \Longrightarrow \mathrm{PhysReal}^{+}_{C_A}(s) \wedge \mathrm{PhysReal}^{+}_{C_B}(s). \end{aligned} \tag{561}$$

Therefore, under the conjunction of CMA and UCC, the two clock systems share literally the same common cosmic change stage while each realizes its own system-specific physical change at that stage. Different physical histories and different outputs therefore remain differences within one common cosmic succession.

27.15 Gravitational clock comparison

A weak-field comparison may contain the standard leading relation

$$\frac{\Delta\nu}{\nu} \simeq \frac{\Delta\Psi}{c^2}, \tag{562}$$

within its declared approximation domain.

In ITOF,

$$\frac{\Delta \nu}{\nu} \tag{563}$$

is a difference in physical transition or clock-record quantities under different physical conditions.

It is not a difference in time:

$$\frac{\Delta \nu}{\nu} \neq 0 \not\Rightarrow \text{ITOFGravitationalTimeDilation}\,. \tag{564}$$

The physical clock bridge represents such response through system-specific conditions and coefficients:

$$\frac{\Delta \nu}{\nu} = \mathcal{Q}_M\left(\Delta\Psi, \Delta\mathbf{v}, \Delta Z, \Pi, \theta, J^{\text{phys}}\right). \tag{565}$$

The phrase "gravitational redshift" may remain a conventional name for the frequency relation.

The relation does not establish that time is curved, slowed, stretched, accelerated, or position-dependent.

27.16 Gravitational geometry

General relativity represents gravitation through geometrical quantities satisfying equations including

$$G_{\mu\nu} + \Lambda g_{\mu\nu} = \frac{8\pi G}{c^4} T_{\mu\nu}. \tag{566}$$

These equations may successfully relate metric quantities, matter-energy models, trajectories, gravitational systems, propagation, and physical records [4, 5].

Such success does not establish

$$g_{\mu\nu} \equiv_{\text{type}} T_{\text{ITOF}}. \tag{567}$$

Metric curvature likewise does not imply curvature of time:

$$R^{\rho}{}_{\sigma\mu\nu} \neq 0 \not\Rightarrow \text{ITOFTimeCurved}\,. \tag{568}$$

The curvature tensor is a geometrical object of the adopted model.

The universal cosmic ordering

$$\left(\mathcal{S}_{\mathrm{C}}^{\text{tot}}, \prec_{\mathrm{C}}\right) \tag{569}$$

is not a metric field and is assigned no curvature tensor.

ITOF therefore rejects the identification of spacetime geometry with the identity of time.

27.17 Light cones and causal accessibility

For modeled event p, relativistic causal domains

$$J^{+}(p), \qquad J^{-}(p) \tag{570}$$

represent causal accessibility according to the adopted spacetime model.

They are not the common cosmic change-stage totality:

$$J^{\pm}(p) \not\equiv_{\text{type}} \mathcal{S}_{\text{C}}^{\text{tot}}. \tag{571}$$

Causal accessibility and cosmic ordering therefore remain distinct:

$$\text{CausallyAccessible}(e_1, e_2) \not\equiv_{\text{def}} \text{CosmicallyOrdered}(e_1, e_2). \tag{572}$$

Two spatially separated systems may belong to the same common cosmic change-stage population while no signal has yet propagated between them.

Thus,

$$A, B \in \mathcal{S}_{\text{phys}}(s) \wedge \text{SignalNotYetReceived}(A, B; s) \not\Rightarrow \neg\,\text{PhysReal}_{B}^{+}(s). \tag{573}$$

Signal access does not determine whether the distant system participates in the common cosmic change stage.

27.18 Einstein synchronization

Einstein synchronization constructs relations among separated clock outputs through signal transmission and declared propagation assumptions.

Let

$$\text{Sync}_{\text{E}} \tag{574}$$

denote such an operational synchronization relation.

Then

$$\text{Sync}_{\text{E}} \not\equiv_{\text{type}} \text{CosmicCoPresence}_{\text{C}}\,. \tag{575}$$

Changing a synchronization convention can alter coordinate assignments without altering the objective common cosmic change-stage realization:

$$\text{SynchronizationConventionChanged} \not\Rightarrow \text{CommonCosmicChangeStageRealizationChanged}\,. \tag{576}$$

Synchronization therefore neither creates CMA nor replaces it.

27.19 GPS and navigation

GPS and related navigation systems combine satellite physical systems, clock systems, orbital models, signal emission, propagation, receiver systems, coordinate assignments, synchronization conventions, physical corrections, and record processing [12].

Let

$$\mathrm{NavigationError} \le \varepsilon_{\mathrm{nav}} \tag{577}$$

represent a declared operational accuracy condition.

Then

$$\mathrm{NavigationError} \le \varepsilon_{\mathrm{nav}} \Longrightarrow \mathrm{GPSOperationalSuccess}\,. \tag{578}$$

This establishes adequacy of the integrated navigation system within the declared domain.

It does not establish

$$t_{\mathrm{GPS}} \equiv_{\mathrm{type}} T_{\mathrm{ITOF}}. \tag{579}$$

Nor do different clock corrections establish different rates of time:

$$\mathrm{DifferentGPSClockCorrections} \not\Rightarrow \mathrm{DifferentRatesOfTime}\,. \tag{580}$$

GPS success is therefore success of a physical clock, orbit, signal, coordinate, synchronization, correction, and record-processing architecture.

It is not evidence that signals transport time, that clocks possess private temporal extensions, or that the universal cosmic ordering has different local rates.

27.20 Relativistic cosmological parameter

A cosmological model may introduce

$$ds^2 = -c^2 dt_{\mathrm{cos}}^2 + a^2(t_{\mathrm{cos}})\, d\Sigma_k^2. \tag{581}$$

The parameter t_{cos} belongs to that cosmological model.

Even where it organizes a useful family of hypersurfaces,

$$t_{\mathrm{cos}} \not\equiv_{\mathrm{type}} T_{\mathrm{ITOF}}. \tag{582}$$

A model-derived cosmological age such as

$$t_{\mathrm{age}} = \int_{a_{\mathrm{i}}}^{a_0} \frac{da}{aH(a;\Omega_i,\ldots)} \tag{583}$$

is likewise a model-derived quantitative magnitude.

It does not count common cosmic change stages:

$$\text{CosmologicalAgeComputed}(t_{\text{age}}) \not\Rightarrow \text{CommonCosmicChangeStagesCounted}\,. \tag{584}$$

The optional Cosmic Origin commitment in ITOF and an origin parameter or boundary in a relativistic cosmological model therefore remain logically distinct.

27.21 Attainment and block descriptions: recall

Change-stage-relative attainment was defined before the full physical-system identity-realization treatment in Equations (18)–(21). The distinction is recalled here because a full relativistic or cosmological model may represent an extensive domain without thereby establishing that every member of the ITOF full common cosmic change-stage totality is already attained relative to an attained reference change stage. Under Non-Terminating Cosmic Succession, Equation (22) excludes that identification.

27.22 Formal reversal and physical irreversibility

A physical equation may admit a formal parameter transformation

$$\lambda \longmapsto -\lambda. \tag{585}$$

Such a transformation does not reverse the actual cosmic ordering.

For actual common cosmic change stages,

$$r \prec_{\mathrm{C}} s \Longrightarrow \neg\,(s \prec_{\mathrm{C}} r)\,. \tag{586}$$

Accordingly,

$$\text{ModelInvariantUnder}(\lambda \mapsto -\lambda) \not\Rightarrow \text{CosmicOrderingReversed}\,. \tag{587}$$

A reversed mathematical solution, reversed film, reconstructed earlier condition, or later recurrence of a selected physical state does not make a later common cosmic change stage earlier.

27.23 Summary of the relativistic confrontation

The type-level conclusion is

$$\boxed{\forall q \in \mathcal{Q}_{\text{rel}}, \qquad q \not\equiv_{\text{type}} T_{\text{ITOF}}.} \tag{588}$$

Quantitative performance is a separate empirical question and cannot reopen or revise this type relation. The governing temporal definition remains

$$T_{\text{ITOF}} = \left(\mathcal{S}_{\mathrm{C}}^{\text{tot}}, \prec_{\mathrm{C}}\right), \tag{589}$$

with $\mathcal{E}_{\mathrm{C}} := (\mathcal{S}_{\mathrm{C}}^{\text{tot}}, \prec_{\mathrm{C}})$ retained only as the name of the same non-metric common extension represented by that ordering and succession, and with CSPP supplying nonempty common cosmic-stage population, CMA supplying universal common cosmic-stage co-realization of the complete then-existing population, and UCC separately supplying memberwise system-specific physical-change actuality throughout each realized identity history.

Relativistic coordinate, metric, proper-time, simultaneity, and geometrical quantities therefore remain outside the denotation of time in ITOF. Where an ontological interpretation denies the universal common cosmic-stage co-realization asserted by CMA, the conflict is direct and foundational.

28. Signals, Light, and Remote Physical Access

28.1 Signal propagation

A signal relation contains a physical source, emission process, propagation process, path conditions, receiver interaction, detector response, and record production.

For declared source–receiver chain Γ, an operational record lag may be represented by

$$L_\Gamma^{\mathrm{rec}} = L_\Gamma^{\mathrm{emit}} + L_\Gamma^{\mathrm{prop}} + L_\Gamma^{\mathrm{path}} + L_\Gamma^{\mathrm{interaction}} + L_\Gamma^{\mathrm{detect}} + L_\Gamma^{\mathrm{process}}. \tag{590}$$

The terms represent operationally quantified physical contributions.

A positive record lag does not imply multiple times:

$$L_\Gamma^{\mathrm{rec}} > 0 \nRightarrow \mathrm{MultipleTimesExist}\,. \tag{591}$$

Signal propagation likewise does not transport time:

$$\mathrm{SignalPropagation}(S \to D) \nRightarrow \mathrm{TimeTransported}(S \to D). \tag{592}$$

The physical signal, source, receiver, detector, and environment undergo their own system-specific physical changes within the one common cosmic succession.

28.2 Remote records

For remote source A_S, detector or receiving system A_D, and record r, a valid physical chain may be represented by

$$\mathrm{SourceChange} \longrightarrow \mathrm{Emission} \longrightarrow \mathrm{Propagation} \longrightarrow \mathrm{ReceiverInteraction} \longrightarrow \mathrm{RecordFormation}\,. \tag{593}$$

The received record is not the remote source change:

$$r \not\equiv_{\mathrm{type}} \mathrm{SourceChange}\,. \tag{594}$$

It is also not the exact common cosmic change stage at which the source manifestation was realized:

$$r \not\equiv_{\mathrm{type}} s_S, \qquad s_S \in I_{A_S}. \tag{595}$$

A valid remote record may warrant

$$\mathrm{Warrant}_{P,M}\left[\exists s \in I_{A_S}\ \mathrm{ManifestationAt}(A_S, \chi; s)\right], \tag{596}$$

without identifying that exact s.

Delay in access therefore does not mean delay in the remote system's participation in common cosmic change-stage realization:

$$\mathrm{RemoteAccessDelayed}(A_S, A_D) \not\Rightarrow \mathrm{RemotePhysicalChangeDelayed}(A_S). \tag{597}$$

28.3 Successive stellar records and source-development reconstruction

The distinction between source history and delayed access is especially clear for a distant star. Let two physically attributable source manifestations E_1 and E_2 occur in the same stellar identity with $E_1 \prec_{\mathrm{C}} E_2$, and let their associated records be received at a terrestrial detector with reconstructed arrival separation Δ_{arr}. A declared source–path–detector model may write

$$\boxed{\Delta_{\mathrm{arr}} = \Delta_{\mathrm{src}} + \Delta_{\mathrm{prop}},} \tag{598}$$

where Δ_{src} is the source-development separation represented by the two records and Δ_{prop} is the differential propagation, path, and reconstruction contribution. If the latter is controlled by

$$|\Delta_{\mathrm{prop}}| \leq \varepsilon_{\mathrm{prop}}, \tag{599}$$

then

$$|\Delta_{\mathrm{arr}} - \Delta_{\mathrm{src}}| \leq \varepsilon_{\mathrm{prop}}. \tag{600}$$

The potentially enormous common first-arrival latency from the distant source is not itself the quantity compared in this differential reconstruction. What matters is the difference in propagation conditions between successive records. Any warranted non-unit scaling, cosmological correction, lensing, medium effect, source motion, or detector contribution belongs explicitly to the physical propagation and reconstruction model rather than to a rate of T_{ITOF}.

A star may be observationally stable under a declared criterion and later show a resolvable development—for example over days, weeks, months, or longer—in successive records. Such prior observational stability does not mean complete physical stasis; the UCC expresses uninterrupted memberwise change throughout the stellar identity's realized history. The later record sequence can support an ordered source history when source identity, attribution, propagation, detection, calibration, and uncertainty are controlled.

Receiving today a record that carries information about an earlier stellar condition does not place a presently existing star in a private "past time." If the stellar identity and the terrestrial detector identity are both realized at a current common cosmic stage a, CMA requires both to be realized at literally that same current common cosmic stage a; UCC separately requires each to realize its own system-specific physical change there throughout its applicable identity history. Under the joint CMA–UCC realization architecture, that common stage bears the full-theory common cosmic change-stage role. The arriving record may warrant information about a source manifestation at some $r \prec_{\mathrm{C}} a$; the record-arrival common cosmic change stage is not thereby the source common cosmic change stage at which that manifestation occurred. This bridge supports relative historical reconstruction; it does not by itself prove CMA or identify the exact cosmic change-stage member of the remote manifestation.

28.4 Light and radiation

A radiation pulse, photon-qualified entity, beam, excitation, or field object is admitted to $\mathcal{U}_{\text{phys}}$ only where it independently satisfies the applicable physical-system identity criterion.

Thus,

$$\text{RadiationModelObject}(q) \not\Rightarrow \text{PhysicalSystem}(q). \tag{601}$$

Where a radiation entity R is independently classified as a physical system,

$$R \in \mathcal{S}_{\text{phys}}(s) \wedge \text{UCC} \Longrightarrow \text{PhysReal}^{+}_{R}(s). \tag{602}$$

Propagation, scattering, attenuation, interference, refraction, lensing, spectral change, or path deviation concerns physical radiation systems, fields, media, sources, detectors, and models.

Optical path deviation is not bending of time:

$$\text{OpticalPathDeviation}(R) \not\Rightarrow \text{TimeBent}\,. \tag{603}$$

Radiation arrival delay is not delay of time:

$$\text{RadiationArrivalDelay}(R) \not\Rightarrow \text{TimeDelayed}\,. \tag{604}$$

The physical explanation remains assigned to the radiation process and its physical conditions.

29. Quantum States, Records, and Physical-System Classification

29.1 Quantum model object and physical-system identity

A state vector, wavefunction, density operator, operator assignment, path amplitude, entanglement relation, superposition symbol, or collapse notation is not automatically a physical-system identity.

For example,

$$\text{ModelState}\left(|\psi\rangle\right) \not\Rightarrow \text{PhysicalSystem}\left(|\psi\rangle\right), \tag{605}$$

and

$$\text{DensityOperator}(\rho) \not\Rightarrow \text{PhysicalSystem}(\rho). \tag{606}$$

The model objects may represent physical states, correlations, probabilities, or physical-system configurations under a declared quantum model.

Their mathematical status does not make them independent physical systems.

They are also not time:

$$|\psi\rangle \not\equiv_{\text{type}} T_{\text{ITOF}}, \qquad \rho \not\equiv_{\text{type}} T_{\text{ITOF}}. \tag{607}$$

29.2 Quantum-state classification does not determine system number

For joint quantum state q_{AB},

$$\text{JointQuantumState}(q_{AB}) \not\Rightarrow \text{PhysicalSystemNumber}(q_{AB}). \tag{608}$$

The physically warranted classification may involve several interacting physical systems, one composite system, a state assigned jointly to several systems, or another organization established by the applicable physical identity criteria.

Superposition and entanglement therefore do not independently decide whether the physical ontology contains one system or several.

29.3 Quantum measurement

Where apparatus, source, field, particle, detector, and record-bearing entities independently satisfy physical-system criteria, CMA and UCC apply according to their distinct roles in the same way as to other qualified physical systems.

A detector outcome is a physical record relation:

$$\text{QuantumDetectorOutcome}(r) \not\equiv_{\text{type}} T_{\text{ITOF}}. \tag{609}$$

A probability assignment is likewise not time:

$$P(o|\psi, M) \not\equiv_{\text{type}} T_{\text{ITOF}}. \tag{610}$$

If collapse terminology denotes an actual physical transformation of a physical system, the transformation belongs to the physical history of that system and is realized at an actual common cosmic change stage.

If collapse terminology denotes a change in model assignment or information state, the change belongs to the representational level.

Neither interpretation creates a private time or a second cosmic ordering.

29.4 Delayed-choice and quantum-eraser records

Delayed-choice and quantum-eraser arrangements contain physical source systems, apparatus settings, paths, detectors, selection procedures, coincidence relations, and final records [21, 22, 23].

A later record classification does not alter the earlier physical realization that occurred at an attained common cosmic change stage:

$$\text{LaterCorrelationClassification}(r) \not\Rightarrow \text{EarlierPhysicalRealizationAltered}\,. \tag{611}$$

Nor does a delayed-choice record create another cosmic order:

$$\text{DelayedChoiceRecord}(r) \not\Rightarrow \exists \prec_{\mathrm{C}}' \neq \prec_{\mathrm{C}} . \tag{612}$$

The observed quantum correlations remain relations among physical systems and physically produced records within the one irreversible cosmic ordering.

30. Higher-Dimensional and Coordinate Constructions

30.1 Mathematical dimension and physical existence

Let $\mathcal{M}_n$ be an n-dimensional mathematical manifold, embedding space, or coordinate model.

Its mathematical consistency may be stated as

$$\text{MathematicallyConsistent}(\mathcal{M}_n). \tag{613}$$

Mathematical consistency does not establish physical realization of every dimension:

$$\text{MathematicallyConsistent}(\mathcal{M}_n) \not\Rightarrow \text{AllDimensionsPhysicallyReal}(\mathcal{M}_n). \tag{614}$$

Nor does a coordinate dimension become time:

$$x^j \not\equiv_{\text{type}} T_{\text{ITOF}}. \tag{615}$$

An additional coordinate dimension in a model therefore does not establish another cosmic time:

$$\text{ExtraCoordinateDimensionExistsInModel} \not\Rightarrow \text{AdditionalCosmicTimeExists} . \tag{616}$$

A higher-dimensional model may represent physical relations if a physically warranted correspondence is independently established.

Its formal existence alone establishes neither a new physical system nor an additional cosmic extension.

30.2 Coordinate transformations

For coordinate representation

$$x' = \Phi(x), \tag{617}$$

the transformation changes the representation.

It does not transform the universal cosmic ordering:

$$x' = \Phi(x) \not\Rightarrow \text{Transform}\left(\mathcal{S}_{\mathrm{C}}^{\text{tot}}, \prec_{\mathrm{C}}\right). \tag{618}$$

Likewise, for arbitrary $s_1, s_2 \in I_A$, equality of selected spatial coordinates does not establish complete physical stasis:

$$x_P(A;s_1) = x_P(A;s_2) \not\Rightarrow X_A(s_1) = X_A(s_2). \tag{619}$$

Coordinates represent declared relations. They do not replace physical-system states, physical histories, common cosmic change stages, or time.

31. Integrated Non-Transfer Result

The cross-domain applications above are governed by one type rule. Mathematical consistency, physical realization, operational usefulness, and predictive success are distinct from temporal identity.

For any model or operational quantity q,

$$\mathrm{MathematicallyConsistent}_M(q) \wedge \mathrm{OperationalSuccess}_{P,M,D}(q) \not\Rightarrow q \equiv_{\mathrm{type}} T_{\mathrm{ITOF}}. \tag{620}$$

Where the physical reality of q is itself at issue,

$$\mathrm{MathematicallyConsistent}_M(q) \not\Rightarrow \mathrm{ActuallyPhysicallyRealized}(q). \tag{621}$$

Where q is independently established as physically realized,

$$\mathrm{ActuallyPhysicallyRealized}(q) \not\Rightarrow q \equiv_{\mathrm{type}} T_{\mathrm{ITOF}}. \tag{622}$$

Accordingly, clocks, signals, coordinates, metric quantities, proper-time functionals, simultaneity relations, foliations, quantum-state representations, cosmological parameters, and higher-dimensional coordinate constructions retain the physical or mathematical roles warranted for them without becoming the entity denoted by time.

For the relativistic family introduced in Section 27,

$$\forall q \in \mathcal{Q}_{\mathrm{rel}}, \qquad q \not\equiv_{\mathrm{type}} T_{\mathrm{ITOF}}. \tag{623}$$

This type conclusion is fixed by the governing definition: calculational or operational success cannot transfer temporal identity. The governing temporal referent remains Equation (3), and the governing realization/change architecture remains the distinct conjunction of CMA and UCC.

32. Scope, Limits, and Foundational Status

32.1 Scope of the V36/F16 architecture

V36/F16 distinguishes the minimal temporal definition, the governing cosmic-succession conditions, the universal common cosmic change-stage realization architecture, the physical-change and causal architecture, the identity-history architecture, the lifecycle architecture, the observational architecture, and the application-level quantitative architecture.

These levels are connected but are not interchangeable.

The minimal temporal definition is

$$T_{\mathrm{ITOF}} = \left(\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \prec_{\mathrm{C}}\right). \tag{624}$$

The notation $\mathcal{E}_{\mathrm{C}} := (\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \prec_{\mathrm{C}})$ names the same common non-metric extension and adds no further temporal layer.

The governing V36/F16 cosmic-succession conditions on this ordered pair are

$$\mathrm{StrictTotalOrder}\left(\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \prec_{\mathrm{C}}\right), \tag{625}$$

$$\mathrm{NoInterruption}_{\mathrm{C}}\left(\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \prec_{\mathrm{C}}\right), \tag{626}$$

and

$$\mathrm{NoTerminalStage}_{\mathrm{C}}\,. \tag{627}$$

These succession conditions constrain the full V36/F16 architecture but do not enlarge the temporal definition in Equation (624), introduce a metric component, or turn cosmic succession into a physical cause of system change.

The universal common cosmic change-stage realization architecture adopts three distinct foundational inputs:

$$\mathrm{CSPP}, \qquad \mathrm{CMA}, \qquad \mathrm{UCC}, \tag{628}$$

where CSPP governs population nonemptiness, CMA governs common cosmic-stage unity, and UCC governs system-specific physical change throughout realized identity histories.

The causal architecture adds

$$\mathrm{CRP}, \tag{629}$$

with exactly the three physical causal-source classes

$$\mathfrak{C}_A(s) = \left(\mathcal{C}_A^{\mathrm{int}}(s), \mathcal{C}_A^{\text{ext-sys}}(s), \mathcal{C}_A^{\text{ext-fac}}(s)\right). \tag{630}$$

The identity-history architecture adds

$$I_A, \qquad \mathrm{IdentityRealizationConvexity}, \qquad \mathrm{AFB}, \qquad \mathcal{H}_A. \tag{631}$$

The lifecycle architecture contains

$$\mathrm{End}_A(e), \qquad \mathrm{PIECP}, \qquad \mathrm{UEIE}, \qquad \mathrm{SuccAt}(A, B; e) \tag{632}$$

with their distinct logical statuses.

The observational and application layers add records, measurement outputs, Exact-Change-Stage Restraint, clocks, physical response models, predeclared quantitative tests, the Non-Transfer Principle, and external confrontation with relativistic temporal identifications.

No later layer redefines Equation (624).

32.2 Cosmic succession and physical change

The common cosmic succession and system-specific physical change are distinct:

$$\text{UninterruptedCosmicSuccession} \not\equiv_{\text{def}} \text{SystemSpecificPhysicalChange}\,. \tag{633}$$

The first concerns the universal common cosmic-stage carrier, its ordering, and its succession.

The second concerns physical systems realized at members of that common cosmic-stage carrier.

Consequently,

$$\text{NoTerminalStage}_{\text{C}} \not\Rightarrow \text{UCC}, \tag{634}$$

and

$$\text{UCC} \not\Rightarrow \text{NoTerminalStage}_{\text{C}}\,. \tag{635}$$

The full V36/F16 position therefore adopts non-terminal cosmic succession together with the distinct CMA and UCC commitments: CMA fixes universal common cosmic-stage unity, while UCC requires every continuing physical-system identity to undergo its own physical change throughout its realized identity range.

32.3 No terminal common cosmic stage

V36/F16 places non-termination directly in the cosmic-succession architecture:

$$\text{NoTerminalStage}_{\text{C}} \Longleftrightarrow \forall s \in \mathcal{S}_{\text{C}}^{\text{tot}}\ \exists t \in \mathcal{S}_{\text{C}}^{\text{tot}}\ (s \prec_{\text{C}} t)\,. \tag{636}$$

Therefore,

$$\nexists g \in \mathcal{S}_{\text{C}}^{\text{tot}} \quad \text{Greatest}_{\prec_{\text{C}}}(g). \tag{637}$$

Since $\mathcal{S}_{\text{C}}^{\text{tot}} \neq \varnothing$ and is strictly totally ordered,

$$\text{Infinite}(\mathcal{S}_{\text{C}}^{\text{tot}}) \tag{638}$$

follows without invoking UEIE, AFB, PIECP, or successor production.

The continuation of the universal cosmic succession is therefore logically independent of the ending history of any particular physical-system identity.

32.4 Cosmic Origin

Cosmic Origin remains a separate cosmological commitment:

$$\text{CosmicOrigin} \Longleftrightarrow \exists! s_{\text{C}}^{0} \in \mathcal{S}_{\text{C}}^{\text{tot}} \left[\nexists r \in \mathcal{S}_{\text{C}}^{\text{tot}} \left(r \prec_{\text{C}} s_{\text{C}}^{0}\right)\right]. \tag{639}$$

It is not required by the definition of time, strict ordering, CMA, UCC, or non-terminal succession. Accordingly,

$$\left\{T_{\mathrm{ITOF}} = \left(\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \prec_{\mathrm{C}}\right)\right\} \nvdash \mathrm{CosmicOrigin}\,. \tag{640}$$

Where Cosmic Origin is adopted,

$$\mathrm{CosmicOrigin} \wedge \mathrm{NoTerminalStage}_{\mathrm{C}} \Longrightarrow \exists s \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}} \left(s_{\mathrm{C}}^{0} \prec_{\mathrm{C}} s\right). \tag{641}$$

No separate postulate of extension beyond the origin is required.

32.5 Scope of CMA

CMA states universal common cosmic-stage realization:

$$\mathrm{CMA} \Longleftrightarrow \forall s \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \quad \mathrm{CosmicCoPresence}_{\mathrm{C}}\left(\mathcal{S}_{\mathrm{phys}}(s); s\right). \tag{642}$$

Its content is stronger than the assertion that one mathematical domain exists.

For every actual common cosmic change stage, the complete then-existing physical-system population is realized together at that same common cosmic change stage.

The common cosmic change-stage totality is therefore not partitioned into private temporal sequences belonging to individual systems.

For $A, B \in \mathcal{S}_{\mathrm{phys}}(s)$,

$$s \in I_A \cap I_B \tag{643}$$

means one and the same common cosmic change stage.

It does not mean two system-private change stages declared equivalent by convention.

CMA does not impose a common state space or cross-system state equality. For numerically distinct co-realized physical systems,

$$\mathrm{CMA} \nRightarrow \Omega_A = \Omega_B, \tag{644}$$

and, where independently declared maps into a common state-comparison space make a comparison well typed, CMA likewise does not imply equality of the mapped state values.

CMA also does not impose one common change-content type:

$$\mathrm{CMA} \nRightarrow \Xi_A = \Xi_B, \tag{645}$$

Where an application supplies an admissible common comparison space, equality of selected mapped change-content values, if it occurs, does not identify the system-indexed physical-change realizations: they remain necessarily distinct for numerically distinct physical systems. This system-level distinction does not require all underlying physical processes or contributors to be disjoint across scientifically warranted system boundaries.

Nor does CMA impose instantaneous interaction:

$$\text{CMA} \nRightarrow \text{InstantaneousUniversalInteraction}\,. \tag{646}$$

Spatial separation, signal delay, and causal accessibility affect physical interaction and observational access. They do not divide the common cosmic change stage.

32.6 Scope of UCC

UCC states

$$\text{UCC} \iff \forall A \in \mathcal{U}_{\text{phys}}\, \forall s \in I_A, \quad \text{PhysReal}^{+}_{A}(s). \tag{647}$$

It requires actual system-specific physical change throughout every realized physical-system identity.

It does not specify one universal change magnitude:

$$\text{UCC} \nRightarrow \exists \mu_{\text{univ}} \quad \forall A, s, \quad \text{Magnitude}_A(s) = \mu_{\text{univ}}. \tag{648}$$

It does not specify one universal mechanism:

$$\text{UCC} \nRightarrow \text{UniversalChangeMechanism}\,. \tag{649}$$

It does not require mathematical continuity:

$$\text{UCC} \nRightarrow \text{MathematicalContinuity}\left(\Delta^{\text{phys}}_{A}\right). \tag{650}$$

It does not entail ending:

$$\text{UCC} \nRightarrow \text{UEIE}\,. \tag{651}$$

It does not entail a retained cumulative resultant:

$$I^{<s}_{A} \neq \varnothing \wedge \text{UCC} \nRightarrow \text{CumulativePhysicalResultThrough}_A(s). \tag{652}$$

UCC therefore remains the separate universal actuality-of-change commitment and is not expanded into claims concerning magnitude, retention, ending, observability, or quantitative clock response.

32.7 Causal scope

For every realized change,

$$\text{PhysReal}^{+}_{A}(s) \Longrightarrow \mathcal{C}^{\text{act}}_{A}(s) \neq \varnothing. \tag{653}$$

The causal-source classes remain exhausted by

$$\mathcal{C}_A^{\mathrm{int}}(s), \qquad \mathcal{C}_A^{\text{ext-sys}}(s), \qquad \mathcal{C}_A^{\text{ext-fac}}(s). \tag{654}$$

No additional causal-source class is created for time, common cosmic change stage, ordering, history, accumulation, or cumulative-result notation.

Thus,

$$\forall q \in \left\{ \begin{array}{c} T_{\mathrm{ITOF}},\ s,\ \prec_{\mathrm{C}},\ \mathcal{H}_A, \\ \mathrm{HistoricalPhysicalAccumulation}_A^{<s} \end{array} \right\}, \qquad q \not\equiv_{\mathrm{type}} \mathrm{PhysicalCausalContributor}\,. \tag{655}$$

An effect of earlier change that remains physically embodied and currently operative is classified according to its actual present physical status, not as a historical cause acting from the past.

32.8 Historical accumulation and present result

For the expressions in this subsection, assume the domain condition $I_A^{<s} \neq \varnothing$ under which the earlier-history restriction and historical-accumulation designation are defined.

V36/F16 preserves the distinction

$$\mathrm{PairwiseDefDistinct}\begin{pmatrix} \mathcal{H}_A^{<s} \\ \mathrm{HistoricalPhysicalAccumulation}_A^{<s} \\ \mathrm{CumulativePhysicalResultThrough}_A(s) \end{pmatrix}. \tag{656}$$

The first is a formal restriction of the history representation.

The second designates system-specific physical change actually realized strictly earlier than s.

The third states that retained or transformed effects of earlier realized change remain physically embodied in the present developed condition $X_A(s)$.

No arithmetic-sum interpretation is imposed:

$$\mathrm{HistoricalPhysicalAccumulation}_A^{<s} \not\equiv_{\mathrm{def}} \sum_{r \in I_A^{<s} \cap I_A^{\Delta}} \Delta_A^{\mathrm{phys}}(r). \tag{657}$$

No universal ending threshold is imposed:

$$I_A^{<s} \neq \varnothing \not\Rightarrow \mathrm{End}_A(s). \tag{658}$$

32.9 Identity ending and uninterrupted development

An actual ending satisfies

$$\mathrm{End}_A(e) \Longrightarrow e \in I_A. \tag{659}$$

Therefore,

$$\mathrm{End}_A(e) \wedge \mathrm{UCC} \Longrightarrow \mathrm{PhysReal}_A^+(e). \tag{660}$$

The terminal ending-change content is well typed under that same condition:

$$\mathrm{End}_A(e) \wedge \mathrm{UCC} \Longrightarrow \Delta_A^{\mathrm{end}}(e) = \Delta_A^{\mathrm{phys}}(e) \tag{661}$$

is a boundary classification of the same system-specific physical change.

It is not a physically detached final event added after the system's development.

Where earlier identity history exists,

$$I_A^{<e} \neq \varnothing, \tag{662}$$

the earlier physical development and the ending-change-stage change belong to one identity-bounded history: UCC governs the continuing system-specific change, while CMA governs the common cosmic-stage unity at which that history is realized.

The fact that the terminal change belongs to the same uninterrupted physical development as the earlier history does not make historical accumulation the independent cause of ending.

Ending-specific causal attribution remains governed by PIECP:

$$\mathrm{End}_A(e) \Longrightarrow \exists c \in \mathcal{C}_A^{\mathrm{act}}(e)\ \ \mathrm{PhysicallyContributes}\left(c; \mathrm{IdentityEndingTransformation}(A; e)\right). \tag{663}$$

32.10 Scope of UEIE

UEIE is an independent universal lifecycle postulate:

$$\mathrm{UEIE} \Longleftrightarrow \forall A \in \mathcal{U}_{\mathrm{phys}}\ \exists e_A \in I_A \left[\mathrm{End}_A(e_A) \wedge \exists r_A \in I_A \left(r_A \prec_{\mathrm{C}} e_A\right)\right]. \tag{664}$$

It is not part of the definition of time.

It is not required to establish non-terminal cosmic succession.

Its strict pre-ending-history requirement is non-metric and non-numerical: it does not prescribe a duration, a change-stage count, a cumulative magnitude, a universal physical mechanism, or a universal ending threshold.

It does not predict an ending change stage in advance.

Thus,

$$\mathrm{UEIE} \not\Rightarrow \mathrm{AdvanceEndingChangeStagePrediction}(A). \tag{665}$$

Likewise,

$$\mathrm{UEIE} \not\Rightarrow \mathrm{UniversalEndingMechanism}. \tag{666}$$

32.11 Scope of successor attribution

The relation

$$\mathrm{SuccAt}(A, B; e) \tag{667}$$

applies where the ending transformation of A physically produces a genuinely new numerical identity B whose formation boundary is e.

V36/F16 does not impose

$$\mathrm{End}_A(e) \Longrightarrow \exists B \in \mathcal{U}_{\mathrm{phys}}\ \mathrm{SuccAt}(A, B; e) \tag{668}$$

as a universal postulate.

Therefore,

$$\text{CosmicSuccessionContinues} \not\equiv_{\mathrm{def}} \text{EveryEndingProducesNewSuccessor}\,. \tag{669}$$

The first belongs to the cosmic-succession architecture.

The second is a system-specific physical transformation claim requiring physical warrant in the case under consideration.

32.12 Observational scope

A valid observation may warrant

$$\mathrm{Warrant}_{P,M}\left[\exists s \in I_A\ \ \mathrm{ManifestationAt}(A, \chi; s)\right]. \tag{670}$$

It does not thereby establish

$$\mathrm{ExactCosmicChangeStageIdentified}_{P,M}(A, \chi) \tag{671}$$

or

$$\mathrm{ExactCosmicOrderPositionIdentified}_{P,M}(A, \chi). \tag{672}$$

This restraint is epistemic.

It does not make the cosmic ordering physically indefinite.

The physical manifestation is realized at an actual common cosmic change stage even when available records do not identify that exact member of $\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}$.

32.13 Quantitative scope

The physical clock bridge is application-level.

It connects

$$
\begin{aligned}
\text{PhysicalCondition} &\longrightarrow \text{PhysicalResponseModel} \longrightarrow \text{TransitionOrOscillatorResponse} \\
&\longrightarrow \text{DetectorResponse} \longrightarrow \text{Record} \longrightarrow \text{OperationalOutput}\,.
\end{aligned}
\tag{673}
$$

The bridge requires physical-system boundaries, parameter provenance, acquisition support, uncertainty, covariance, approximation control, identifiable model structure, and evaluation independent of outcome-dependent fitting.

Current high-precision clock experiments provide demanding physical record domains for such evaluation [13, 14, 15, 16, 17, 19, 20].

Carrier-sensitivity calculations and independently derived response coefficients may provide application-level provenance where physically warranted [18].

No clock experiment is assigned more foundational force than its derivation permits.

Thus,

$$
\text{ApplicationBridgeFailed} \not\Rightarrow \text{FoundationalITOFRefuted}, \tag{674}
$$

unless the failed observable is independently derived as a necessary consequence of the foundational commitment under test.

Likewise,

$$
\text{ApplicationBridgeRecovered} \not\Rightarrow \text{TemporalIdentityEstablished}\,. \tag{675}
$$

32.14 Relativistic scope

The confrontation with relativity has two distinct levels.

At the type level,

$$
\forall q \in \mathcal{Q}_{\mathrm{rel}}, \quad q \not\equiv_{\mathrm{type}} T_{\mathrm{ITOF}}. \tag{676}
$$

This result belongs to the ITOF definition and Non-Transfer architecture.

At the empirical level, relativistic calculations and ITOF-admissible application models may be compared where independently derived predictions differ beyond combined uncertainty.

The two levels must not be confused.

ITOF does not require an experimental discrepancy before rejecting identification of coordinate time, proper time, metric interval, spacetime geometry, simultaneity relation, or clock output with T_{ITOF}.

Conversely, a type distinction alone does not establish superior quantitative prediction in a physical experiment.

An ontological interpretation that denies universal frame-independent common cosmic-stage co-realization conflicts directly with CMA, as formalized once in Equation (540). This disagreement is stated without converting CMA into instantaneous interaction, signal transfer, preferred-frame dynamics, or a synchronization convention.

33. Central Commitments of V36/F16

The governing commitments can be summarized without repeating their full definitions.

I. Temporal identity. Time denotes the one universal cosmic extension of common cosmic change stages, constituted by their invariant universal earlier–later ordering and succession:

$$T_{\mathrm{ITOF}} = \mathcal{E}_{\mathrm{C}} = \left(\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \prec_{\mathrm{C}}\right). \tag{677}$$

The extension is the non-metric extension of that ordered succession itself; it is not a container, duration, causal process, or second temporal object. Strict Cosmic Ordering fixes irreversibility, while NoInterruption and NoTerminalStage separately govern uninterrupted continuation.

II. Cosmic succession. The common succession is strictly ordered, intrinsically uninterrupted in the adopted non-metric sense, and non-terminal:

$$\mathrm{StrictTotalOrder}\left(\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \prec_{\mathrm{C}}\right) \wedge \mathrm{NoInterruption}_{\mathrm{C}} \wedge \mathrm{NoTerminalStage}_{\mathrm{C}}. \tag{678}$$

III. Common physical realization and system-specific change. CSPP, CMA, and UCC have three distinct governing roles at this realization layer: nonempty population, explicit universal common cosmic-stage unity, and universal system-specific physical-change actuality. Their joint physical consequence is

$$\begin{aligned} \forall s \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \quad & \Big[\mathcal{S}_{\mathrm{phys}}(s) \neq \varnothing \\ & \wedge\ \mathrm{CosmicCoPresence}_{\mathrm{C}}\left(\mathcal{S}_{\mathrm{phys}}(s); s\right) \\ & \wedge\ \forall A \in \mathcal{S}_{\mathrm{phys}}(s), \mathrm{PhysReal}_{A}^{+}(s)\Big]. \end{aligned} \tag{679}$$

The common cosmic change stage is one; the physical change is system-specific to each physical system.
V36/F16 additionally represents the system-level coverage by

$$\mathcal{B}_{\Delta}(s) = \mathcal{S}_{\mathrm{phys}}(s), \tag{680}$$

and the joint common-change-stage/system-change content by the CMA–UCC foundational bridge $\mathrm{StageChangeBridge}_{\mathrm{C}}(s)$. Thus no member of the realized population is replaced by a collective change term or exempted by a mixed change/stasis exception.

IV. Physical causation. Every actual system-specific change has a nonempty physical causal realization under CRP, and all causal contributors remain within the three declared classes:

$$\mathcal{C}_{A}^{\mathrm{act}}(s) = \mathcal{C}_{A}^{\mathrm{int}}(s) \cup \mathcal{C}_{A}^{\text{ext-sys}}(s) \cup \mathcal{C}_{A}^{\text{ext-fac}}(s). \tag{681}$$

Time, the common cosmic extension, common cosmic change stage, ordering, and historical accumulation are not additional causal-source classes.

V. Identity and physical history. Each numerical physical-system identity is realized over a restriction $I_A \subseteq \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}$ of the same common cosmic change-stage totality. Under

Identity-Realization Convexity and AFB, its formal physical history is

$$\mathcal{H}_A = \Big(I_A, \prec_{\mathrm{C}} |_{I_A}, X_A, \Delta_A^{\mathrm{phys}} \Big) . \tag{682}$$

This history is system-specific but is not a private time.

VI. Development, accumulation, and ending. Historical physical accumulation designates earlier actually realized change, whereas the present cumulative physical resultant concerns retained or transformed earlier effects physically embodied in the present condition. Neither is an independent causal source or a universal ending threshold. An actual ending remains within the same UCC-governed system-specific physical development, at common cosmic change stages whose unity is governed separately by CMA:

$$\mathrm{End}_A(e) \wedge \mathrm{UCC} \Longrightarrow \mathrm{PhysReal}_A^{+}(e). \tag{683}$$

PIECP adds ending-specific causal attribution; UEIE separately adds universal ending existence together with a nonempty strict pre-ending identity history, without imposing a duration or change-stage count; successor production remains conditional on actual physical production of a new identity.

VII. Observation and clocks. Observation may warrant that a physical manifestation belongs to an actual physical history without thereby identifying its exact common cosmic change stage or global order position. Clocks are physical systems whose records and numerical outputs are operational quantities:

$$\mathrm{ClockOutput} \not\equiv_{\mathrm{type}} T_{\mathrm{ITOF}}. \tag{684}$$

VIII. Quantitative applications and non-transfer. Application-level predictions require independently specified physical models, parameter provenance, controls, uncertainty, evaluation independence, and model separation where discrimination is claimed. Mathematical or operational success does not transfer temporal identity:

$$\mathrm{MathematicallyConsistent}_M(q) \wedge \mathrm{OperationalSuccess}_{P,M,D}(q) \not\Rightarrow q \equiv_{\mathrm{type}} T_{\mathrm{ITOF}}. \tag{685}$$

This rule also governs the direct rejection of relativistic coordinate, metric, proper-time, simultaneity, geometrical, and clock quantities as definitions of time.

These commitments form one dependency architecture but do not have one logical status. Definitions, axioms, postulates, principles, derived consequences, epistemic restraints, and application-level hypotheses remain distinguished throughout the framework.

34. Integrated Dependency Architecture

The principal dependencies of V36/F16 may be expressed as

$\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \prec_{\mathrm{C}}$

$\overset{\text{definition}}{\Longrightarrow}$

$$
\begin{aligned}
&T_{\mathrm{ITOF}} = \mathcal{E}_{\mathrm{C}} = \left(\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \prec_{\mathrm{C}}\right), \\
&\ \mathrm{StrictTotalOrder}\left(\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \prec_{\mathrm{C}}\right) + \mathrm{NoInterruption}_{\mathrm{C}} + \mathrm{NoTerminalStage}_{\mathrm{C}} \\
&\quad \text{independently govern the same common cosmic-stage carrier, its ordering,} \\
&\quad \text{and its continuing succession,} \\
&\ \mathrm{PhysicalSystem} + \mathrm{ExistsAs} \\
&\quad \Downarrow \\
&\mathcal{U}_{\mathrm{phys}}, \quad I_A, \quad \mathcal{S}_{\mathrm{phys}}(s) \\
&\quad \Downarrow \\
&\ \mathrm{CSPP} + \mathrm{CMA} + \mathrm{UCC} \\
&\quad \Downarrow \\
&\mathcal{B}_{\Delta}(s) = \mathcal{S}_{\mathrm{phys}}(s), \qquad \mathrm{StageChangeBridge}_{\mathrm{C}}(s) \\
&\quad \Downarrow \\
&\text{one common cosmic change stage with complete-population system-specific physical change,} \\
&\ \mathrm{UCC} + \mathrm{CRP} \\
&\quad \Downarrow \\
&\text{actual physical change with physical causal realization,} \\
&I_A + \prec_{\mathrm{C}}|_{I_A} + X_A + \Delta_A^{\mathrm{phys}} \\
&\quad \xRightarrow{\text{definition}} \\
&\mathcal{H}_A, \\
&\ \mathrm{IdentityRealizationConvexity} + \mathrm{AFB} \\
&\quad \text{independently constrain the identity-realization range } I_A, \\
&\mathcal{H}_A + I_A^{<s} \neq \varnothing + \mathrm{UCC} \\
&\quad \Downarrow \\
&\ \mathrm{HistoricalPhysicalAccumulation}_A^{<s}, \\
&X_A(s) + \mathrm{EmbodiedEarlierEffects}_A(X_A(s); s) \\
&\quad \Longleftrightarrow \\
&\ \mathrm{CumulativePhysicalResultThrough}_A(s), \\
&\ \mathrm{End}_A(e) + \mathrm{UCC} \\
&\quad \Downarrow \\
&\Delta_A^{\mathrm{end}}(e) = \Delta_A^{\mathrm{phys}}(e), \\
&\ \mathrm{End}_A(e) + \mathrm{PIECP} \\
&\quad \Downarrow
\end{aligned}
\tag{686}
$$

$$
\begin{aligned}
&\text{ending-specific physical causal attribution,}\\
&\text{UEIE}\\
&\quad\Downarrow\\
&\text{universal eventual numerical identity ending}\\
&\text{with nonempty strict pre-ending identity history,}\\
&\mathrm{SuccAt}(A, B; e)\\
&\quad\Downarrow\\
&\text{new successor identity only where physically produced,}\\
&\text{physical records}\\
&\quad\Downarrow\\
&\text{positive manifestation warrant} + \text{Exact-Change-Stage Restraint,}\\
&\text{clock systems} + \text{physical response models}\\
&\quad\Downarrow\\
&\text{predeclared quantitative comparison}\\
&\quad\Downarrow\\
&\text{bounded model-level conclusion,}\\
&\text{NTP}\\
&\quad\Downarrow\\
&\text{no transfer of temporal identity to successful model objects.}
\end{aligned}
\tag{688}
$$

The two explicit definition arrows in Equation (688) identify definitional construction only. The strict-ordering, non-interruption, and non-termination commitments govern the already defined common cosmic-stage carrier and its ordering and succession; they do not generate the definition of T_{ITOF}. Likewise, Identity-Realization Convexity and AFB constrain the physical identity range but do not generate the formal history representation, whose components are I_A, $\prec_{\mathrm{C}} |_{I_A}$, X_A, and Δ_A^{phys}.

No downward arrow in Equation (688) reverses automatically.

In particular,

$$\mathrm{ClockRecordDifference} \not\Rightarrow \mathrm{DifferentCosmicTimes}, \tag{689}$$

$$\mathrm{CumulativePhysicalResultThrough}_A(s) \not\equiv_{\mathrm{def}} \mathrm{HistoricalPhysicalAccumulation}_A^{<s}, \tag{690}$$

$$\mathrm{End}_A(e) \not\Rightarrow \exists B\ \mathrm{SuccAt}(A, B; e), \tag{691}$$

and

$$\mathrm{UEIE} \nRightarrow \mathrm{NoTerminalStage}_{\mathrm{C}}\,. \tag{692}$$

The dependency architecture therefore prevents lifecycle, observational, or application-level claims from carrying hidden temporal premises.

35. Physical Counterconditions and Contrary Conditions

A foundational commitment is not protected by observational ambiguity where a genuine physically warranted contrary condition is established.

Operational non-detection, model failure, and a physical countercondition remain distinct.

35.1 Countercondition to CSPP

A direct countercondition to CSPP is

$$\exists s \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \quad \mathcal{S}_{\mathrm{phys}}(s) = \varnothing. \tag{693}$$

If Equation (693) is physically established, CSPP fails.

35.2 Countercondition to uninterrupted cosmic succession

The formal contrary condition to the adopted non-interruption postulate is

$$\boxed{\neg\, \mathrm{NoInterruption}_{\mathrm{C}} \left(\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \prec_{\mathrm{C}}\right).} \tag{694}$$

This is an ontological and semantic contrary to the adopted actual cosmic succession. It is not shorthand for failure of order density, discreteness, adjacency, topology, metric continuity, or order completeness, and it is not established by a physically unpopulated or observationally stable system state. Population nonemptiness is governed by CSPP, common cosmic-stage unity by CMA, and memberwise physical non-stasis by UCC. A finite observational record that fails to resolve succession does not by itself establish Equation (694).

35.3 Countercondition to CMA

CMA has one direct contrary condition: failure of universal common cosmic-stage co-realization for the complete qualified population then realized:

$$\boxed{\neg\, \mathrm{CMA} \iff \exists s \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \quad \neg\, \mathrm{CosmicCoPresence}_{\mathrm{C}} \left(\mathcal{S}_{\mathrm{phys}}(s); s\right).} \tag{695}$$

A warranted challenge of this form contradicts the CMA-governed common-stage ontology. Equation (695) is a formal contrary expression, not an admissible internal countermodel that keeps the declared meanings of the same common stage fixed while negating its commonness. Different physical states, different clock outputs, spatial separation, delayed signal access, unequal record arrival, or absence of all-to-all interaction do not by themselves establish this contrary.

35.4 Countercondition to UCC

A direct countercondition to UCC is

$$\boxed{\exists A \in \mathcal{U}_{\text{phys}}\ \exists s \in I_A, \quad \neg\, \text{PhysReal}_A^+(s).} \tag{696}$$

This condition can retain the same common cosmic change-stage ontology and hence does not by itself contradict CMA. It contradicts the independent physical commitment UCC. A null or unresolved record does not establish the condition; positive physical warrant for complete physical non-change of a qualified realized system is required.

35.5 Countercondition to the Causal Realization Principle

A direct countercondition is

$$\exists A \in \mathcal{U}_{\text{phys}}\ \exists s \in I_A, \quad \text{PhysReal}_A^+(s) \wedge \mathcal{C}_A^{\text{act}}(s) = \varnothing. \tag{697}$$

Failure to identify a cause experimentally is not equivalent to Equation (697).

The latter is a physical claim that no actual physical causal contributor exists.

35.6 Countercondition to Identity-Realization Convexity

A direct contrary condition is

$$\exists A \in \mathcal{U}_{\text{phys}}\ \exists r, s, t \in \mathcal{S}_{\text{C}}^{\text{tot}}, \quad r, t \in I_A, \quad r \prec_{\text{C}} s \prec_{\text{C}} t, \quad s \notin I_A. \tag{698}$$

This would establish an internal gap in the realization of the same numerical physical-system identity.

A later newly formed system that resembles the earlier system does not satisfy this condition unless numerical identity across the gap is independently established.

35.7 Countercondition to AFB

AFB fails for a physical-system identity A if its realized identity range has no unique least member:

$$\exists A \in \mathcal{U}_{\text{phys}}, \quad \neg\exists! f_A \in I_A \left[\nexists r \in I_A (r \prec_{\text{C}} f_A)\right]. \tag{699}$$

Uncertainty about the observational location of f_A does not satisfy Equation (699).

AFB concerns the physical boundary, not exact observational identification of that boundary.

35.8 Countercondition to non-terminal cosmic succession

A direct countercondition to $\text{NoTerminalStage}_{\text{C}}$ is

$$\exists g \in \mathcal{S}_{\text{C}}^{\text{tot}}, \quad \nexists t \in \mathcal{S}_{\text{C}}^{\text{tot}} \left(g \prec_{\text{C}} t\right). \tag{700}$$

Such g would be a terminal common cosmic stage.

The ending of an individual physical-system identity does not satisfy this condition.

35.9 Countercondition to Cosmic Origin

Where Cosmic Origin is adopted, its contrary condition is failure of the common cosmic-stage totality to possess the required least member:

$$\neg\exists! s^0_{\mathrm{C}} \in \mathcal{S}^{\mathrm{tot}}_{\mathrm{C}} \left[\nexists r \in \mathcal{S}^{\mathrm{tot}}_{\mathrm{C}} (r \prec_{\mathrm{C}} s^0_{\mathrm{C}})\right]. \tag{701}$$

Cosmic Origin remains independent of the minimal temporal definition, so failure of this cosmological commitment would not by itself negate Equation (624).

35.10 Countercondition to UEIE

A direct countercondition to UEIE is

$$\exists A \in \mathcal{U}_{\mathrm{phys}}, \quad \neg\exists e \in I_A \left[\mathrm{End}_A(e) \wedge \exists r \in I_A \left(r \prec_{\mathrm{C}} e\right)\right]. \tag{702}$$

This is stronger than failure to observe an ending or failure to reconstruct its full prior history.

It requires physical warrant that the numerical identity lacks any ending member satisfying the UEIE lifecycle condition, namely an ending with at least one strictly earlier realization of the same numerical identity.

35.11 Countercondition to PIECP

A direct physical countercondition to PIECP is

$$\begin{aligned} &\exists A \in \mathcal{U}_{\mathrm{phys}}\ \exists e \in \mathcal{S}^{\mathrm{tot}}_{\mathrm{C}}, \quad \mathrm{End}_A(e) \\ &\qquad \wedge \neg\exists c \in \mathcal{C}^{\mathrm{act}}_A(e)\ \ \mathrm{PhysicallyContributes}\left(c; \mathrm{IdentityEndingTransformation}(A; e)\right). \end{aligned} \tag{703}$$

A model that cannot resolve the operative ending-specific contributor does not by itself establish Equation (703).

The distinction is

$$\mathrm{PIECPResolutionFailure} \not\equiv_{\mathrm{def}} \mathrm{PIECPPhysicalCountercondition}. \tag{704}$$

35.12 Failure of a successor claim

Because universal successor closure is not adopted, absence of a newly formed successor does not constitute failure of the V36/F16 temporal or lifecycle architecture.

A particular successor attribution fails if

$$\mathrm{SuccAt}(A, B; e) \tag{705}$$

is asserted but one or more defining conditions are false:

$$\neg \operatorname{End}_A(e) \vee A = B \vee f_B \neq e \vee \neg \operatorname{PhysicalProductionLink}(A, B; e). \tag{706}$$

35.13 Application-model failure

For application model M, a failed predeclared prediction warrants

$$\operatorname{ApplicationModelRejectedOrRestricted}(M, D) \tag{707}$$

within the tested domain.

It does not automatically warrant

$$\neg T_{\mathrm{ITOF}}, \qquad \neg \operatorname{CMA}, \qquad \neg \operatorname{UCC}. \tag{708}$$

The inferential consequence is determined by the actual dependency of the failed observable.

36. General Conclusion: Universal Cosmic Extension, Invariant Ordering, and System-Specific Change

V36/F16 defines time as the one universal cosmic extension of common cosmic change stages, constituted by their invariant earlier–later ordering and succession:

$$\boxed{T_{\mathrm{ITOF}} = \mathcal{E}_{\mathrm{C}} = \left(\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \prec_{\mathrm{C}}\right).} \tag{709}$$

Here $\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}$ is the formal universal common cosmic-stage carrier and $\prec_{\mathrm{C}}$ is the governing earlier–later relation. In every admissible V36/F16 realization, the admitted members instantiate the literal common-cosmic-change-stage role. Strict Cosmic Ordering makes the ordering irreversible; NoInterruption and NoTerminalStage separately govern the uninterrupted and continuing extension. CSPP, CMA, and UCC jointly secure nonempty population, one-common-change-stage realization for the complete then-realized qualified population, and exhaustive system-specific physical-change actuality.

Under the separately stated NoInterruption and NoTerminalStage commitments, the common cosmic succession is uninterrupted and has no terminal common cosmic stage:

$$\boxed{\operatorname{NoInterruption}_{\mathrm{C}} \wedge \forall s \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}\ \exists t \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}\ (s \prec_{\mathrm{C}} t)\,.} \tag{710}$$

The universe is the physical totality of qualified physical-system identities realized at one or more common cosmic change stages in the succession.

At every common cosmic change stage, the physical architecture is

$$\boxed{\forall s \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \left[\mathcal{S}_{\mathrm{phys}}(s) \neq \varnothing \wedge \operatorname{CosmicCoPresence}_{\mathrm{C}}\left(\mathcal{S}_{\mathrm{phys}}(s); s\right) \wedge \forall A \in \mathcal{S}_{\mathrm{phys}}(s), \operatorname{PhysReal}_A^{+}(s)\right].} \tag{711}$$

Equation (711) expresses the joint result of three distinct foundational commitments at this realization layer: CSPP, CMA, and UCC.

CSPP independently requires a nonempty physical-system population.

CMA requires the complete then-existing population to be realized together at one and the same common cosmic stage.

UCC separately requires system-specific physical change across every realized identity history.

V36/F16 makes the joint common-change-stage/system-change relation explicit through the foundational bridge:

$$\boxed{\forall s \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \quad \mathrm{StageChangeBridge}_{\mathrm{C}}(s).} \tag{712}$$

Under the governing definitions this display is equivalent to the conjunction of CMA and UCC. Its coverage component excludes every memberwise complete-stasis violation, while its common-change-stage component preserves one shared cosmic change stage without making that stage a physical cause or measurement operation.

The unity is unity of cosmic change-stage realization.

The multiplicity is the plurality of physical systems, physical states, physical histories, causal profiles, physical-change contents, magnitudes, mechanisms, consequences, and observable manifestations.

No private temporal sequence is introduced for an individual physical system.

For every system,

$$I_A \subseteq \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \tag{713}$$

and its physical history is

$$\mathcal{H}_A = \left(I_A, \prec_{\mathrm{C}}|_{I_A}, X_A, \Delta_A^{\mathrm{phys}}\right). \tag{714}$$

Physical development belongs to the system and remains subject to UCC throughout the realized numerical identity.

Where $I_A^{<s} \neq \varnothing$, historical physical accumulation designates the earlier realized change of that system:

$$\mathrm{HistoricalPhysicalAccumulation}_A^{<s}. \tag{715}$$

The present cumulative physical resultant concerns only those earlier effects still physically embodied in the present developed condition:

$$\mathrm{CumulativePhysicalResultThrough}_A(s). \tag{716}$$

The two are not identical and neither is a new causal source.

Where a system ends, the ending occurs within the same uninterrupted physical development:

$$\mathrm{End}_A(e) \wedge \mathrm{UCC} \Longrightarrow \mathrm{PhysReal}_A^{+}(e). \tag{717}$$

Under the same $\mathrm{End}_A(e) \wedge \mathrm{UCC}$ condition, the terminal change is the system-specific physical-change content realized at the ending boundary:

$$\mathrm{End}_A(e) \wedge \mathrm{UCC} \Longrightarrow \Delta_A^{\mathrm{end}}(e) = \Delta_A^{\mathrm{phys}}(e). \tag{718}$$

PIECP assigns ending-specific causal attribution only to actual physical contributors already belonging to the three governed causal-source classes.

The physical history preceding the ending remains connected without an inserted changeless break to the ending-change-stage change under the UCC. Historical accumulation does not become a detached cause that acts separately at the boundary.

UEIE separately states eventual ending of every physical-system identity together with a nonempty strict pre-ending identity history:

$$\mathrm{UEIE} \Longleftrightarrow \forall A \in \mathcal{U}_{\mathrm{phys}}\ \exists e_A \in I_A \left[\mathrm{End}_A(e_A) \wedge \exists r_A \in I_A\, (r_A \prec_{\mathrm{C}} e_A)\right]. \tag{719}$$

The earlier-member clause introduces no metric duration, numerical history length, cumulative magnitude, or ending threshold. UEIE does not establish the continuation of the cosmic succession and does not imply that every ending must produce a newly formed successor.

Where successor production is physically realized,

$$\mathrm{SuccAt}(A, B; e) \tag{720}$$

describes that relation precisely.

Observation remains physically meaningful without becoming exact cosmic change-stage identification.

A valid record may establish that a manifestation belongs to an actual physical-system history:

$$\mathrm{ValidObservedManifestation} \Longrightarrow \mathrm{Warrant}\left[\exists s \in I_A\ \ \mathrm{ManifestationAt}(A, \chi; s)\right], \tag{721}$$

while

$$\mathrm{ValidObservedManifestation} \not\Rightarrow \mathrm{ExactCosmicChangeStageIdentified}\,. \tag{722}$$

Clocks are physical systems.

Their transitions, oscillators, detectors, records, comparisons, and numerical outputs are physical or operational quantities.

Their precision does not convert them into time.

Quantitative tests are strongest where response laws, parameters, controls, uncertainty, model separation, and failure criteria are fixed before evaluation and where independent replication is available.

Such tests may support or reject a declared physical application model.

They do not acquire more foundational meaning than their derivation warrants.

The Non-Transfer Principle preserves the governing type distinction:

$$\boxed{\mathrm{MathematicallyConsistent}_M(q) \wedge \mathrm{OperationalSuccess}_{P,M,D}(q) \not\Rightarrow q \equiv_{\mathrm{type}} T_{\mathrm{ITOF}}.} \tag{723}$$

Accordingly, ITOF does not identify coordinate time, proper time, metric intervals, spacetime geometry, frame-dependent simultaneity, clock outputs, cosmological coordinate parameters, quantum state symbols, or higher-dimensional coordinates with time.

For the declared relativistic family,

$$\boxed{\forall q \in \mathcal{Q}_{\mathrm{rel}}, \quad q \not\equiv_{\mathrm{type}} T_{\mathrm{ITOF}}.} \tag{724}$$

This rejection does not depend on denying the calculational success of relativistic methods.

It rejects the transfer from successful representation or prediction to temporal identity.

Where a relativistic interpretation denies universal common cosmic-stage co-realization of the complete then-existing physical-system population, the disagreement with CMA is direct.

The governing V36/F16 architecture may therefore be stated concisely as

$$\boxed{\begin{array}{l}
\text{one universal cosmic change-stage totality,}\\
\text{one common non-metric cosmic extension of those stages,}\\
\text{one fixed irreversible earlier–later ordering,}\\
\text{one uninterrupted and non-terminal common cosmic succession,}\\
\text{one common cosmic change-stage realization for the complete then-existing population,}\\
\text{system-specific physical change in every realized physical system,}\\
\text{system-specific physical histories and causal profiles,}\\
\text{no transfer of physical, operational, or geometrical quantities into the identity of time.}
\end{array}} \tag{725}$$

At each position in the succession there is one common cosmic change stage shared by the complete qualified population realized there.

The physical histories are many.

Physical change remains actual at every common cosmic change stage throughout each realized identity range as required by UCC.

The actual physical content and cause of that change belong to the physical systems.

Time denotes the one universal cosmic extension of those common cosmic change stages, constituted by their invariant earlier–later ordering and succession. Strict Cosmic Ordering fixes the ordering as irreversible. Under the separately adopted NoInterruption and NoTerminalStage commitments, the actual cosmic succession is uninterrupted and continuing. The physical histories remain ordered within the same common extension without becoming private times.

A. Statement Status and Direct Dependency Register

Table 1: Logical status and direct dependency of the principal V36/F16 statements.

Item	Status	Direct dependency or role
$\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}$	Primitive carrier/totality	Carrier of the one universal common cosmic-stage succession. Under the full CSPP–CMA–UCC architecture its admitted members instantiate the governing role of common cosmic change stages; bare carrier membership does not analytically entail UCC.
$\prec_{\mathrm{C}}$	Primitive ordering relation	Earlier–later relation on $\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}$.
Strict Cosmic Ordering	Foundational axiom	Requires $\prec_{\mathrm{C}}$ to be a strict total order on $\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}$.
$\mathrm{NoInterruption}_{\mathrm{C}}$	Foundational postulate	Irreducible ontological/semantic commitment that admitted common cosmic stages belong to one intrinsically uninterrupted succession; not determined by density, adjacency, topology, metric continuity, or order completeness.
$\mathrm{NoTerminalStage}_{\mathrm{C}}$	Foundational postulate	Every $s \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}$ has some later $t \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}$; directly excludes a greatest admitted common cosmic stage.
Integrated cosmic succession	Defined conjunction	$\mathrm{NoInterruption}_{\mathrm{C}} \wedge \mathrm{NoTerminalStage}_{\mathrm{C}}$; combines non-interruption with non-termination without identifying the two.
T_{ITOF}	Governing definition	$T_{\mathrm{ITOF}} := \mathcal{E}_{\mathrm{C}} := (\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \prec_{\mathrm{C}})$; time denotes the one universal cosmic extension of common cosmic change stages, constituted by their invariant universal earlier–later ordering and succession. NoInterruption and NoTerminalStage separately govern the uninterrupted and continuing character of the actual cosmic succession.
CosmicOrigin	Independent cosmological postulate	Optional commitment that $\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}$ has a unique least member s_{C}^{0}.

Item	Status	Direct dependency or role
$\mathcal{U}_{\text{phys}}$	Defined physical-system totality	$\{A \mid \text{PhysicalSystem}(A) \wedge \exists s \in \mathcal{S}_{\text{C}}^{\text{tot}}\ \text{ExistsAs}(A, s)\}$; excludes empty identity-realization ranges and does not imply already-attained status relative to an arbitrary reference stage.
$\mathcal{U}$	Defined physical totality	$\text{Totality}(\mathcal{U}_{\text{phys}})$; not a container or additional physical system.
$\text{ExistsAs}(A, s)$	Primitive identity-realization relation	Numerical identity A is physically realized at common cosmic stage s.
I_A	Defined identity-realization range	$\{s \in \mathcal{S}_{\text{C}}^{\text{tot}} \mid \text{ExistsAs}(A, s)\}$; not a system-owned stage totality or private time.
I_A^{Δ}	Defined actual-change subset	$\{s \in I_A \mid \text{PhysReal}_A^{+}(s)\}$; it equals I_A under UCC and keeps Δ_A^{phys} well typed in UCC countermodels.
$\mathcal{S}_{\text{phys}}(s)$	Defined common cosmic-stage population	$\{A \in \mathcal{U}_{\text{phys}} \mid \text{ExistsAs}(A, s)\}$.
CSPP	Independent foundational postulate	Requires $\mathcal{S}_{\text{phys}}(s) \neq \varnothing$ for every $s \in \mathcal{S}_{\text{C}}^{\text{tot}}$.
$\text{CosmicCoPresence}_{\text{C}}$	Governing semantic–ontological notation under CMA	States literal objective common-stage identity for the complete then-existing population; not independently toggleable while the declared common-stage meanings are held fixed, and not reducible to synchronization or physical interaction.
CMA	Governing foundational axiom	Universal co-realization of the complete then-existing qualified physical-system population at literally one and the same common cosmic stage; excludes private per-system cosmic stages.
$\text{PhysReal}_A^{+}(s)$	Primitive physical-change actuality relation	Actual system-specific physical change realized in A at s.

Item	Status	Direct dependency or role
UCC	Foundational postulate	System-specific physical-change actuality for every $A \in \mathcal{U}_{\mathrm{phys}}$ and every common cosmic stage $s \in I_A$; under the full realization architecture these stages bear the change-stage role.
$\mathcal{B}_\Delta(s)$	Defined physical-system set	Members of $\mathcal{S}_{\mathrm{phys}}(s)$ in which actual physical change is realized at s; complete-population equality $\mathcal{B}_\Delta(s) = \mathcal{S}_{\mathrm{phys}}(s)$ at every common cosmic stage is equivalent to UCC under the governing definitions.
$\mathfrak{D}_{\mathrm{C}}(s)$	Defined system-change profile	System-indexed dependent family of system-specific physical-change contents, typed by Ξ_A over $\mathcal{B}_\Delta(s)$; does not impose one common change codomain.
$\mathrm{StageChangeBridge}_{\mathrm{C}}(s)$	Defined foundational bridge	CMA-governed common-stage co-presence plus complete-population change coverage; universally equivalent to the joint CMA–UCC architecture and not an additional axiom, causal mechanism, observational bridge, or clock-response law.
$\Delta_A^{\mathrm{phys}}(s)$	Typed physical-change content	System-specific physical content defined for $s \in I_A^\Delta$; under UCC, $I_A^\Delta = I_A$.
$\mathfrak{C}_A(s)$	Defined causal triple	Internal contributors, external physical systems, and external non-system physical factors.
Causal Realization Principle	Foundational physical principle	$\mathrm{PhysReal}_A^+(s) \Rightarrow \mathcal{C}_A^{\mathrm{act}}(s) \neq \varnothing$.
Identity-Realization Convexity	Foundational identity principle	Prevents internal gaps in one numerical identity range I_A.
AFB	Independent identity postulate	Every realized numerical physical-system identity has one unique least identity member f_A.
X_A	Defined state map	$X_A : I_A \to \Omega_A$.

Item	Status	Direct dependency or role
$\mathcal{H}_A$	Formal physical-history representation	$(I_A, \prec_C \|_{I_A}, X_A, \Delta_A^{\mathrm{phys}})$.
$\mathcal{H}_A^{<s}$	Formal order restriction	Strictly earlier restriction of $\mathcal{H}_A$; not a second history or physical object.
HistoricalPhysical Accumulation$_A^{<s}$	Historical designation	Earlier actually realized system-specific physical change; not an arithmetic sum or causal-source class.
CumulativePhysical ResultThrough$_A(s)$	Defined truth-valued present-resultant predicate	Retained or transformed earlier effects physically embodied in $X_A(s)$; no separate resultant object is introduced.
Identity-ending transformation	Local primitive ending classification	Transformation at e satisfies the applicable numerical-identity-ending criterion; later-change-stage absence is carried by $\mathrm{End}_A(e)$.
$\mathrm{End}_A(e)$	Defined identity-ending predicate	Ending transformation at $e \in I_A$ together with absence of the same identity from every later common cosmic change stage.
$\Delta_A^{\mathrm{end}}(e)$	Defined boundary classification	$\Delta_A^{\mathrm{phys}}(e)$ for an actual ending under UCC, where $e \in I_A^{\Delta}$; not a separate final process.
PIECP	Independent ending-specific causal principle	Requires at least one member of $\mathcal{C}_A^{\mathrm{act}}(e)$ to contribute physically to the identity-ending transformation.
UEIE	Independent universal lifecycle postulate	Requires, for every $A \in \mathcal{U}_{\mathrm{phys}}$, an ending member with at least one strictly earlier realization of the same identity; imposes no metric or numerical prior-history length and remains independent of cosmic non-termination.
$\mathrm{SuccAt}(A, B; e)$	Defined conditional successor relation	Actual ending of A, new identity B, $f_B = e$, and physical production link. No universal successor-closure postulate is adopted.
Exact-Change-Stage Restraint	Epistemic principle	Observation may warrant occurrence at some $s \in I_A$ without identifying exact s or exact global order position.

Item	Status	Direct dependency or role
Clock-record bridge	Application-level physical bridge	Physical conditions and response model $\to$ detector and record $\to$ operational output.
Predeclared test architecture	Methodological application architecture	Protocol freeze, provenance, controls, covariance, model separation, independent evaluation, and replication where claimed.
Typed core model structure	Meta-level dependency device	Organizes the core carriers and primitive relations for consistency and independence analysis; distinguishes typed structures, governing core models, and countermodel witnesses without adding a physical commitment.
NTP	Foundational type principle	Mathematical consistency and operational success do not transfer temporal identity.
Relativistic temporal nonidentity	Direct external type position	Every declared $q \in \mathcal{Q}_{\mathrm{rel}}$ is type-distinct from T_{ITOF}.

B. Compact Countercondition Register

Table 2: Principal V36/F16 counterconditions and distinctions from epistemic failure.

Commitment	Contrary condition	Not sufficient by itself
CSPP	$\exists s \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}} : \mathcal{S}_{\mathrm{phys}}(s) = \varnothing$.	Failure to detect systems at an observationally reconstructed condition.
NoInterruption	$\neg\,\mathrm{NoInterruption}_{\mathrm{C}}(\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \prec_{\mathrm{C}})$.	Failure of density, adjacency, metric continuity, or a null physical-change observation.
CMA	$\neg\,$CMA; the direct quantified contrary is given in Equation (695).	Different records, spatial separation, delayed signals, clock disagreement, or different physical states.
UCC	$\exists A \in \mathcal{U}_{\mathrm{phys}}, \exists s \in I_A :$ $\neg\,\mathrm{PhysReal}_A^{+}(s)$.	Null measurement, criterion-relative stability, or no resolved difference.

Commitment	Contrary condition	Not sufficient by itself
Stage-to-change bridge	Its defining conjunction is contradicted if the CMA common-stage clause is denied or if complete-population change coverage fails, $\mathcal{B}_{\Delta}(s) \neq \mathcal{S}_{\text{phys}}(s)$, for some s; it has no independent contrary beyond these dependencies.	Different change contents, unequal rates, clock disagreement, spatial separation, or failure to observe every physical system.
CRP	$\text{PhysReal}^{+}_{A}(s) \wedge \mathcal{C}^{\text{act}}_{A}(s) = \varnothing$.	Failure to identify the causal contributor.
Identity Convexity	$r, t \in I_A,\ r \prec_{\text{C}} s \prec_{\text{C}} t,\ s \notin I_A$.	Later resemblance by a new identity.
AFB	A realized I_A lacks a unique least member.	Inability to observe the exact formation boundary.
Non-Terminating Succession	$\exists g \in \mathcal{S}^{\text{tot}}_{\text{C}}$ with no later $t \in \mathcal{S}^{\text{tot}}_{\text{C}}$.	Ending of one physical-system identity.
Cosmic Origin	No least common cosmic stage exists under the adopted cosmological module.	Uncertainty in a model-derived cosmological age.
UEIE	$\exists A \in \mathcal{U}_{\text{phys}}$ for which no ending member has any strictly earlier realization of the same identity.	Failure to observe or predict the ending, or incomplete reconstruction of the prior history.
PIECP	Actual ending with no ending-specific contributor in $\mathcal{C}^{\text{act}}_{A}(e)$.	Model-resolution failure concerning the contributor.
Successor attribution	One defining condition of $\text{SuccAt}(A, B; e)$ fails.	Absence of a successor where none was asserted.
Clock application	Predeclared physical prediction fails under valid evaluation.	Automatic rejection of T_{ITOF}, CMA, or UCC.

C. Core Symbol and Notation Register

Table 3: Core V36/F16 symbols and their governing meanings.

Symbol	Type	Meaning
T_{ITOF}	Defined temporal referent	Time in ITOF: the one universal cosmic extension of common cosmic change stages, constituted by their invariant universal earlier–later ordering and succession and represented by $(\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \prec_{\mathrm{C}})$. Its uninterrupted and continuing character is governed separately by NoInterruption and NoTerminalStage.
$\mathcal{E}_{\mathrm{C}}$	Governing temporal referent	The one non-metric universal cosmic extension constituted by the invariantly ordered succession; identical in referent to T_{ITOF}, not a second temporal object, container, spatial length, metric duration, or causal process. Its uninterrupted and continuing character is governed separately by NoInterruption and NoTerminalStage.
$\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}$	Primitive carrier/totality	Carrier of the universal common cosmic stages. The full-theory change-stage role is obtained only under CSPP–CMA–UCC; carrier membership alone does not entail UCC.
$\prec_{\mathrm{C}}$	Strict order	Universal earlier–later relation.
$\mathrm{NoInterruption}_{\mathrm{C}}$	Postulate symbol	No independent interruption in the governed common cosmic-stage succession.
$\mathrm{NoTerminalStage}_{\mathrm{C}}$	Postulate symbol	Every common cosmic stage has some later common cosmic stage.
s_{C}^{0}	Boundary symbol	Least common cosmic stage where Cosmic Origin is adopted.
$\mathcal{U}_{\mathrm{phys}}$	Physical-system totality	Qualified physical-system identities with at least one $\mathrm{ExistsAs}(A, s)$ realization in $\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}$; not an already-attained population at every reference stage.
$\mathcal{U}$	Physical totality	Totality of $\mathcal{U}_{\mathrm{phys}}$.
I_A	Identity-realization range	Common cosmic stages at which numerical identity A is realized; under CSPP–CMA–UCC they bear the full-theory change-stage role.

Symbol	Type	Meaning
$\mathcal{S}_{\text{phys}}(s)$	Population	Complete physical-system population realized at common cosmic stage s.
CSPP	Foundational postulate	Nonempty qualified physical-system population at every member of $\mathcal{S}_{\text{C}}^{\text{tot}}$.
CMA	Governing foundational axiom	Common cosmic-stage realization of the complete then-existing qualified population at one and the same common cosmic stage; excludes private system-specific stages without implying spatial co-location or universal causal interaction.
UCC	Foundational postulate	System-specific physical change at every common cosmic stage of every realized physical-system identity; under the full realization architecture these stages bear the change-stage role.
$\mathcal{B}_{\Delta}(s)$	Defined physical-system set	Change-realizing physical systems of the stage-relative physical population; equality with $\mathcal{S}_{\text{phys}}(s)$ at every common cosmic stage is equivalent to UCC.
$\mathfrak{D}_{\text{C}}(s)$	Defined profile	System-indexed dependent family of system-specific physical-change contents, typed by Ξ_A across $\mathcal{B}_{\Delta}(s)$.
$\text{StageChangeBridge}_{\text{C}}(s)$	Defined foundational bridge	Joint CMA-governed common cosmic-stage realization and complete-population change coverage at s; universally equivalent to the joint CMA–UCC architecture under the governing definitions.
$\text{PhysReal}_A^{+}(s)$	Physical relation	Actual physical change realized by A at s.
$\Delta_A^{\text{phys}}(s)$	Physical change content	System-specific content defined only for $s \in I_A^{\Delta}$; under UCC, $I_A^{\Delta} = I_A$.
$\mathfrak{C}_A(s)$	Causal triple	Internal, external-system, and external-factor physical contributors.
$\mathcal{C}_A^{\text{act}}(s)$	Actual causal set	Union of the three actual physical causal-source classes.
f_A	Formation boundary	Unique least member of I_A under AFB.

Symbol	Type	Meaning
$X_A(s)$	Physical state	State of system A realized at common cosmic change stage s.
$\mathcal{H}_A$	Formal history representation	Identity range, restricted common order, state map, and physical-change-content map.
HistoricalPhysical Accumulation$_A^{<s}$	Historical designation	System-specific physical change actually realized strictly earlier than s.
CumulativePhysical ResultThrough$_A(s)$	Truth-valued present-resultant predicate	Retained or transformed earlier effects physically embodied in $X_A(s)$; no separate resultant object is introduced.
$\mathrm{End}_A(e)$	Ending predicate	Numerical identity A ends at common cosmic change stage e.
$\Delta_A^{\mathrm{end}}(e)$	Boundary-classified change	Physical-change content realized at the ending boundary.
PIECP	Ending-specific causal principle	Physical contributor from the actual causal set contributes to the identity-ending transformation.
UEIE	Lifecycle postulate	Every realized physical-system identity eventually ends at an ending change stage with at least one strictly earlier realization of that same identity; no duration or change-stage count is imposed.
$\mathrm{SuccAt}(A, B; e)$	Conditional relation	New identity B is physically produced through the ending transformation of A at e.
$\mathrm{ManifestationAt}(A, \chi; s)$	Physical manifestation relation	Manifestation χ of A is physically realized at s.
r	Physical record	Record produced by a physical acquisition chain.
$N_{C,P}(r)$	Operational output	Standardized numerical clock reading under protocol P.
$\mathfrak{P}^{\star}$	Test protocol	Predeclared quantitative test architecture.
NTP	Type principle	Non-Transfer Principle.

Symbol	Type	Meaning
$\mathcal{Q}_{\mathrm{rel}}$	External model family	Relativistic quantities and representations examined for temporal nonidentity.

D. Formal Model Constructions and Independence Results

D.1 Purpose and logical status of the constructions

The constructions in this appendix test logical dependency among the principal V36/F16 commitments. They are abstract model-theoretic witnesses. They are not empirical cosmological models, not proposed microscopic mechanisms, and not additional postulates.

A construction satisfying a set of commitments while violating another commitment establishes only that the violated commitment is not logically entailed by the satisfied set.

Accordingly,

$$\mathrm{Model}\,[\Gamma \wedge \neg P] \Longrightarrow \Gamma \nvdash P. \tag{726}$$

Conversely, existence of one internally coherent construction does not establish physical truth:

$$\mathrm{FormalModelExists}(M) \not\Rightarrow \mathrm{PhysicallyRealized}(M). \tag{727}$$

The purpose of the constructions is therefore restricted to consistency, independence, and dependency analysis under the governing meanings fixed in the main text. A countermodel may vary a genuinely independent primitive or postulate, but it may not keep the declared common-stage vocabulary unchanged while silently reinterpreting the same stage argument as a family of private system stages. In particular, $\mathrm{CosmicCoPresence}_{\mathrm{C}}$ remains the semantic notation governed by CMA for the already common change-stage ontology; it is not independently toggled while $\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}$, s, ExistsAs, and $\mathcal{S}_{\mathrm{phys}}(s)$ retain their governing meanings. The constructions likewise do not derive the physical meaning of $\mathrm{NoInterruption}_{\mathrm{C}}$ from the carrier order. CMA and UCC remain nonidentical in role: CMA explicitly governs common-stage unity, whereas UCC supplies memberwise physical-change actuality. The appendix tests non-entailments only where the countermodel preserves the declared semantic types.

D.2 Typed core signature and model status

For dependency analysis, V36/F16 uses the following typed core meta-signature. This is an organizational model-theoretic device, not a claim that the full framework has been reduced to one first-order axiomatization:

$$\boxed{\begin{gathered}\Sigma_{36}^{\mathrm{core}} := \Big\langle \mathsf{S}_{\mathrm{C}}, \mathsf{U}_{\mathrm{phys}}; \prec_{\mathrm{C}}, \mathrm{ExistsAs}, \mathrm{PhysReal}^{+} \Big\rangle, \\ \prec_{\mathrm{C}} \subseteq \mathsf{S}_{\mathrm{C}} \times \mathsf{S}_{\mathrm{C}}, \qquad \mathrm{ExistsAs} \subseteq \mathsf{U}_{\mathrm{phys}} \times \mathsf{S}_{\mathrm{C}}, \\ \mathrm{PhysReal}^{+} \subseteq \mathsf{U}_{\mathrm{phys}} \times \mathsf{S}_{\mathrm{C}}.\end{gathered}} \tag{728}$$

Here S_{C} is interpreted by the already common change-stage totality $\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}$ and $\mathsf{U}_{\mathrm{phys}}$ by $\mathcal{U}_{\mathrm{phys}}$. The indexed notation $\mathrm{PhysReal}_A^+(s)$ is the curried presentation of $\mathrm{PhysReal}^+(A, s)$. The expressions I_A, $\mathcal{S}_{\mathrm{phys}}(s)$, I_A^{Δ}, and $\mathcal{B}_{\Delta}(s)$ remain defined constructions from the declared relations and are not promoted to additional independent primitives. The notation $\mathrm{CosmicCoPresence}_{\mathrm{C}}(\mathcal{S}_{\mathrm{phys}}(s); s)$ is intentionally absent from the independently variable core signature: it states the CMA-governed common-stage semantics fixed for the same s, rather than an extra relation that can be negated while all common-stage meanings are left unchanged. The system-indexed change-content maps retain the governing typing

$$\Delta_A^{\mathrm{phys}} : I_A^{\Delta} \longrightarrow \Xi_A. \tag{729}$$

Because the main-text definition of $\mathcal{U}_{\mathrm{phys}}$ admits only identities realized at one or more common cosmic change stages, every core interpretation of that carrier must satisfy the definitional domain-admissibility condition

$$\mathrm{DomainAdmissible}_{36} \iff \forall A \in \mathcal{U}_{\mathrm{phys}}\ \exists s \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}\ \ \mathrm{ExistsAs}(A, s). \tag{730}$$

This is not an additional physical postulate. It is the model-theoretic enforcement of Equation (24) and prevents empty identity-realization ranges from being introduced by the abstract carrier notation.

The primitive non-interruption commitment is deliberately not inserted into $\Sigma_{36}^{\mathrm{core}}$ as a zero-argument predicate. Its governing form is the separately declared pair-level condition $\mathrm{NoInterruption}_{\mathrm{C}}(\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \prec_{\mathrm{C}})$; the bare symbol $\mathrm{NoInterruption}_{\mathrm{C}}$ continues to abbreviate that condition only after its declaration in Section 2. Thus the core signature records the carriers and primitive relations used in the realization layer, while non-interruption retains its independently stated succession status.

A *typed V36/F16 core structure* interprets the carriers and relations of Equation (728) with the displayed types. A *governing V36/F16 realization-core model* is such a structure together with the independently declared succession conditions that satisfies

$$\boxed{\begin{aligned} \mathfrak{M} \models \mathfrak{G}_{36}^{\mathrm{core}} \iff\ & \mathrm{DomainAdmissible}_{36} \wedge \mathrm{StrictTotalOrder}(\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \prec_{\mathrm{C}}) \\ & \wedge \mathrm{NoInterruption}_{\mathrm{C}} \wedge \mathrm{NoTerminalStage}_{\mathrm{C}} \\ & \wedge \mathrm{CSPP} \wedge \mathrm{CMA} \wedge \mathrm{UCC}\,. \end{aligned}} \tag{731}$$

A dependency witness used below need satisfy only the explicitly listed subset of commitments under test. It is therefore a typed structure, together where needed with a valuation of independently declared pair-level succession conditions, for logical comparison; it is not an admissible realization of the full governing core when it violates a conjunct in Equation (731). This distinction prevents a countermodel from being misreported as a physically adopted ITOF world-model.

D.3 No-interruption primitive-status non-derivability witness

Because $\mathrm{NoInterruption}_{\mathrm{C}}$ is deliberately assigned primitive pair-level ontological status, the relevant formal question is whether the remaining declared commitments derive that primitive condition. The following paired expansions are therefore a primitive-status non-derivability witness; they do not discover a hidden metric, topological, density, adjacency, or order-completeness property of the carrier order. Let $\mathfrak{M}_+$ and $\mathfrak{M}_-$ have the same reduct to $\Sigma_{36}^{\mathrm{core}}$: the same common cosmic-stage carrier, strict order, physical-system totality, identity-realization relation, governing common-stage semantics, and physical-change actuality interpretation. Treat them as distinct expansions of that common reduct by the independently declared pair-level non-interruption condition. Let both satisfy Strict Cosmic Ordering, non-terminal succession, CSPP, CMA, and UCC, while the expanded interpretations of non-interruption differ:

$$\mathfrak{M}_+ \models \mathrm{NoInterruption}_{\mathrm{C}}, \qquad \mathfrak{M}_- \models \neg\,\mathrm{NoInterruption}_{\mathrm{C}}\,. \tag{732}$$

The second expanded dependency structure is not a governing V36/F16 core model; its role is solely to test whether the independently declared non-interruption condition follows from the other listed commitments. The pair establishes

$$\boxed{\begin{gathered}\mathrm{StrictTotalOrder}(\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \prec_{\mathrm{C}}) \wedge \mathrm{NoTerminalStage}_{\mathrm{C}} \wedge \mathrm{CSPP} \wedge \mathrm{CMA} \wedge \mathrm{UCC} \\ \nvDash \mathrm{NoInterruption}_{\mathrm{C}}\,.\end{gathered}} \tag{733}$$

Thus, given the deliberately primitive status assigned to non-interruption, the other listed carrier, ordering, population, common-realization, and change commitments do not derive that primitive condition. The witness adds no new physical postulate and does not identify non-interruption with a topological, metric, density, adjacency, or order-completeness property of the carrier order.

D.4 A consistency witness for the principal V36/F16 architecture

Consider the ordered common cosmic-stage totality

$$\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}} = \mathbb{N}_0 = \{0, 1, 2, \ldots\} \tag{734}$$

with the ordinary strict ordering

$$m \prec_{\mathrm{C}} n \Longleftrightarrow m < n. \tag{735}$$

Then

$$\mathrm{StrictTotalOrder}\,(\mathbb{N}_0, <) \tag{736}$$

holds. Assign the independent non-interruption condition

$$\mathrm{NoInterruption}_{\mathrm{C}}\,(\mathbb{N}_0, <)\,. \tag{737}$$

Also,

$$\forall n \in \mathbb{N}_0, \quad \exists m \in \mathbb{N}_0\,(n < m)\,, \tag{738}$$

so $\mathrm{NoTerminalStage}_{\mathrm{C}}$ is satisfied.

The least common cosmic stage is

$$s_{\mathrm{C}}^{0} = 0, \tag{739}$$

so this construction also satisfies the optional Cosmic Origin commitment.

Let the physical-system totality include the countable family

$$\mathcal{U}_{\text{phys}} = \{A_0, A_1, A_2, \ldots\}\,. \tag{740}$$

Assign to each A_k the identity-realization range

$$I_{A_k} = \{0, 1, \ldots, k+1\}\,. \tag{741}$$

Each I_{A_k} is convex under $<$, has the unique least member

$$f_{A_k} = 0, \tag{742}$$

and has the unique greatest identity member

$$e_{A_k} = k+1. \tag{743}$$

For every $k \in \mathbb{N}_0$, assign the identity-ending transformation

$$\text{IdentityEndingTransformation}\,(A_k; k+1)\,. \tag{744}$$

Because $k+1 \in I_{A_k}$ and no later member of $\mathcal{S}_{\text{C}}^{\text{tot}}$ belongs to I_{A_k}, the governing ending definition gives

$$\text{End}_{A_k}(k+1) \tag{745}$$

for every $k \in \mathbb{N}_0$.

Thus every physical-system identity has a formation boundary and an ending boundary:

$$\text{AFB} \wedge \text{UEIE}\,. \tag{746}$$

At common cosmic change stage n, the population is

$$\mathcal{S}_{\text{phys}}(n) = \{A_k \mid k+1 \geq n\}\,. \tag{747}$$

For every $n \in \mathbb{N}_0$,

$$\mathcal{S}_{\text{phys}}(n) \neq \varnothing, \tag{748}$$

because infinitely many k satisfy $k+1 \geq n$.

Hence CSPP holds.

Under the governing common cosmic-stage semantics,

$$\forall n \in \mathbb{N}_0, \quad \text{CosmicCoPresence}_{\text{C}}\,(\mathcal{S}_{\text{phys}}(n); n)\,. \tag{749}$$

Equation (749) satisfies CMA's universal common cosmic-stage co-realization requirement for the declared population. The physical-change commitment is not part of CMA and must be satisfied independently through UCC.

For every A_k and every $n \in I_{A_k}$, assign actual system-specific physical change:

$$\mathrm{PhysReal}^{+}_{A_k}(n). \tag{750}$$

This assignment independently satisfies UCC:

$$\mathrm{UCC}, \qquad \forall A_k \in \mathcal{U}_{\mathrm{phys}}\ \forall n \in I_{A_k}, \quad \mathrm{PhysReal}^{+}_{A_k}(n). \tag{751}$$

For each such pair (A_k, n), choose $c_{k,n}$ as the sole actual contributing source for this abstract attribution, classify it as internal, and assign

$$c_{k,n} \in \mathcal{C}^{\mathrm{int}}_{A_k}(n) \tag{752}$$

together with

$$\mathrm{PhysicallyContributes}\left(c_{k,n}; \Delta^{\mathrm{phys}}_{A_k}(n)\right). \tag{753}$$

The causal-membership definition then gives

$$\mathcal{C}^{\mathrm{act}}_{A_k}(n) = \{c_{k,n}\}, \tag{754}$$

and the Causal Realization Principle is satisfied.

At the ending boundary define

$$\mathrm{PhysicallyContributes}\left(c_{k,k+1}; \mathrm{IdentityEndingTransformation}(A_k; k+1)\right). \tag{755}$$

PIECP is therefore satisfied for every ending.

No physical-production linkage to a newly formed successor is assigned:

$$\forall k, j, \quad \neg\, \mathrm{PhysicalProductionLink}\left(A_k, A_j; k+1\right). \tag{756}$$

Hence

$$\forall k, j, \quad \neg\, \mathrm{SuccAt}\left(A_k, A_j; k+1\right). \tag{757}$$

Nevertheless, the cosmic succession remains non-terminal and every common cosmic change stage remains populated.

This construction therefore witnesses the joint formal satisfiability of

$$\left\{\begin{array}{c}\text{StrictTotalOrder},\ \text{NoInterruption}_{\text{C}},\ \text{NoTerminalStage}_{\text{C}},\ \text{CosmicOrigin},\\ \text{CSPP},\ \text{CMA},\ \text{UCC},\ \text{CRP},\\ \text{IdentityRealizationConvexity},\ \text{AFB},\ \text{UEIE},\ \text{PIECP}\end{array}\right\} \tag{758}$$

without requiring universal successor production. CMA and UCC both appear in the satisfiability basis because their governing roles are distinct and neither role is replaced by the other.

Accordingly,

$$\left\{\begin{array}{c}\text{NoTerminalStage}_{\text{C}},\ \text{CSPP},\ \text{AFB},\\ \text{UEIE},\ \text{PIECP}\end{array}\right\} \nvdash \forall A, e\left[\text{End}_A(e) \Longrightarrow \exists B\ \text{SuccAt}(A, B; e)\right]. \tag{759}$$

The construction is a consistency witness only. Its countably infinite initial system population is not asserted as a physical cosmology.

D.5 The V36/F16 stage-to-change bridge in the consistency witness

The new V36/F16 definitions add no independent satisfiability requirement to the construction above. For every $n \in \mathbb{N}_0$, Equation (747) defines $\mathcal{S}_{\text{phys}}(n)$, and Equation (751) assigns actual physical change to every member of that population. Therefore,

$$\boxed{\forall n \in \mathbb{N}_0, \quad \mathcal{B}_{\Delta}(n) = \mathcal{S}_{\text{phys}}(n).} \tag{760}$$

Equation (749) records the CMA-governed common cosmic-stage semantics, while Equation (751) separately supplies UCC's memberwise physical-change actuality. Hence,

$$\boxed{\forall n \in \mathbb{N}_0, \quad \text{StageChangeBridge}_{\text{C}}(n).} \tag{761}$$

The system-indexed profile $\mathfrak{D}_{\text{C}}(n)$ is then well defined by Equation (65). Thus the bridge and change profile are conservative definitional extensions, while complete-population coverage is an equivalent representation of the already satisfiable V36/F16 core. None introduces an additional primitive truth assignment; their truth in a V36 model is fixed by the joint CMA–UCC commitments and the governing definitions.

D.6 UCC does not entail UEIE

Let

$$\mathcal{S}_{\text{C}}^{\text{tot}} = \mathbb{N}_0 \tag{762}$$

with the ordinary strict ordering.

Let the physical-system population contain one physical-system identity A satisfying

$$I_A = \mathbb{N}_0. \tag{763}$$

Then

$$f_A = 0 \tag{764}$$

satisfies AFB.

Assign

$$\mathrm{PhysReal}^{+}_{A}(n) \tag{765}$$

for every $n \in \mathbb{N}_0$, with a nonempty causal set at every member.

Then

$$\mathrm{UCC} \wedge \mathrm{CRP} \wedge \mathrm{AFB} \wedge \mathrm{CSPP} \wedge \mathrm{CMA} \wedge \mathrm{NoTerminalStage}_{\mathrm{C}} \tag{766}$$

may all hold.

Now assign

$$\forall e \in I_A, \quad \neg\,\mathrm{End}_A(e). \tag{767}$$

Then UEIE fails.

Therefore,

$$\boxed{\mathrm{UCC} \nvdash \mathrm{UEIE}\,.} \tag{768}$$

The result is important because uninterrupted physical change does not logically entail eventual identity ending.

UEIE remains an additional universal lifecycle commitment.

D.7 Cosmic Origin is independent of the governing temporal–realization architecture

Let

$$\mathcal{S}^{\mathrm{tot}}_{\mathrm{C}} = \mathbb{Z} \tag{769}$$

with the ordinary strict order. Assign the independent non-interruption condition

$$\mathrm{NoInterruption}_{\mathrm{C}}\,(\mathbb{Z}, <)\,. \tag{770}$$

For every $n \in \mathbb{Z}$, introduce physical system A_n with

$$I_{A_n} = \{n, n+1\}. \tag{771}$$

Each A_n has the formation boundary

$$f_{A_n} = n. \tag{772}$$

Assign

$$\text{IdentityEndingTransformation}\,(A_n; n+1) \tag{773}$$

for every $n \in \mathbb{Z}$. Since $n+1$ is the greatest member of I_{A_n}, the ending definition gives

$$\text{End}_{A_n}(n+1). \tag{774}$$

At every common cosmic stage m,

$$A_{m-1}, A_m \in \mathcal{S}_{\text{phys}}(m), \tag{775}$$

so CSPP holds.

Under the governing common cosmic-stage semantics, $\text{CosmicCoPresence}_{\text{C}}(\mathcal{S}_{\text{phys}}(m); m)$ holds for every $m \in \mathbb{Z}$. Independently assign $\text{PhysReal}^{+}_{A_n}(s)$ for every $s \in I_{A_n}$, and assign actual physical contributors satisfying CRP at every such member and PIECP at every ending boundary. The construction then satisfies

$$\begin{gathered} \text{StrictTotalOrder}, \quad \text{NoInterruption}_{\text{C}}, \quad \text{NoTerminalStage}_{\text{C}}, \quad \text{CSPP}, \quad \text{CMA}, \\ \text{UCC}, \quad \text{CRP}, \quad \text{AFB}, \quad \text{UEIE}, \quad \text{PIECP}\,. \end{gathered} \tag{776}$$

However,

$$\forall s_0 \in \mathbb{Z}, \quad \exists r \in \mathbb{Z}\,(r < s_0)\,. \tag{777}$$

Thus no candidate s_0 satisfies the least-stage condition required by Cosmic Origin, and Cosmic Origin fails.

Therefore,

$$\boxed{\begin{gathered} \left\{\begin{gathered} \text{StrictTotalOrder}, \text{NoInterruption}_{\text{C}}, \text{NoTerminalStage}_{\text{C}}, \text{CSPP}, \text{CMA}, \\ \text{CRP}, \text{AFB}, \text{UEIE}, \text{PIECP} \end{gathered}\right\} \\ \nvdash \text{CosmicOrigin}\,. \end{gathered}} \tag{778}$$

Cosmic Origin is therefore not a concealed consequence of the general temporal, common-stage realization, physical-change, identity, or lifecycle architecture.

D.8 AFB is not entailed by the CMA/UCC realization architecture

Let

$$\mathcal{S}^{\text{tot}}_{\text{C}} = \mathbb{Q}_{\geq 0} \tag{779}$$

with the ordinary strict order.

The ordered stage totality has least member 0 and has no terminal member.

Let a background physical-system identity B satisfy

$$I_B = \mathbb{Q}_{\geq 0}. \tag{780}$$

Let another physical-system identity A satisfy

$$I_A = (0, 1] \cap \mathbb{Q}. \tag{781}$$

Both I_A and I_B are convex under the common ordering.

Assign

$$\forall X \in \{A, B\}\ \forall s \in I_X, \quad \mathrm{PhysReal}^{+}_{X}(s). \tag{782}$$

Thus UCC holds for the declared physical-system totality. CSPP is maintained by B. Under the governing common-stage semantics, CMA is satisfied at every common cosmic stage; the memberwise physical-change assignments are used for UCC, not for CMA.

However, I_A has no least member:

$$\forall s \in I_A, \quad \exists r \in I_A\, (r \prec_{\mathrm{C}} s)\,. \tag{783}$$

Hence AFB fails for A.

Therefore,

$$\boxed{\{\mathrm{CSPP}, \mathrm{CMA}, \mathrm{UCC}, \mathrm{IdentityRealizationConvexity}\} \nvdash \mathrm{AFB}\,.} \tag{784}$$

AFB is therefore a genuine identity-boundary commitment: even universal memberwise physical change, common-stage realization, nonempty population, and identity-range convexity do not generate a least identity member.

D.9 Formation and ending alone do not entail non-terminal cosmic succession

Consider any finite strict total order

$$\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}} = \{0, 1, \ldots, N\} \tag{785}$$

with $N \geq 1$.

Let one or more physical systems possess well-defined formation and ending boundaries within the finite ordered stage totality, with UCC and PIECP satisfied wherever applicable.

The finite ordered stage totality nevertheless has greatest member N:

$$\nexists t \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}\, (N \prec_{\mathrm{C}} t)\,. \tag{786}$$

Therefore,

$$\neg\,\mathrm{NoTerminalStage}_{\mathrm{C}}\,. \tag{787}$$

The existence of formation, physical change, and identity-ending relations inside a finite ordered stage totality does not by itself prevent the cosmic stage totality from terminating.

Thus formation and ending alone do not entail non-terminal cosmic succession. Earlier historical formulations used stronger lifecycle premise sets to obtain such a result; V36/F16 instead adopts non-termination directly within the ordering architecture.

V36/F16 adopts the direct ordering commitment

$$\mathrm{NoTerminalStage}_{\mathrm{C}} \iff \forall s \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}\ \exists t \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}\ (s \prec_{\mathrm{C}} t)\,. \tag{788}$$

It is therefore not derived in V36/F16 from formation or ending commitments.

D.10 Ending does not entail a newly formed successor

Consider common cosmic change stages

$$0 \prec_{\mathrm{C}} 1 \prec_{\mathrm{C}} 2 \prec_{\mathrm{C}} \cdots \tag{789}$$

and two physical-system identities A and B.

Let

$$I_A = \{0, 1\}, \tag{790}$$

with

$$\mathrm{End}_A(1). \tag{791}$$

Let

$$I_B = \mathbb{N}_0. \tag{792}$$

Thus B already exists before the ending of A.

Suppose the transformation at common cosmic change stage 1 physically terminates identity A, and physical constituents or effects associated with A are assimilated into or interact with B, while numerical identity B persists.

Assign UCC throughout both identity ranges:

$$\forall X \in \{A, B\}\ \forall s \in I_X, \quad \mathrm{PhysReal}_X^{+}(s). \tag{793}$$

Assign nonempty actual causal sets consistent with the causal-membership definition at every applicable member, and assign at least one ending-specific contributor satisfying PIECP for A at common cosmic change stage 1.

No new physical-system identity C is formed at common cosmic change stage 1.

Hence

$$\neg\exists C \in \mathcal{U}_{\text{phys}}\ \operatorname{SuccAt}(A, C; 1). \tag{794}$$

Nevertheless,

$$\operatorname{End}_A(1), \quad \text{UCC}, \quad \text{CRP}, \quad \text{PIECP} \tag{795}$$

remain jointly satisfiable.

Therefore,

$$\boxed{\{\operatorname{End}_A(e), \text{UCC}, \text{CRP}, \text{PIECP}\} \nvdash \exists B \in \mathcal{U}_{\text{phys}}\ \operatorname{SuccAt}(A, B; e).} \tag{796}$$

The result concerns logical entailment. It does not deny the physical existence of genuine successor-producing transformations.

D.11 General causal realization does not entail PIECP

Let A end at common cosmic change stage e:

$$\operatorname{End}_A(e). \tag{797}$$

By UCC,

$$\operatorname{PhysReal}_A^+(e). \tag{798}$$

Assign a nonempty actual causal set

$$\mathcal{C}_A^{\text{act}}(e) = \{c\}. \tag{799}$$

Then the Causal Realization Principle is satisfied.

Now suppose only that

$$\operatorname{PhysicallyContributes}\left(c; \Delta_A^{\text{phys}}(e)\right) \tag{800}$$

holds, while

$$\neg \operatorname{PhysicallyContributes}\left(c; \operatorname{IdentityEndingTransformation}(A; e)\right). \tag{801}$$

Then CRP is true while PIECP is false.

Therefore,

$$\boxed{\{\text{CRP}, \operatorname{End}_A(e)\} \nvdash \text{PIECP}\,.} \tag{802}$$

This construction isolates the independent content of PIECP: ending-specific causal attribution.

Uninterrupted physical change through the ending change stage is already supplied by UCC and the membership relation $e \in I_A$.

D.12 Formal Status and Distinct Governing Roles of CMA and UCC

CMA and UCC have distinct governing roles. CMA is the constitutive semantic–ontological meaning-fixing axiom of one-common-change-stage realization for the complete qualified population realized there. UCC independently fixes system-specific physical-change actuality for every qualified realized system throughout its identity range. Their contents are not definitionally identical:

$$\boxed{\mathrm{CMA} \not\equiv_{\mathrm{def}} \mathrm{UCC}\,.} \tag{803}$$

CMA by itself does not supply memberwise physical-change actuality, so the valid non-entailment is

$$\boxed{\mathrm{CMA} \nvdash \mathrm{UCC}\,.} \tag{804}$$

A typed dependency structure may preserve the carrier, the fixed common-stage ordering, and CMA-governed one-common-stage semantics while deliberately assigning $\neg\,\mathrm{PhysReal}_A^+(s)$ to one or more qualified realized pairs. It then satisfies CMA and violates UCC, but it is not an admissible full V36/F16 realization. In particular, it does not establish a physically admissible changeless common cosmic change stage. Its sole logical function is to show that universal stage unity does not by itself entail exhaustive memberwise physical change.

The reverse model-theoretic non-entailment is deliberately not asserted under fixed V36/F16 common-stage meanings. Denying $\mathrm{CosmicCoPresence}_{\mathrm{C}}(\mathcal{S}_{\mathrm{phys}}(s); s)$ while retaining the declared meaning that the same $s \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}$ is the common stage at which all members are realized would change the common-stage ontology rather than hold it fixed. UCC does not replace CMA as the explicit governing axiom of that semantics, but no artificial "CMA-off" countermodel is used by reinterpreting a common stage as private stages.

CSPP supplies nonempty population but not physical change, so

$$\mathrm{CSPP} \nvdash \mathrm{UCC}\,. \tag{805}$$

The full realization/change layer therefore requires CSPP, the CMA-governed common stage, and UCC's exhaustive memberwise change actuality, with their respective roles kept distinct.

D.13 CMA does not eliminate stochastic physical dynamics

Let two systems A and B satisfy

$$A, B \in \mathcal{S}_{\mathrm{phys}}(s) \tag{806}$$

under CMA.

Suppose their physical response laws include stochastic transition kernels

$$P_A\left(X_A' | X_A, \Lambda_A\right) \tag{807}$$

and

$$P_B\left(X_B'|X_B,\Lambda_B\right). \tag{808}$$

The outcome distributions may differ:

$$P_A \neq P_B. \tag{809}$$

This does not contradict CMA.

CMA constrains common cosmic-stage realization, not determinism of physical outcomes.

Thus,

$$\mathrm{CMA} \not\Rightarrow \mathrm{DeterministicPhysicalDynamics}\,. \tag{810}$$

and

$$\mathrm{StochasticPhysicalDynamics} \not\Rightarrow \neg\,\mathrm{CMA}\,. \tag{811}$$

The absence of arbitrary private change stage assignment is therefore not a denial of physically warranted stochasticity.

D.14 Historical accumulation does not entail ending

Let A possess an unbounded identity range

$$I_A = \mathbb{N}_0 \tag{812}$$

and satisfy UCC.

For every $n > 0$,

$$I_A^{<n} \neq \varnothing, \tag{813}$$

so

$$\mathrm{HistoricalPhysicalAccumulation}_A^{<n} \tag{814}$$

is defined.

Suppose

$$\forall n \in \mathbb{N}_0, \quad \neg\,\mathrm{End}_A(n). \tag{815}$$

Then historical physical accumulation exists throughout arbitrarily extended portions of the identity history while the identity does not end.

Therefore,

$$\boxed{\{I_A^{<s} \neq \varnothing, \mathrm{UCC}\} \nvdash \mathrm{End}_A(s).} \tag{816}$$

The same construction confirms that no universal ending threshold follows from the mere existence of earlier realized change.

D.15 Present cumulative resultant does not entail ending

Suppose earlier effects remain physically embodied in $X_A(s)$, so that

$$\mathrm{CumulativePhysicalResultThrough}_A(s) \tag{817}$$

holds.

If the applicable physical identity criterion continues to classify the same numerical identity as realized after s, then

$$\neg\,\mathrm{End}_A(s). \tag{818}$$

Therefore,

$$\boxed{\mathrm{CumulativePhysicalResultThrough}_A(s) \nvdash \mathrm{End}_A(s).} \tag{819}$$

The present developed condition may embody extensive earlier physical consequences without ending the identity.

Identity ending requires the physical identity-ending transformation specified by the applicable identity criterion.

D.16 Non-injective observational model

Let a physical-system identity be realized at ordered common cosmic change stages

$$s_0, s_1, s_2, s_3 \in I_A, \qquad s_0 \prec_{\mathrm{C}} s_1 \prec_{\mathrm{C}} s_2 \prec_{\mathrm{C}} s_3. \tag{820}$$

Define a selected observational map

$$\mathcal{O}_{P,\varepsilon} : I_A \longrightarrow \{0,1\} \tag{821}$$

by

$$\mathcal{O}_{P,\varepsilon}(s) = \begin{cases} 0, & \mathrm{Response}_P(A;s) < \varepsilon, \\ 1, & \mathrm{Response}_P(A;s) \geq \varepsilon. \end{cases} \tag{822}$$

Suppose

$$\mathcal{O}_{P,\varepsilon}(s_0) = \mathcal{O}_{P,\varepsilon}(s_1) = 0 \tag{823}$$

and

$$\mathcal{O}_{P,\varepsilon}(s_2) = \mathcal{O}_{P,\varepsilon}(s_3) = 1. \tag{824}$$

Then

$$\exists r, s \in I_A, \quad r \neq s, \quad \mathcal{O}_{P,\varepsilon}(r) = \mathcal{O}_{P,\varepsilon}(s). \tag{825}$$

Therefore $\mathcal{O}_{P,\varepsilon}$ is not injective.

No inverse of the form

$$\mathcal{O}_{P,\varepsilon}^{-1} : \{0, 1\} \longrightarrow I_A \tag{826}$$

can uniquely identify a common cosmic change stage from the observational output alone.

Hence

$$\mathcal{O}_{P,\varepsilon}(s) = 1 \nRightarrow \mathrm{ExactCosmicChangeStageIdentified}(s). \tag{827}$$

This construction does not constitute the complete justification of Exact-Change-Stage Restraint.

It demonstrates one physically familiar mathematical source of observational non-uniqueness: distinct actual common cosmic change stages may produce the same selected observational classification.

D.17 Unique selected-state reconstruction does not imply exact cosmic change-stage identity

Even if a selected state variable can be reconstructed uniquely,

$$\widehat{X}_{A;P,M}(r) = X^\star, \tag{828}$$

there may exist distinct common cosmic change stages satisfying

$$\exists s_1, s_2 \in I_A, \quad s_1 \neq s_2, \quad X_A(s_1) = X_A(s_2) = X^\star. \tag{829}$$

Therefore,

$$\mathrm{UniqueSelectedStateReconstruction} \nRightarrow \mathrm{UniqueCosmicChangeStageIdentification}\,. \tag{830}$$

This result follows from the distinction between physical state and common cosmic change stage and remains compatible with recurrence without reversal.

D.18 Clock-output agreement does not imply temporal identity

Let two distinct physical models M_1 and M_2 predict the same clock output over a restricted domain D:

$$\widehat{\mathbf{y}}_D^{M_1} = \widehat{\mathbf{y}}_D^{M_2}. \tag{831}$$

Suppose both agree with the observations:

$$\widehat{\mathbf{y}}_D^{M_1} = \widehat{\mathbf{y}}_D^{M_2} = \mathbf{y}_D^{\mathrm{obs}}. \tag{832}$$

Then both may satisfy the same recovery criterion.

However,

$$\mathrm{Recovered}_D(M_1) \wedge \mathrm{Recovered}_D(M_2) \not\Rightarrow \mathrm{TemporalOntologyOf}(M_1) = \mathrm{TemporalOntologyOf}(M_2). \tag{833}$$

Nor does recovery determine which model quantity, if any, is identical with time:

$$\mathrm{Recovered}_D(M) \not\Rightarrow q_M \equiv_{\mathrm{type}} T_{\mathrm{ITOF}}. \tag{834}$$

This is the model-theoretic form of the Non-Transfer distinction used in the quantitative architecture.

D.19 Model separation is required for empirical discrimination

Let

$$\widehat{\mathbf{D}}^{M_1} = \widehat{\mathbf{D}}^{M_2} \tag{835}$$

within the uncertainty resolution of an experiment.

Then no observation drawn solely from that domain can discriminate between the two predictions on the basis of the declared observable.

Formally, if

$$\Delta_D \left(\widehat{\mathbf{D}}^{M_1}, \widehat{\mathbf{D}}^{M_2} \right) \le \varepsilon_D^{\mathrm{sep}}, \tag{836}$$

then

$$\neg\, \mathrm{DiscriminatingPower}_D(M_1, M_2). \tag{837}$$

Thus successful recovery of an existing clock relation is not, by itself, a discriminating test.

The empirical architecture requires an independently predicted separation exceeding the declared uncertainty threshold.

D.20 Post-hoc parameter rescue destroys advance-prediction status

Let model M contain parameter vector θ.

If the parameter is determined before evaluation,

$$\widehat{\theta} = \Theta\left(D_{\mathrm{der}}\right), \qquad D_{\mathrm{der}} \cap D_{\mathrm{eval}} = \varnothing, \tag{838}$$

then

$$\widehat{\mathbf{y}}_{\text{eval}} = \mathcal{Q}_M \left(\widehat{\theta}, D_{\text{eval}}\right) \tag{839}$$

may possess advance-prediction status.

If instead

$$\widehat{\theta}' = \Theta \left(D_{\text{der}}, \mathbf{y}^{\text{obs}}_{\text{eval}}\right), \tag{840}$$

then the adjusted prediction

$$\widehat{\mathbf{y}}'_{\text{eval}} = \mathcal{Q}_M \left(\widehat{\theta}', D_{\text{eval}}\right) \tag{841}$$

does not independently predict the same evaluation outcome.

Therefore,

$$\boxed{\text{EvaluationDependentParameterAdjustment} \not\Rightarrow \text{AdvancePrediction}\,.} \tag{842}$$

A revised model may subsequently be tested on new independent data.

It does not retroactively convert the original evaluation into an advance prediction.

D.21 Dependency separation theorem

The constructions above establish the following set of principal non-entailments:

$$\boxed{\left\{\begin{matrix} \text{StrictTotalOrder}(\mathcal{S}^{\text{tot}}_{\text{C}}, \prec_{\text{C}}),\ \text{NoTerminalStage}_{\text{C}}, \\ \text{CSPP},\ \text{CMA},\ \text{UCC} \end{matrix}\right\} \nvdash \text{NoInterruption}_{\text{C}}\,.} \tag{843}$$

$$\begin{aligned} \text{UCC} &\nvdash \text{UEIE}, & (844)\\ \{\text{CSPP}, \text{CMA}\} &\nvdash \text{CosmicOrigin}, & (845)\\ \{\text{CSPP}, \text{CMA}, \text{IdentityRealizationConvexity}\} &\nvdash \text{AFB}, & (846)\\ \{\text{CRP}, \text{End}_A(e)\} &\nvdash \text{PIECP}, & (847)\\ \{\text{End}_A(e), \text{UCC}, \text{CRP}, \text{PIECP}\} &\nvdash \exists B\ \text{SuccAt}(A, B; e), & (848)\\ \text{CSPP} &\nvdash \text{UCC}, & (849)\\ \text{CMA} &\nvdash \text{UCC}, & (850)\\ \{I^{<s}_A \neq \varnothing, \text{UCC}\} &\nvdash \text{End}_A(s), & (851)\\ \text{CumulativePhysicalResultThrough}_A(s) &\nvdash \text{End}_A(s), & (852)\\ \text{ClockRecovery} &\nvdash \text{TemporalIdentity}\,. & (853) \end{aligned}$$

The formal architecture therefore separates claims that were previously capable of appearing physically associated while not being logically equivalent.

D.22 Direct derivations retained by V36/F16

The same architecture preserves genuine direct derivations.

From strict total ordering,

$$r \prec_{\mathrm{C}} s \Longrightarrow \neg \left(s \prec_{\mathrm{C}} r\right). \tag{854}$$

From non-terminal succession,

$$\mathrm{NoTerminalStage}_{\mathrm{C}} \Longrightarrow \nexists g \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}} \ \ \mathrm{Greatest}_{\prec_{\mathrm{C}}}(g). \tag{855}$$

For nonempty strictly totally ordered $\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}$,

$$\mathrm{NoTerminalStage}_{\mathrm{C}} \Longrightarrow \mathrm{Infinite}(\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}). \tag{856}$$

From UEIE,

$$\mathrm{UEIE} \Longrightarrow \forall A \in \mathcal{U}_{\mathrm{phys}}\ \exists e_A \in I_A \left[\mathrm{End}_A(e_A) \wedge I_A^{<e_A} \neq \varnothing\right]. \tag{857}$$

From non-terminal succession, CSPP, UEIE, and strict total ordering,

$$\left\{\mathrm{NoTerminalStage}_{\mathrm{C}}, \mathrm{CSPP}, \mathrm{UEIE}, \mathrm{StrictTotalOrder}(\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \prec_{\mathrm{C}})\right\} \Longrightarrow \mathrm{Infinite}(\mathcal{U}_{\mathrm{phys}}). \tag{858}$$

Where direct successor production is physically realized, AFB and UEIE also preserve a strict successor history beyond formation:

$$\left\{\mathrm{AFB}, \mathrm{UEIE}, \mathrm{StrictTotalOrder}(\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \prec_{\mathrm{C}})\right\} \wedge \mathrm{SuccAt}(A, B; e) \Longrightarrow f_B = e \prec_{\mathrm{C}} e_B. \tag{859}$$

From AFB and UCC,

$$\mathrm{AFB} \wedge \mathrm{UCC} \Longrightarrow \forall A \in \mathcal{U}_{\mathrm{phys}}, \quad \mathrm{FormationChange}_A(f_A). \tag{860}$$

From ending membership and UCC,

$$\mathrm{End}_A(e) \wedge \mathrm{UCC} \Longrightarrow \mathrm{PhysReal}_A^{+}(e). \tag{861}$$

From UCC and CRP,

$$\{\mathrm{UCC}, \mathrm{CRP}\} \Longrightarrow \forall A \in \mathcal{U}_{\mathrm{phys}}\ \forall s \in I_A, \quad \mathcal{C}_A^{\mathrm{act}}(s) \neq \varnothing. \tag{862}$$

From Cosmic Origin and non-terminal succession,

$$\mathrm{CosmicOrigin} \wedge \mathrm{NoTerminalStage}_{\mathrm{C}} \Longrightarrow \exists s \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}} \left(s_{\mathrm{C}}^{0} \prec_{\mathrm{C}} s\right). \tag{863}$$

From CSPP, CMA, and UCC,

$$\{\mathrm{CSPP},\mathrm{CMA},\mathrm{UCC}\} \Longrightarrow \forall s \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \Big[\mathcal{S}_{\mathrm{phys}}(s) \neq \varnothing \\ \wedge\ \mathrm{CosmicCoPresence}_{\mathrm{C}}\left(\mathcal{S}_{\mathrm{phys}}(s); s\right) \\ \wedge\ \forall A \in \mathcal{S}_{\mathrm{phys}}(s), \mathrm{PhysReal}_A^{+}(s)\Big]. \tag{864}$$

These derivations identify precisely where V36/F16 makes a theorem and where it makes an independent commitment.

D.23 Definitional nucleus, ordering, succession, and extended modules

The architecture distinguishes what fixes the referent of time from additional V36/F16 commitments about that referent and the actual cosmic succession.

The definitional nucleus is

$$\mathfrak{T}_{\mathrm{def}} = \left\{\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \prec_{\mathrm{C}}, T_{\mathrm{ITOF}}\right\}. \tag{865}$$

The ordering module is

$$\mathfrak{T}_{\mathrm{order}} = \left\{\mathrm{StrictTotalOrder}(\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \prec_{\mathrm{C}})\right\}. \tag{866}$$

The cosmic-succession module is

$$\mathfrak{T}_{\mathrm{succ}} = \left\{\mathrm{NoInterruption}_{\mathrm{C}}, \mathrm{NoTerminalStage}_{\mathrm{C}}\right\}. \tag{867}$$

For compact organizational reference only,

$$\mathfrak{T}_{\mathrm{temporal}} = \mathfrak{T}_{\mathrm{def}} \cup \mathfrak{T}_{\mathrm{order}} \cup \mathfrak{T}_{\mathrm{succ}}. \tag{868}$$

Only $\mathfrak{T}_{\mathrm{def}}$ fixes the entity denoted by time. $\mathfrak{T}_{\mathrm{order}}$ and $\mathfrak{T}_{\mathrm{succ}}$ state additional foundational commitments about the ordering and the actual cosmic succession; $\mathrm{NoTerminalStage}_{\mathrm{C}}$ is not a hidden component of the definition $T_{\mathrm{ITOF}} = (\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \prec_{\mathrm{C}})$.

The common-realization and physical-change module contains the distinct governing inputs:

$$\mathfrak{T}_{\mathrm{real}} = \left\{\mathcal{U}_{\mathrm{phys}}, I_A, \mathcal{S}_{\mathrm{phys}}(s), \mathrm{CSPP}, \mathrm{CMA}, \mathrm{UCC}, \mathrm{CRP}\right\}. \tag{869}$$

The identity-history module is

$$\mathfrak{T}_{\mathrm{id}} = \Big\{\mathrm{IdentityRealizationConvexity}, \mathrm{AFB}, X_A, \Delta_A^{\mathrm{phys}}, \mathcal{H}_A, \\ \mathrm{HistoricalPhysicalAccumulation}_A^{<s}, \mathrm{CumulativePhysicalResultThrough}_A(s)\Big\}. \tag{870}$$

The lifecycle module is

$$\mathfrak{T}_{\mathrm{life}} = \left\{\mathrm{End}_A(e), \Delta_A^{\mathrm{end}}(e), \mathrm{PIECP}, \mathrm{UEIE}, \mathrm{SuccAt}(A, B; e)\right\}. \tag{871}$$

The cosmological extension is

$$\mathfrak{T}_{\text{cosmo}} = \{\text{CosmicOrigin}\}\,. \tag{872}$$

The epistemic and observational module is

$$\mathfrak{T}_{\text{obs}} = \{\text{ManifestationAt}, \text{PositiveManifestationWitness}, \text{ExactChangeStageRestraint}\}\,. \tag{873}$$

The application module is

$$\mathfrak{T}_{\text{app}} = \{\text{ClockBridge}, \mathfrak{P}^{\star}, \text{ModelDiscrimination}, \text{NTP}, \mathcal{Q}_{\text{rel}}\}\,. \tag{874}$$

The governing V36/F16 architecture without the optional Cosmic Origin module is

$$\boxed{\mathfrak{F}^{\text{gov}}_{\text{V36}} = \mathfrak{T}_{\text{temporal}} \cup \mathfrak{T}_{\text{real}} \cup \mathfrak{T}_{\text{id}} \cup \mathfrak{T}_{\text{life}} \cup \mathfrak{T}_{\text{obs}} \cup \mathfrak{T}_{\text{app}}.} \tag{875}$$

Where the independent Cosmic Origin postulate is additionally adopted, the cosmologically augmented architecture is

$$\boxed{\mathfrak{F}^{(+\text{Origin})}_{\text{V36}} = \mathfrak{F}^{\text{gov}}_{\text{V36}} \cup \mathfrak{T}_{\text{cosmo}}.} \tag{876}$$

Union in Equations (875) and (876) denotes organization of the framework. It does not imply that every member has identical logical status. In particular, CosmicOrigin remains an optional cosmological commitment and is not silently promoted into the governing temporal core.

Definitions, axioms, postulates, principles, derived propositions, epistemic restraints, and application-level bridges retain the statuses assigned to them in Appendix A.

D.24 Formal conclusion

The model constructions establish that the central V36/F16 architecture is not dependent on hidden equivalences among cosmic continuation, system-specific change, identity ending, successor production, causal realization, observation, or operational measurement.

In particular,

$$\boxed{\text{PairwiseDefDistinct}\begin{pmatrix}\text{CosmicNonTermination}\\ \text{UniversalIdentityEnding}\\ \text{UniversalSuccessorProduction}\end{pmatrix},} \tag{877}$$

$$\boxed{\text{CommonCosmicRealization} \not\equiv_{\text{def}} \text{SystemSpecificPhysicalChange},} \tag{878}$$

$$\boxed{\text{PairwiseDefDistinct}\begin{pmatrix}\text{HistoricalPhysicalAccumulation}\\ \text{PresentCumulativePhysicalResultant}\\ \text{IdentityEndingCause}\end{pmatrix}.} \tag{879}$$

and

$$\boxed{\text{OperationalPrediction} \not\equiv_{\text{def}} \text{TemporalIdentity}\,.} \tag{880}$$

The positive integrated result remains

$$\boxed{\forall s \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}},\, \Big[\mathcal{S}_{\mathrm{phys}}(s) \neq \varnothing \wedge \mathrm{CosmicCoPresence}_{\mathrm{C}}\left(\mathcal{S}_{\mathrm{phys}}(s); s\right) \wedge \forall A \in \mathcal{S}_{\mathrm{phys}}(s), \mathrm{PhysReal}_A^{+}(s)\Big]\,.} \tag{881}$$

Thus one and the same common cosmic change stage is universally shared by the complete then-existing physical-system population, while every member realizes its own system-specific physical change.

The common cosmic succession remains non-terminal independently of individual lifecycle closure.

The physical histories remain system-specific without becoming private temporal successions.

Identity ending remains within the same uninterrupted physical development as the system's preceding history without making historical accumulation an independent ending cause.

Successor production remains a physical relation where actually realized rather than a universal logical requirement.

Observation can warrant actual physical manifestation without becoming exact cosmic change-stage identification.

Quantitative prediction can test physical application models without transferring the identity of time to clocks, coordinates, metrics, proper-time functionals, or other successful representational quantities.

E. Historical-Critical Transition from V35/F15 to V36/F16

E.1 Direct predecessor, retained formal pair, and refined denotation

V36/F16 is the direct historical-critical successor to V35/F15 [1]. It retains the formal ordered pair

$$\boxed{T_{\mathrm{ITOF}} = \mathcal{E}_{\mathrm{C}} = \left(\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \prec_{\mathrm{C}}\right).} \tag{882}$$

but intentionally refines the governing denotation. V35/F15 gave the invariant universal ordering and succession denotational priority within one common cosmic extension. V36/F16 instead states that time denotes the one universal cosmic extension of common cosmic change stages, constituted by their invariant earlier–later ordering and succession. This is a foundational semantic re-centering within the historical ITOF series, not an application-level change. The symbol $\mathcal{E}_{\mathrm{C}}$ names the same temporal referent and introduces no third temporal component, second temporal object, metric magnitude, or causal process. Strict Cosmic Ordering fixes irreversibility; NoInterruption and NoTerminalStage separately govern the uninterrupted and continuing character of the actual cosmic succession and are not part of the minimal temporal definition.

V36/F16 preserves CSPP, CMA, UCC, CRP, identity architecture, lifecycle commitments, observational restraints, quantitative discipline, and the Non-Transfer Principle. Historical retention is never automatic: each inherited statement remains governing only where it survives the present definitions and dependency analysis.

E.2 From common cosmic stage to literal common cosmic change stage

V35/F15 already required system-specific physical change at every common stage of each realized identity through UCC. V36/F16 does not invent that universal change requirement. Its V36/F16 clarification is to make the full-theory physical role of the stage explicit in the governing terminology: every member of the admitted cosmic succession has the ontological role *common cosmic change stage* in an admissible V36/F16 realization. CSPP prevents population-empty vacuity, CMA governs literal one-common-stage realization, and UCC separately supplies exhaustive system-specific physical-change actuality. Bare carrier membership used in a dependency witness is not an analytic derivation of UCC; a witness that violates UCC is therefore not an admissible full V36/F16 realization and does not constitute a physically admissible changeless change stage.

This refinement does not identify the stage with a physical-change content. For any actual-change pair (A, s) with $s \in I_A^{\Delta}$,

$$s \not\equiv_{\text{type}} \Delta_A^{\text{phys}}(s). \tag{883}$$

Nor does it make the stage a cause, carrier, quantity, or completed packet of change. The physical changes are many and system-specific; the common stage and its position in the one cosmic extension are one.

E.3 CMA and UCC: retained distinct roles without artificial semantic toggling

V35/F15 already separated common-stage unity from universal system-specific physical change. V36/F16 retains that separation:

$$\boxed{\begin{aligned} \text{CMA}_{36} &\iff \forall s \in \mathcal{S}_{\text{C}}^{\text{tot}}\ \ \text{CosmicCoPresence}_{\text{C}}\left(\mathcal{S}_{\text{phys}}(s); s\right), \\ \text{UCC}_{36} &\iff \forall A \in \mathcal{U}_{\text{phys}}\ \forall s \in I_A, \quad \text{PhysReal}_A^{+}(s). \end{aligned}} \tag{884}$$

Their contents are not definitionally identical, and CMA alone does not entail UCC:

$$\boxed{\text{CMA}_{36} \not\equiv_{\text{def}} \text{UCC}_{36}, \qquad \text{CMA}_{36} \nvdash \text{UCC}_{36}\,.} \tag{885}$$

V36/F16 also retains the V35 semantic restraint that a common stage cannot be turned into private system stages merely by toggling an auxiliary predicate while the declared meanings of s, ExistsAs, and $\mathcal{S}_{\text{phys}}(s)$ are said to remain fixed. Thus the advance is not a redistribution that hides UCC inside CMA, and it is not a return to a private-stage/synchronization architecture.

E.4 Explicit complete-population change coverage and typing

V36/F16 introduces the actual-change subset

$$I_A^{\Delta} = \left\{ s \in I_A \mid \text{PhysReal}_A^{+}(s) \right\} \tag{886}$$

and types

$$\Delta_A^{\text{phys}} : I_A^{\Delta} \longrightarrow \Xi_A. \tag{887}$$

Under UCC, $I_A^{\Delta} = I_A$. This prevents a formal UCC countercondition from being forced to carry a physical-change content at a member where actual change has been denied.

V36/F16 also defines

$$\mathcal{B}_{\Delta}(s) = \left\{ A \in \mathcal{S}_{\mathrm{phys}}(s) \mid \mathrm{PhysReal}_A^{+}(s) \right\} \tag{888}$$

and proves the exact equivalence

$$\boxed{\mathrm{UCC} \iff \forall s \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \quad \mathcal{B}_{\Delta}(s) = \mathcal{S}_{\mathrm{phys}}(s).} \tag{889}$$

This makes exhaustive memberwise coverage explicit without strengthening UCC into a new physical postulate. The full contrary is simply

$$\exists A \in \mathcal{S}_{\mathrm{phys}}(s) : \neg\, \mathrm{PhysReal}_A^{+}(s).$$

A mixed change/stasis pattern is only one subclass of that contrary.

E.5 System-indexed change profile and foundational bridge

V36/F16 retains system specificity through

$$\mathfrak{D}_{\mathrm{C}}(s) = \left(A \mapsto \Delta_A^{\mathrm{phys}}(s) \right)_{A \in \mathcal{B}_{\Delta}(s)} \in \prod_{A \in \mathcal{B}_{\Delta}(s)} \Xi_A, \tag{890}$$

so complete-population coverage does not create a universal change substance or common change codomain.

The foundational bridge is

$$\boxed{\mathrm{StageChangeBridge}_{\mathrm{C}}(s) \iff \mathrm{CosmicCoPresence}_{\mathrm{C}} \left(\mathcal{S}_{\mathrm{phys}}(s); s \right) \wedge \left[\mathcal{B}_{\Delta}(s) = \mathcal{S}_{\mathrm{phys}}(s) \right].} \tag{891}$$

Under the governing definitions,

$$\boxed{(\mathrm{CMA} \wedge \mathrm{UCC}) \iff \forall s \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}} \;\; \mathrm{StageChangeBridge}_{\mathrm{C}}(s).} \tag{892}$$

The bridge therefore represents the joint common-stage/change-coverage content. It is not an additional axiom, causal transmission relation, or observational bridge.

E.6 Single extension, continuing change, and observation

The governing picture is one ordered extension

$$s_1 \prec_{\mathrm{C}} s_2 \prec_{\mathrm{C}} s_3 \prec_{\mathrm{C}} \cdots$$

of common cosmic change stages. This display is schematic and introduces neither a numerical stage index nor equal spacing. At every applicable stage, UCC requires each qualified realized system to undergo its own physical change; therefore physical change is not realized once and then suspended. The later stage is not a moving successor-object and no change packet travels from the earlier stage into the later one. Rather, each later realized stage carries its own actual system-specific change realization for the systems then existing.

Formation and ending are identity boundaries within this continuing physical development. At an ending member $e \in I_A$,

$$\mathrm{End}_A(e) \wedge \mathrm{UCC} \Longrightarrow \mathrm{PhysReal}_A^+(e). \tag{893}$$

The ending of one identity does not terminate the common cosmic extension.

Observation remains epistemically limited. A valid record may warrant

$$\mathrm{Warrant}_{P,M}\left[\exists s \in I_A\ \ \mathrm{ManifestationAt}(A,\chi;s)\right], \tag{894}$$

while

$$\mathrm{ValidObservedManifestation} \not\Rightarrow \mathrm{ExactCosmicChangeStageIdentified}\,. \tag{895}$$

First detection therefore neither begins physical change nor identifies the exact order position of the relevant common cosmic change stage.

E.7 Net foundational effect of the transition

The transition is summarized by

$$\boxed{\begin{array}{c} \text{V35/F15: } T_{\mathrm{ITOF}} = (\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \prec_{\mathrm{C}}) \text{ with ordering-and-succession denotational priority;} \\ \text{V36/F16: retained formal pair + intentional foundational re-centering} \\ \text{to the one universal cosmic extension} \\ \text{constituted by invariant earlier–later ordering and succession} \\ \text{+ literal common-cosmic-change-stage ontology} \\ \text{with CMA unity and UCC memberwise change} \\ \text{+ nonempty realized identity-domain typing} \\ \text{+ explicit complete-population change coverage and change profile} \\ \text{+ joint CMA–UCC foundational stage-to-change representation.} \end{array}} \tag{896}$$

V36/F16 therefore preserves the V35/F15 formal pair while intentionally refining its governing denotation: the one universal cosmic extension becomes the denotational head, constituted by the invariant earlier–later ordering and succession of common cosmic change stages. NoInterruption and NoTerminalStage remain separately stated succession commitments governing the uninterrupted and continuing character of the actual cosmic succession. This semantic re-centering does not redefine time as a physical quantity, causal process, clock output, coordinate, metric interval, or additional entity.

F. Framework Identity and Admissible Extension

F.1 Identity-preserving conditions

An extension or application presented as V36/F16-admissible ITOF must preserve the governing temporal identity:

$$T_{\mathrm{ITOF}} = \mathcal{E}_{\mathrm{C}} = \left(\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \prec_{\mathrm{C}}\right). \tag{897}$$

It must also preserve the governing V36/F16 cosmic-ordering and succession commitments:

$$\mathrm{StrictTotalOrder}\left(\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \prec_{\mathrm{C}}\right) \wedge \mathrm{NoInterruption}_{\mathrm{C}}\left(\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \prec_{\mathrm{C}}\right) \wedge \mathrm{NoTerminalStage}_{\mathrm{C}}\,. \tag{898}$$

These conditions preserve the formal carrier, the invariant ordering, and the separately adopted succession properties of the V36/F16 architecture. The temporal referent itself remains $T_{\mathrm{ITOF}} = \mathcal{E}_{\mathrm{C}} = (\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \prec_{\mathrm{C}})$. NoInterruption and NoTerminalStage govern the uninterrupted and continuing character of the actual cosmic succession; they do not by themselves analytically entail UCC, do not add a metric component to T_{ITOF}, and are not hidden members of the minimal governing definition. A future revision that removes one of these succession commitments may still belong to the historical ITOF series, but it would constitute a foundational revision of the V36/F16 architecture rather than an application-level extension.

It must preserve one universal common cosmic-stage carrier,

$$\forall A \in \mathcal{U}_{\mathrm{phys}}, \quad I_A \subseteq \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \tag{899}$$

and must not introduce independent private temporal orders for physical systems. The governing ontological role of the admitted members as common cosmic change stages is preserved throughout V36/F16. In dependency analysis, however, bare carrier membership is not an inference rule for memberwise physical change; CSPP, CMA, and UCC jointly secure the populated, one-common-change-stage, universally change-realizing full-theory realization. It must also preserve the nonempty realized-identity condition

$$\forall A \in \mathcal{U}_{\mathrm{phys}}, \quad I_A \neq \varnothing, \tag{900}$$

and the literal complete-population change-stage realization expressed by

$$\mathrm{UCC} \iff \forall s \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \quad \mathcal{B}_{\Delta}(s) = \mathcal{S}_{\mathrm{phys}}(s). \tag{901}$$

It must also preserve the distinction

$$\mathrm{CMA} \not\equiv_{\mathrm{def}} \mathrm{UCC}, \tag{902}$$

the physical typing of causal contributors, the distinction between physical history and time, and the Non-Transfer Principle.

Historical physical accumulation may inform an application through presently embodied effects, but it may not be introduced as a fourth causal-source class.

F.2 What may vary at application level

ITOF does not require one permanent physical model for every system class. Subject to explicit provenance and empirical evaluation, an application may revise

$$\left\{\begin{array}{c} \mathrm{ClockResponseModel}, \\ \mathrm{PhysicalCouplingLaw}, \\ \mathrm{IdentityCriterionForSystemClass}, \\ \mathrm{ObservationModel}, \\ \mathrm{ExperimentalProtocol} \end{array}\right\} \tag{903}$$

without redefining time.

Application-level failure therefore need not be foundational failure. Conversely, an application is not protected from rejection merely because it is described as ITOF-admissible.

F.3 What would alter the identity of the framework

The following substitutions would constitute foundational changes rather than ordinary extensions. The same status applies to removal of Strict Cosmic Ordering, $\mathrm{NoInterruption}_{\mathrm{C}}$, or $\mathrm{NoTerminalStage}_{\mathrm{C}}$ from the governing V36/F16 architecture:

$$\begin{aligned} T_{\mathrm{ITOF}} &\longrightarrow \mathrm{ClockOutput}, \\ T_{\mathrm{ITOF}} &\longrightarrow \mathrm{MetricInterval}, \\ T_{\mathrm{ITOF}} &\longrightarrow \mathrm{ProperTimeFunctional}, \\ \mathrm{OneCommonCosmicChangeStageTotality} &\longrightarrow \mathrm{IndependentPerSystemTimes}, \\ \mathrm{PhysicalCausation} &\longrightarrow \mathrm{TimeAsCauseOfChange}, \\ \mathrm{HistoricalPhysicalAccumulation} &\longrightarrow \mathrm{FourthPhysicalCausalSource}\,. \end{aligned} \tag{904}$$

Any future revision making one of these substitutions would require explicit presentation as a change in foundational identity rather than as a routine application-level refinement.

F.4 Admissibility rule for future physical extensions

Let E be a proposed physical extension. It is structurally admissible only if

$$\begin{aligned} \mathrm{AdmissibleExtension}(E) \Longrightarrow \Big[&\mathrm{CorePreserved}(E) \\ &\wedge \mathrm{PhysicalTypingExplicit}(E) \\ &\wedge \mathrm{ProvenanceDeclared}(E) \Big]. \end{aligned} \tag{905}$$

Where E produces a quantitative prediction, the prediction additionally inherits the protocol, uncertainty, model-separation, and evaluation-independence requirements of the quantitative architecture.

This rule leaves the framework open to new physics while preventing an application hypothesis from silently rewriting the temporal core.

G. Scientific Claim Boundary and Falsification Discipline

G.1 Formal contrary conditions and empirical access are different

A formal countercondition specifies what would contradict a commitment. It does not automatically supply an observational procedure capable of establishing that countercondition.

Thus,

$$\mathrm{FormalCountercondition}(F) \not\equiv_{\mathrm{def}} \mathrm{DirectFiniteExperimentFor}(F). \tag{906}$$

This distinction is essential for universal or cosmological commitments.

The necessary methodological burden for any claim of foundational empirical discrimination is stated in Equation (468). Its outcome-independent specification condition permits declared shared calibration or systematic inputs only when their dependence is represented explicitly. Failure to satisfy the burden is a failure of the discrimination claim, not by itself a physical countercondition to the foundational commitment under discussion.

G.2 NoInterruption

The formal contrary condition to the adopted non-interruption postulate is

$$\boxed{\neg\,\mathrm{NoInterruption}_{\mathrm{C}}\left(\mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \prec_{\mathrm{C}}\right).} \tag{907}$$

This is an ontological and semantic contrary to the adopted actual cosmic succession. It is not established by failure of density, adjacency, topology, metric continuity, or order completeness, and it is not equivalent to a population-empty common cosmic change stage or to absence of detected physical change. A finite observational record that fails to resolve succession does not by itself establish this countercondition.

G.3 UCC

A direct contrary condition to UCC is

$$\exists A \in \mathcal{U}_{\mathrm{phys}}\ \exists s \in I_A, \quad \neg\,\mathrm{PhysReal}_A^{+}(s). \tag{908}$$

A null or unresolved measurement does not establish this condition. A scientifically relevant challenge would require positive warrant that the physical system was realized while undergoing no physical change under a sufficiently complete physical characterization.

Because UCC is universal, repeated positive observations of change can support applications and exclude particular complete-stasis hypotheses, but no finite set of observations deductively confirms UCC for every physical system and every realized common cosmic change stage. A positively warranted counterexample to UCC contradicts UCC itself; it does not by itself contradict CMA's distinct common cosmic-stage co-realization claim.

G.4 CMA

The direct formal contrary to CMA is failure of universal common cosmic change-stage co-realization:

$$\boxed{\neg\,\mathrm{CMA} \iff \exists s \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \quad \neg\,\mathrm{CosmicCoPresence}_{\mathrm{C}}\left(\mathcal{S}_{\mathrm{phys}}(s); s\right).} \tag{909}$$

A scientifically relevant challenge must therefore address the governing claim that the complete qualified population realized at a given cosmic change stage shares literally that same one change stage. Such a challenge would oppose the common-stage ontology itself; it is not represented as an internal model that keeps the same common-stage meanings fixed while merely switching a predicate value. Different clock readings, coordinate assignments, signal delays, spatial separation, different physical states, or absence of visible motion do not by themselves establish this contrary. Complete physical non-change of a qualified realized system is instead the contrary to UCC and is assessed under the separate UCC subsection above.

G.5 Non-terminal cosmic succession

The formal contrary condition to $\mathrm{NoTerminalStage}_{\mathrm{C}}$ is existence of a greatest common cosmic stage:

$$\exists g \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}, \quad \nexists t \in \mathcal{S}_{\mathrm{C}}^{\mathrm{tot}}\,(g \prec_{\mathrm{C}} t)\,. \tag{910}$$

Finite absence of a later record does not establish that g is globally terminal. Nor can repeated observations of later common cosmic stages deductively confirm that every common cosmic stage has a later member. The postulate therefore has a cosmological and order-theoretic evidential status rather than the status of a routine finite laboratory prediction.

G.6 UEIE and PIECP

UEIE is likewise universal:

$$\forall A \in \mathcal{U}_{\mathrm{phys}}\ \exists e_A \in I_A\,[\mathrm{End}_A(e_A) \wedge \exists r_A \in I_A\,(r_A \prec_{\mathrm{C}} e_A)]\,. \tag{911}$$

Observation of many identity endings does not deductively establish the universal UEIE claim. Failure to observe an ending, or failure to reconstruct all of its earlier history, is also not sufficient to refute UEIE. A countercondition would require physical warrant that some realized identity has no ending satisfying the required nonempty strict pre-ending identity history.

PIECP is challenged only by an actual identity ending for which no actual physical contributor is implicated in the identity-ending transformation:

$$\mathrm{End}_A(e) \wedge \neg\exists c \in \mathcal{C}_A^{\mathrm{act}}(e)\ \ \mathrm{PhysicallyContributes}\,(c; \mathrm{IdentityEndingTransformation}(A; e))\,. \tag{912}$$

Ignorance of the relevant contributor is epistemic underdetermination, not by itself a physical counterexample.

G.7 Application-level prediction and failure

For application model M, let $\mathfrak{P}_M^{\star}$ be its declared pre-evaluation protocol and D_M its declared evaluation context. Advance predictive status requires the outcome-sensitive content to be fixed before evaluation:

$$\begin{aligned} \mathrm{AdvancePrediction}(M) \Longrightarrow\ & \mathrm{ProtocolFrozen}(\mathfrak{P}_M^{\star}) \\ & \wedge \mathrm{IndependentParameterProvenance}(M) \\ & \wedge \mathrm{NoEvaluationLeakage}(\mathfrak{P}_M^{\star}, D_M). \end{aligned} \tag{913}$$

If an independently evaluated prediction fails under its declared acceptance rule, the immediate conclusion is

$$\mathrm{ApplicationModelRejectedOrRestricted}(M, D_M). \tag{914}$$

The failure reaches a foundational commitment only through an established derivation from that commitment to the failed observable:

$$F \wedge \mathcal{P}_{\mathrm{aux}} \vdash O. \tag{915}$$

If an additional application-specific hypothesis L is essential,

$$F \wedge L \vdash O, \tag{916}$$

then $\neg O$ does not by itself identify F rather than L as the failed premise.

G.8 No post-hoc immunity

A new physical contributor discovered after a failed evaluation may motivate a revised model M_2, but it does not retroactively make the original prediction of M_1 successful:

$$\text{PostEvaluationRevision}(M_1 \to M_2) \not\Rightarrow \text{OriginalAdvancePredictionSucceeded}\,. \tag{917}$$

The revised model requires new independent evaluation.

G.9 Bounded confirmation

Successful recovery or discrimination supports the physical model at the level actually tested:

$$\text{DiscriminationFavours}(M, D) \Longrightarrow \text{Warrant}\left[\text{PhysicalApplicationModelSupportedOn}(M, D)\right]. \tag{918}$$

It does not establish

$$\text{OperationalQuantityIsTime} \tag{919}$$

and does not convert finite empirical success into deductive proof of every universal foundational commitment.

The same discipline therefore governs both confirmation and falsification:

$$\boxed{\begin{array}{c}\text{scientific inference propagates only through explicit dependency}\\ \text{and declared evidential scope.}\end{array}} \tag{920}$$

H. Reference Architecture and Historical Record

The historical development of ITOF is documented through the consolidated project and archive records deposited in OSF and Zenodo [2].

V35/F15 is the immediate foundational predecessor of V36/F16 and is cited directly where the present complete-population change-coverage architecture is compared with its inherited formulation [1]. The consolidated archive supplies the documentary sequence for V14–V35 and the wider historical record.

The reference architecture therefore distinguishes

$$\boxed{\text{ImmediateV35Predecessor} + \text{ConsolidatedITOFArchive} + \text{ExternalScientificLiterature}\,.} \tag{921}$$

This preserves direct predecessor traceability, historical sequence, and external scientific support while keeping V36/F16's governing claims distinguishable from both earlier ITOF formulations and application literature.

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