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FOUNDATIONAL PHYSICS RESEARCH PROGRAM

GIBM 2.1

A Consolidated Framework of Composition, Dependency, Recovery, Scale, and Embedded Observation

Research manuscript • Version 2.1 • July 2026

“Nothing may be added to the basement merely because a later theory needs it.”

Preface Back to TOC

GIBM 2.1 is a consolidation, an audit, and a research map. It is not presented as a completed theory of nature. Its purpose is to preserve the strongest surviving architecture of earlier GIBM work, integrate the useful content of the Egg and scale programs, remove assumptions exposed by the observation and Born-rule audit, and state exactly where mathematics or evidence remains incomplete.

The central correction is methodological. The experimentally successful Born rule governs the statistics of records produced through specified quantum preparations and measurement interfaces. That success does not, by itself, prove that an embedded observer possesses an exhaustive description of reality, that a measurement lists every physically relevant continuation or scale, or that one globally complete reality is selected by an observer. GIBM 2.1 therefore separates underlying physical organization from record formation, and record formation from the interpretation of a complete ontology.

This manuscript uses four claim labels. “Derived” means supported by the framework’s stated structural assumptions, not necessarily proven to the standard of a published mathematical theorem. “Empirical” identifies a feature of observed physics that any realization must reproduce. “Hypothesis” marks a proposed explanatory bridge. “Open” identifies a burden not yet discharged. These labels are deliberately conservative.

OPEN / NOT YET DERIVED: The original V1, V2, Egg, scale, and recovery manuscripts were not present in the working folder used to generate this edition. Specific technical derivations mentioned in the supplied discussion are therefore summarized and bounded, not silently reconstructed. The prior frozen basement artifact and the complete audit conversation supplied the verified continuity source.

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PART I — MOTIVATION

Why a unified explanatory program is still worth attempting

1. The Problem GIBM Addresses Back to TOC

Modern physics is extraordinarily successful at prediction, yet its principal frameworks do not arrive as one continuous explanation. Quantum theory, relativistic geometry, thermodynamics, classical mechanics, and scale-dependent effective theories use different mathematical objects and different explanatory vocabularies. GIBM asks whether these successes can be understood as recoveries of a deeper organization rather than as unrelated fundamental layers.

EMPIRICAL REQUIREMENT: Any viable framework must preserve the tested predictions of quantum mechanics, relativity, gravity, and thermodynamics in their established domains.

WORKING HYPOTHESIS: The apparent plurality of physical theories may reflect different recoverable descriptions of one underlying organized dependency structure.

1.1 The inverse-problem constraint Back to TOC

The universe around us is not merely an example to be generated after the foundation is chosen; it is the target data. Stable regularities, persistent structures, quantum interference, Bell correlations, classical records, gravitation, and thermodynamic asymmetry constrain the admissible foundations. Yet our view is partial: embedded observers occupy finite regions, interact through finite interfaces, and recover finite records. The reconstruction must therefore work backward from observed reality without pretending that present observations exhaust all physical structure.

1.2 What GIBM 2.1 is not Back to TOC

- It is not a declaration that GIBM has replaced quantum mechanics or general relativity.
- It is not a proof that reality is literally information, interaction, an egg, a graph, or a nested hierarchy.
- It is not a collapse theory and does not postulate observer-created reality.
- It is not permission to treat conceptual compatibility as a completed mathematical derivation.
- It is a disciplined architecture for separating what is retained, recovered, hypothesized, empirically required, and unknown.

2. Method and Freeze Rules Back to TOC

Earlier foundational work repeatedly restarted when a logically deeper word was proposed. GIBM 2.1 replaces that habit with a dependency-sensitive amendment rule. A deeper candidate does not displace the working foundation merely because it sounds more primitive. It must derive an existing beam with fewer independent assumptions, expose a contradiction, or produce a physical consequence that the existing structure cannot.

- Do not import a result because a later recovery needs it.
- Keep ontology separate from representation.
- Do not promote an observer-level description into a claim about exhaustive reality.
- Preserve failed routes in the audit log rather than erasing them.
- Change a frozen premise only through an explicit amendment that identifies every dependent result.

PART II — FOUNDATIONS

The audited conceptual architecture

3. Status of the Basement Back to TOC

A prior frozen specification used the provisional basement B = (P, composition in order, joint composition), with processes and two partial modes of composition. Subsequent attacks showed that "process" can import change and time if read too strongly, while the present audit uses more operational language: organized physical structure, interaction, composition, dependency, persistence, and recoverability. GIBM 2.1 therefore preserves the older basement as provenance but does not falsely claim that the audit has produced a final irreducible ontology.

WORKING HYPOTHESIS: The minimal physical machinery includes partial ordered composition and joint composition, interpreted without external clock time or intrinsic object identity.

OPEN / NOT YET DERIVED: Whether occurrence, process, interaction, or compositional role is the best primitive vocabulary remains unresolved and is quarantined from higher recoveries unless a concrete contradiction appears.

4. Interaction Back to TOC

Interaction is retained in a limited role. GIBM 2.1 does not assert that reality is nothing but interaction. It asserts that embedded physical access and record formation require interaction, and that at least some physical properties may be constituted by relational participation rather than intrinsic labels.

DERIVED / STRUCTURALLY SUPPORTED: A subsystem cannot acquire a physical record of another structure without a coupling through which their states become correlated.

WORKING HYPOTHESIS: Some identities and effective properties are determined by stable relational roles within interaction networks.

OPEN / NOT YET DERIVED: The identity claim "reality is interaction" remains an untested candidate and is not part of the stable core.

5. Composition Back to TOC

Composition is distinct from interaction. Many interactions are transient and do not form a persistent higher-level organization. Composition occurs when an organized physical structure forms whose

behavior depends on that organization and cannot be adequately described as the independent behavior of its constituent roles alone.

Composition is partial. Not every pair of structures can compose, not every ordering is admissible, and joint composition does not automatically mean independence. Associativity is treated cautiously: if regrouping changes the physics, then either the composition is genuinely order-sensitive or a relevant relation has been omitted from the representation.

DERIVED / STRUCTURALLY SUPPORTED: The recovery program requires composition because higher-scale persistent structures and their effective regularities depend on organized lower-scale relations.

OPEN / NOT YET DERIVED: A complete algebra of sequential and joint composition, including domains, equivalences, and failure conditions, has not been supplied.

6. Persistence and Effective Identity Back to TOC

Persistence is not perfect sameness through primitive time. A structure persists when its organization remains sufficiently recoverable across dependent updates, despite allowed internal change, within a declared scope, scale, and tolerance. Identity is therefore an effective achievement of persistent organization rather than a basement substance.

- Stability concerns resistance to disruption.
- Persistence concerns continued recoverability through dependent updates.
- Continuity concerns the physical linkage between those updates.
- Effective identity is the description licensed when the relevant organization remains recoverable.

WORKING HYPOTHESIS: Matter-like objects are persistent compositional organizations whose effective identities survive within specified domains.

7. History as Dependency Back to TOC

History is not defined as an externally ordered list of moments. It is the dependency structure retained within present physical organization. A later organization carries constraints imposed by its constitutive antecedents. This yields an order of dependence without first assuming seconds, clocks, or a global timeline.

Continuity is the preservation of this dependency through successive organizational updates. Physical time may later be recovered when persistent subsystems supply comparable measures of ordered change; that recovery has not been completed here.

DERIVED / STRUCTURALLY SUPPORTED: Records and persistence require retained dependency; without it, present organization could not physically encode or continue earlier organization.

OPEN / NOT YET DERIVED: The derivation of metric duration, clock equivalence, relativistic proper time, and a thermodynamic arrow from dependency remains incomplete.

8. Records Back to TOC

A record is a persistent physical constraint produced by prior interactions that remains recoverable by later interactions. It is not abstract information floating free of a carrier, and it does not require a conscious witness. A footprint, detector state, crater, daughter isotope, or durable correlation may be a record when later interactions can recover a distinction tied to prior dependency.

The total dependency structure is broader than the accessible record structure. Records are recoverable fragments or quotients of dependency, not guaranteed exhaustive reconstructions of the process that produced them.

DERIVED / STRUCTURALLY SUPPORTED: Observation can be modeled as the acquisition, containment, or recovery of stable records by an embedded subsystem.

OPEN / NOT YET DERIVED: A quantitative criterion for record autonomy, durability, error tolerance, redundancy, and scale dependence must be formalized.

9. Scale Back to TOC

A scale is an organizational domain characterized by persistent structures, recoverable records, and effective regularities that remain valid within specified limits of resolution, duration, and coupling. Scale is not merely a viewer zooming in or out. The choice of description is observer-relative; the existence of stable organizational regimes need not be.

Higher-level descriptions compress lower-level distinctions and may be many-to-one. Lower-level detail need not be recoverable from a higher-level record. A valid scale recovery therefore requires consistency across overlap domains, not perfect reconstructibility.

EMPIRICAL REQUIREMENT: Physics already relies on successful scale-bounded descriptions, including thermodynamics, continuum mechanics, chemistry, and effective field theories.

WORKING HYPOTHESIS: Distinct physical theories may describe stable recoveries of a shared deeper dependency structure at different scales.

10. Observation and Embedded Observers Back to TOC

Observation is an interaction through which an embedded physical subsystem acquires, contains, or accesses a stable record. An outcome is the content represented by a stable record within a specified measurement interface. Neither definition implies that the record exhausts reality, that all scales have been accessed, or that an observer causes global physical resolution.

An observer is any embedded subsystem capable of acquiring, retaining, or responding to a stable record. Consciousness is not required. Human reading of a detector is a later interaction with a record that may already be physically stable.

DERIVED / STRUCTURALLY SUPPORTED: Not every interaction is an observation: a transient correlation that leaves no later-recoverable distinction fails the record criterion.

OPEN / NOT YET DERIVED: The threshold separating transient correlation from autonomous record must be stated in an implementation-specific physical model.

11. The Born Firewall Back to TOC

To prevent the original problem from being reintroduced by language, GIBM 2.1 forbids the following claims unless separately derived: one globally selected outcome; a complete known outcome set; exhaustive observer access; probability as fundamental substance; measurement creating reality; unobserved alternatives being unreal; and local record definiteness implying global collapse.

Status	Claim or boundary
Allowed	For a specified preparation and measurement interface, repeated accessible records follow the observed Born distribution.
Not implied	The apparatus outcome list exhausts all underlying degrees of freedom, scales, or continuations.
Not implied	A conscious or physical observer globally creates or selects reality.
Open	Why the unique additive squared measure equals long-run record frequency.

PART III — RECOVERIES

How familiar physics is intended to emerge from the audited architecture

12. Recovery Standards Back to TOC

A recovery is stronger than an analogy and weaker than a declaration of identity. It must state its inputs, mapping, approximation regime, and empirical target. Architectural sketches show routes worth pursuing; conditional derivations establish results given stated assumptions; full recoveries must reproduce tested mathematics and specify corrections or novel predictions.

Status	Claim or boundary
Derived	A conclusion follows from explicitly stated structural and mathematical assumptions.
Empirical	A target is fixed by observation and must be reproduced.
Hypothesis	A proposed mapping or mechanism has not yet been uniquely forced.
Open	A necessary proof, parameter match, or empirical comparison is absent.

13. Gravity Recovery Back to TOC

The gravity program proposes that persistent organized structure alters the admissible transformations or accessible continuations of neighboring structure. In effective descriptions, unequal accessibility may be represented geometrically and may yield preferred trajectories, altered clock rates, inertia-like resistance, and curvature-like behavior.

EMPIRICAL REQUIREMENT: The recovery must reproduce Newtonian gravity in the weak-field, slow-motion limit and general-relativistic tests in the appropriate regime.

WORKING HYPOTHESIS: Concentrated persistent structure modifies relational accessibility in a way that admits an effective geometric description.

OPEN / NOT YET DERIVED: The source documents containing the claimed Newtonian and GR-like derivations were unavailable here; coefficients, field equations, limit procedures, and observational residuals require source-level verification before the recovery can be called complete.

13.1 Required checkpoints Back to TOC

1. Define the primitive or effective quantity that encodes accessibility or compatibility.
2. Show how matter-like persistent structures source changes in that quantity.
3. Derive the weak-field potential and inverse-square behavior without fitting the result by construction.
4. Recover geodesic or equivalent free-motion behavior.
5. Recover gravitational redshift, light deflection, perihelion advance, and wave propagation in controlled approximations.
6. State deviations, new scales, and falsifiable predictions.

14. Inertia Recovery Back to TOC

Inertia is approached as the resistance of a persistent organization to changes that would disrupt its relational and compositional continuity. The useful insight is structural: acceleration is not merely motion through a background but a reorganization cost relative to the system's maintained dependencies and couplings.

WORKING HYPOTHESIS: Inertial mass may quantify the cost of changing the continuation or relational organization of a persistent structure.

OPEN / NOT YET DERIVED: The framework must derive the relativistic momentum-energy relation, inertial equivalence, and composition rules rather than restating them.

15. Energy Recovery Back to TOC

Energy is not placed in the basement. It is treated as an effective measure associated with change, compositional capacity, or invariance under admissible transformation. A successful realization should connect energy to a symmetry or conserved structural measure, while showing how familiar kinetic, potential, rest, field, and thermal forms arise.

WORKING HYPOTHESIS: Energy is an invariant or transferable measure of admissible organized change.

OPEN / NOT YET DERIVED: No unique definition is established by the supplied sources; the relation to time-translation symmetry cannot be assumed before physical time is recovered.

16. Entropy and the Arrow of Time Back to TOC

Entropy is derived rather than primitive. Coarse-grained records omit distinctions, and many lower-level dependency structures may correspond to the same recoverable macro-description. Effective multiplicity therefore grows from quotienting and scale-limited recoverability. The arrow of time is associated with asymmetric accumulation and redundancy of records, not inserted as a universal basement direction.

EMPIRICAL REQUIREMENT: Any recovery must reproduce thermodynamic behavior, fluctuation constraints, and the observed low-entropy boundary problem in the appropriate domains.

WORKING HYPOTHESIS: Macroscopic temporal asymmetry emerges from asymmetric record formation and coarse-grained dependency rather than fundamental one-way time.

OPEN / NOT YET DERIVED: The statistical-mechanical measure, typicality assumptions, and relation to quantum entropy must be explicitly derived or adopted and labeled.

17. Curvature and Geometry Back to TOC

Geometry is treated as an effective representation of relational accessibility, neighborhood structure, and path-dependent measures. The program does not assume that this architectural interpretation automatically produces a differentiable manifold or Einstein's field equations. Geometry earns its role only when it compresses the behavior of admissible transformations and records across a domain.

WORKING HYPOTHESIS: Curvature is the effective representation of nonuniform compositional accessibility or path dependence.

OPEN / NOT YET DERIVED: The emergence of dimension, signature, locality, smoothness, connection, and metric dynamics remains to be shown.

18. Classical Recovery and the Egg Principle Back to TOC

The surviving Egg contribution is a recovery principle, not a literal nested-shell ontology. The first stable description available at a scale need not mark the beginning or full extent of the process that generated it. A description gains effective classical standing when its defining distinctions remain consistently recoverable across repeated interactions, relevant durations, coarse-graining, and coupled scales.

WORKING HYPOTHESIS: Classicality is cross-scale stability and redundant recoverability of record-defining distinctions.

OPEN / NOT YET DERIVED: “Compatibility evolution” requires a formal definition and comparison with decoherence, quantum Darwinism, consistent histories, and related existing approaches.

18.1 Cosmological extension Back to TOC

The suggestion that the Big Bang might be the earliest recoverable cosmological boundary rather than an absolute metaphysical beginning is retained only as speculation. It requires cosmological modeling and cannot be inferred from the measurement analogy alone.

19. Scale Recovery Back to TOC

A scale recovery must identify the coarse-graining or quotient map, the persistent structures it preserves, the records it renders accessible, and the limits beyond which the effective law fails. It must also explain how neighboring scales remain mutually consistent without assuming that either description is complete.

EMPIRICAL REQUIREMENT: Successful effective theories demonstrate that scale-bounded laws can be objectively reliable without being fundamental descriptions.

OPEN / NOT YET DERIVED: The GIBM-specific renormalization, coarse-graining, or categorical machinery has not been fixed.

PART IV — QUANTUM INTERFACE

Amplitudes, records, Born statistics, measurement, and Bell constraints

20. Scope of the Quantum Interface Back to TOC

The quantum interface is the boundary between a successful amplitude-based representation and stable records available to embedded subsystems. GIBM 2.1 does not seek to discard quantum mathematics merely because its ontology is debated. It asks what that mathematics describes, which claims are experimental, and which bridges remain assumptions.

21. Amplitudes and Interference Back to TOC

Earlier GIBM work argued that alternatives capable of interference require more than ordinary scalar probabilities. Cancellable composition, refinement, recombination, and continuous relational orientation motivate an amplitude-like representation. Two real dimensions provide the minimal continuous orientation represented by complex phase. This is a conditional route, not a completed uniqueness theorem.

EMPIRICAL REQUIREMENT: Interference and phase-sensitive phenomena must be reproduced exactly in tested regimes.

WORKING HYPOTHESIS: Complex amplitudes are the minimal representation of continuous relational orientation among composable alternatives.

OPEN / NOT YET DERIVED: The assumptions that force complex Hilbert space, rather than real, quaternionic, generalized probabilistic, or other structures, require a full theorem and empirical branch conditions such as local tomography.

22. The Squared Measure Back to TOC

Given complex amplitude geometry, phase invariance, additive accounting over mutually exclusive record classes, multiplicativity under suitable composition, and refinement consistency, the squared magnitude is the natural additive measure. This explains why a square appears. It does not alone explain why the measure is a probability of a unique actuality or why long-run records sample it proportionally.

DERIVED / STRUCTURALLY SUPPORTED: Conditionally on the stated amplitude and compositional assumptions, squared magnitude is the invariant additive measure over exclusive record classes.

OPEN / NOT YET DERIVED: The uniqueness proof and its precise assumptions must be reproduced in a formal appendix from the original technical sources.

23. The Born Rule Back to TOC

Operationally, the Born rule states that for a specified quantum state and measurement, the probability distribution of measurement records is determined by the state through squared amplitudes or the equivalent operator formulation. Repeated equivalent preparations yield stable record frequencies consistent with that distribution.

GIBM 2.1 separates three statements: the existence of a squared structural measure; the concentration of that measure on typical long-run record sequences; and the equality of measure with first-person or laboratory probability. The first can be mathematically motivated. The second follows conditionally within the amplitude measure. The third remains the measure-to-frequency bridge.

EMPIRICAL REQUIREMENT: Born-distributed records are a nonnegotiable experimental requirement.

OPEN / NOT YET DERIVED: Why observed record frequency tracks squared measure is not derived by the phrase "proportional sampling." That phrase is removed unless a physical mechanism or theorem independently justifies it.

24. Measurement and Record Formation Back to TOC

Measurement is modeled as system-apparatus-environment interaction that generates correlations and, under suitable conditions, stable record classes. "Fixation," "actualization," "selected outcome," and "unchosen residual" are not stable-core terms. They may reappear only within a separately specified collapse or hidden-selection model.

WORKING HYPOTHESIS: Decoherence plus cross-scale record stability may explain the emergence of robust measurement records without observer-created reality.

OPEN / NOT YET DERIVED: Decoherence alone does not automatically settle probability, unique experience, or exhaustive ontology; GIBM 2.1 must not claim otherwise.

25. Bell and Nonclassical Correlation Back to TOC

Bell experiments rule out broad classes of local hidden-variable explanations under their stated assumptions. Any GIBM implementation must reproduce the observed violations while respecting

operational no-signaling. Observer limitation does not nullify Bell's theorem and cannot be used as a generic escape hatch.

EMPIRICAL REQUIREMENT: Bell-inequality violations and no-signaling behavior must be matched quantitatively.

OPEN / NOT YET DERIVED: The framework has not yet supplied a spacetime, causal, contextual, retrocausal, superdeterministic, or nonseparable implementation. No option is adopted here by implication.

26. Quantum Interface Research Program Back to TOC

7. State the state space and allowed transformations.
8. Derive or explicitly adopt the composition rule for amplitudes and phases.
9. Define how a physical interface determines stable record classes.
10. Prove refinement and representation invariance.
11. Recover the Born distribution for those records without assuming proportional sampling.
12. Reproduce Bell correlations and operational no-signaling.
13. Identify whether the implementation is collapse, all-continuation, hidden-variable, relational, or genuinely different.
14. Specify an empirical discriminator if the ontology changes no predictions.

PART V — AUDIT LOG

What changed, what was removed, and why

27. Audit Summary Back to TOC

Status	Claim or boundary
Removed	Primitive actuality as a separate event between reality and records.
Removed	Primitive fixation and global outcome resolution.
Removed	Observer-created reality and exhaustive observer access.
Removed	Proportional sampling as an unexplained Born derivation.
Revised	History: temporal sequence -> retained dependency structure.
Revised	Persistence: sameness through time -> recoverability across dependent updates.
Revised	Observation: outcome resolution -> stable record acquisition or recovery.
Revised	Outcome: complete physical result -> interface-relative record content.
Retained	Interaction as required for physical access, not as the proven substance of reality.
Retained	Composition as organized structure distinct from transient interaction.
Integrated	Scale theory as objective organizational regimes with resolution-limited access.
Integrated	Egg theory as recoverability and cross-scale stability principles, not literal ontology.

Status	Claim or boundary
Quarantined	Reality as interaction, literal nesting, Big Bang boundary analogy, and global selection mechanisms.

28. Why Earlier Versions Repeatedly Restarted Back to TOC

The recurring failure was not proof that every lower layer was wrong. The same unresolved bridge was repeatedly encountered: squared amplitude measure was treated as if it automatically explained observed actuality. When that identification failed, the basement was dismantled. The audit isolated the problem instead. The Born rule remains exact as an empirical rule for accessible records; exhaustive ontology is a separate question.

A second source of instability was vocabulary. “Actuality,” “realization,” “fixation,” “observation,” and “outcome” shifted between local record formation and global metaphysics. The revised definitions assign each term a narrower physical job.

29. Amendment Protocol Back to TOC

15. Name the exact claim to be changed.
16. Classify it as foundation, representation, recovery, empirical input, hypothesis, or open burden.
17. Identify every chapter and mathematical result that depends on it.
18. Provide the contradiction, derivation, or empirical result requiring amendment.
19. Update the audit log; do not silently rewrite provenance.
20. Re-run the Born firewall and recovery consistency checks.

PART VI — OPEN PROBLEMS

A candid map of what is established, required, proposed, and unknown

30. Derived or Structurally Supported Back to TOC

- Records require persistent physical carriers and later recoverability.
- Observation requires physical interaction with a stable record but not consciousness.
- Interaction and composition are distinct: transient coupling need not create organized higher-level structure.
- History can be represented as retained dependency without assuming metric time.
- Effective identity can be defined through scale-bounded persistence rather than primitive sameness.
- Squared magnitude is the additive measure under the stated amplitude, phase, refinement, and composition assumptions.

31. Empirical Commitments Back to TOC

- Quantum interference and phase dependence.
- Born-distributed measurement records.
- Bell-inequality violations with operational no-signaling.
- Stable classical records and effective objects.
- Newtonian and relativistic gravitation in tested regimes.
- Energy-momentum behavior, inertial equivalence, and relativistic limits.
- Thermodynamic regularities and temporal asymmetry.
- Scale-dependent effective laws with consistent overlap domains.

32. Working Hypotheses Back to TOC

- Persistent organized dependency is the common substrate of effective physical identity.
- Classicality is cross-scale stability and redundant record recoverability.
- Geometry and curvature represent nonuniform accessibility or path-dependent transformation structure.
- Inertia quantifies resistance to reorganization of persistent dependency.
- Energy is an invariant or transferable measure of admissible organized change.
- Complex amplitude is the minimal representation of continuous relational orientation.
- Different successful theories are compatible recoveries of one deeper organization.

33. Unknowns Back to TOC

- The irreducible physical root and the exact algebra of partial composition.
- The derivation of metric time, dimension, locality, and spacetime signature.
- The complete gravity field equations and their source coupling.
- The exact relation among mass, inertia, energy, and persistent organization.
- The statistical measure underlying entropy and the origin of cosmological low entropy.
- The unique derivation of complex Hilbert-space quantum mechanics.
- The physical formation criterion for autonomous stable record classes.
- The measure-to-frequency bridge of the Born rule.
- The ontology compatible with Bell correlations.
- Any distinctive test that separates GIBM from existing interpretations or theories.

PART VII — CURRENT MATHEMATICAL REALIZATION

What exists, what is conditional, and what remains to be built

34. Separation of Ontology and Representation Back to TOC

GIBM 2.1 does not treat a mathematical representation as automatically identical to ontology. Processes, compositional roles, dependency, records, amplitudes, graphs, operators, manifolds, and probability measures may occupy different representational levels. A formalism earns ontological interpretation only through explicit mapping and empirical consequence.

35. Provisional Basement Notation Back to TOC

The prior frozen artifact used B = (P, ∘, ⊗): P for processes or process roles, ∘ for partial associative sequential composition, and ⊗ for joint composition. In GIBM 2.1 this notation is preserved as the current historical mathematical placeholder. “Sequential” means constitutive ordering, not external clock time; “joint” does not assume independence.

OPEN / NOT YET DERIVED: Domains, equivalence relations, associativity up to equivalence, interchange laws, identities, null elements, topology, and measures require explicit specification.

36. Current Quantum Representation Back to TOC

Existing quantum mathematics remains the default predictive implementation unless and until a replacement is justified. States, complex amplitudes, unitary or norm-preserving evolution, operators, tensor composition, and the Born rule may therefore be adopted as empirical mathematical structure while GIBM investigates their physical interpretation and possible derivation.

Status	Claim or boundary
Existing mathematics	Complex vector spaces, operators, tensor products, density operators, decoherence, probability measures.

Status	Claim or boundary
Conditional GIBM result	Squared magnitude as the additive measure under phase, refinement, and composition constraints.
Candidate mathematics	Category theory or process theories; operator algebras; generalized probabilistic theories; graph or network models; information geometry; coarse-graining and renormalization tools.
Unresolved	A noncircular measure-to-frequency theorem and a physical record-class construction.

37. Current Gravity Representation Back to TOC

Differential geometry and general relativity remain the benchmark representation. A GIBM realization must either map its accessibility or compatibility variables into a metric and connection or provide an empirically equivalent alternative. Architectural correspondence is not enough; field equations, source terms, conservation identities, limits, and data comparisons are required.

38. Mathematical Acceptance Tests Back to TOC

21. Definitions are explicit and noncircular.
22. Every theorem states its assumptions and domain.
23. No desired upper-layer result is imported into the basement unnoticed.
24. Representational refinements do not change physical predictions.
25. Coarse-graining maps preserve the quantities claimed to survive.
26. Classical, quantum, thermodynamic, Newtonian, and relativistic limits are calculated.
27. Free parameters are identified and constrained.
28. The model produces at least one discriminator or is honestly classified as interpretation.
29. Independent experts can reproduce the derivations.

39. Source and Verification Boundary Back to TOC

This edition consolidates the complete audit conversation supplied for “GIBM Part 3 Discussion” and continuity facts from the prior provisional basement specification. The original detailed V1, V2, Egg,

scale, gravity, inertia, energy, entropy, and curvature documents were not present in the current task folder. Consequently, this manuscript includes their reported architecture and audit conclusions but does not certify equations or proofs that could not be inspected.

The correct next source-level action is to attach or place the canonical earlier manuscripts beside this edition, extract their definitions and equations, and build a traceability appendix mapping every retained recovery to its source location. Until that is done, claims about completed mathematical recovery remain conditional.

40. Closing Position Back to TOC

GIBM 2.1 is strongest where it is disciplined: organized structures compose; persistent organization carries dependency; records are recoverable physical constraints; observers are embedded record-using subsystems; scale determines which structures and distinctions remain effective; and the Born rule constrains accessible quantum records without automatically exhausting reality. The framework is weakest where it has not yet supplied unique mathematics, parameterized predictions, or source-verifiable derivations.

The program therefore does not end with a claim of completion. It ends with a stable research contract: preserve what has survived, label every bridge, keep the Born problem at the interface where it belongs, and require the mathematics to earn each recovery without importing the desired universe by assumption.