SCIREA Journal of Physics
ISSN: 2706-8862
http://www.scirea.org/journal/Physics
August 25, 2026
Volume 11, Issue 5, October 2026
https://doi.org/10.54647/physics140733

Complete-Timeline Configuration Space

Jeet Santosh Bhaskar[1,*],
[1]Founder's Office, Bronto Intelligence, Navi Mumbai, India
*Corresponding author: *jsb@brontointelligence.com*

Abstract

This paper develops a candidate framework in which spacetime is emergent and the fundamental domain is a configuration space of complete physical histories, termed complete-timeline configuration space. A complete timeline is defined as an equivalence class of globally specified field-and-geometry histories modulo gauge redundancies. A complex state functional over this space assigns amplitudes to complete histories, while a timeless constraint replaces evolution with respect to an external time parameter. The central result is the Bhaskar Complete-Timeline Equation, obtained as the Euler-Lagrange condition of a real, gauge-invariant, phase-covariant history-space functional under explicitly stated assumptions: quadraticity in the state functional, second-order locality in smooth history-space sectors, linearity, positivity of the nonlocal mismatch term, and dependence on histories only through quotient-space data. The resulting operator contains a local Laplace-Beltrami term, history-space curvature coupling, a consistency potential, and a nonlocal phase-twisted kernel. This derivation establishes the equation within the stated effective axioms; it does not claim a unique microscopic theory of quantum gravity. In semiclassical, fixed-background, relational-clock, and decoherent limits, the framework is required to reproduce known physics, while a finite-dimensional graph model supplies an exactly defined regulated realization. The paper identifies unresolved questions concerning the measure, positivity, diffeomorphism invariance, normalization, the Born rule, microscopic origin, and empirical

distinguishability. It therefore presents a mathematically constrained research program rather than an experimentally established final theory.

Keywords: emergent spacetime; quantum cosmology; complete histories; configuration space; decoherence; timeless quantum gravity; relational time; superspace

1. Introduction

General relativity describes gravity as the dynamics of spacetime geometry, whereas quantum theory is usually formulated in terms of states, observables, and amplitudes defined on a temporal or spacetime background. Their conceptual tension becomes acute in quantum cosmology, where the universe is a closed system and no external classical clock or external observer is available. Canonical quantum gravity expresses this tension through Hamiltonian constraints and, formally, a timeless Wheeler-DeWitt-type equation. Sum-over-histories formulations instead assign amplitudes to alternatives extending across spacetime. Decoherent-histories quantum mechanics likewise treats histories, rather than instantaneous measurements, as central objects for closed systems [1-7].

The present proposal begins from a stronger ontological hypothesis: an individual spacetime is not fundamental. Fundamental reality is represented by the structured set of all dynamically admissible complete histories. Beings and records internal to a quasiclassical history have access only to correlations within that history and therefore describe an emergent spacetime. The proposal is not that consciousness collapses or creates spacetime. Rather, an observer is a physical information-processing subsystem whose records condition the set of histories relevant to its predictions.

The purpose of this paper is to convert that hypothesis into a disciplined theoretical framework. The main object is a state functional on a quotient configuration space of complete histories. Rather than postulating the central operator without structure, the paper derives its effective form from a real history-space functional subject to explicit assumptions of gauge invariance, phase covariance, linearity, second-order locality in smooth sectors, and a positive nonlocal mismatch penalty. The resulting Bhaskar Complete-Timeline Equation is therefore established as the Euler-Lagrange equation of the proposed effective theory, while its microscopic origin remains open. Any viable realization must reproduce general relativity in a semiclassical sector, quantum field theory on approximately fixed backgrounds, the Born rule for decoherent alternatives, and ordinary causal phenomenology within quasiclassical histories.

2. Relation to Established Physics

2.1 Block-universe language and general relativity

A four-dimensional spacetime solution can be viewed tenselessly as a complete geometric object. This interpretation is compatible with relativity but is not itself an additional field equation. The present framework uses the complete spacetime solution only as an emergent or effective object. It does not assume a preferred foliation, a universal present, or motion of consciousness through a pre-existing block.

2.2 Canonical quantum gravity and superspace

DeWitt's canonical treatment promotes the gravitational constraints to conditions on a state functional and introduces a metric on the space of three-geometries [1]. Conventional superspace is broadly the space of spatial geometries modulo spatial diffeomorphisms. The complete-timeline framework differs by taking entire four-dimensional histories, including matter fields and record structures, as its arguments. This is closer to a covariant history space than to ordinary instantaneous configuration space. The distinction is crucial: a point in the proposed space is an entire candidate physical world-history, not one spatial geometry at one coordinate time.

2.3 Sum over histories and the wave function of the universe

Hartle and Hawking defined a wave function of the universe by a gravitational path integral subject to a boundary proposal [2]. More generally, path-integral quantum theory attaches phases determined by the action to histories. The present theory adopts the action phase as an essential consistency ingredient but does not identify its fundamental state merely with a boundary wave function. It instead seeks a state or field defined on complete-history space itself.

2.4 Decoherent histories and quasiclassical realms

Gell-Mann and Hartle formulated quantum mechanics for closed systems in terms of exhaustive sets of coarse-grained histories. Probabilities are assigned when interference between alternatives is sufficiently suppressed, and quasiclassical domains are understood as emergent [3-7]. The complete-timeline proposal uses this as the appropriate language for observers and classical reality. It therefore avoids treating every arbitrarily specified fine-grained history as a separately observable world. Only suitably decoherent, recorded, and coarse-grained alternatives admit ordinary probabilities.

2.5 Relational and emergent time

Page and Wootters showed that an overall stationary state can support effective dynamics through correlations with an internal clock [8]. Semiclassical treatments of the Wheeler-DeWitt equation similarly recover an approximate time parameter and an effective Schrödinger equation in appropriate regimes. This motivates the absence of a fundamental external time in the proposed master constraint. Time is required to emerge as an ordering of correlations internal to a quasiclassical history, not as a coordinate external to all histories.

2.6 Emergent spacetime

Research in gauge/gravity duality has provided concrete examples in which aspects of spacetime geometry are encoded in non-gravitational quantum degrees of freedom, with entanglement playing a central role [9,10]. These results do not establish the ontology proposed here, but they demonstrate that treating spacetime as emergent is compatible with serious quantum-gravity research. The present framework remains agnostic about the microscopic substrate from which history-space geometry ultimately arises.

3. Postulates

1. Fundamental-domain postulate: the fundamental kinematical domain is a structured space of complete physical histories rather than a pre-existing spacetime manifold.
2. Gauge-equivalence postulate: descriptions related by physically redundant transformations, including diffeomorphisms and internal gauge transformations, represent the same complete timeline.
3. Timeless-state postulate: the total state satisfies a constraint and does not evolve with respect to an external time parameter.
4. Emergent-spacetime postulate: a semiclassical spacetime is an effective geometric description of a narrow, decoherent sector of complete histories.
5. Relational-observer postulate: observers are physical subsystems carrying records; their predictions are conditional probabilities over histories compatible with those records.
6. Correspondence postulate: the framework must recover tested general relativity and quantum theory in their established domains.
7. Empirical-discipline postulate: additions to standard theory are physically meaningful only if they yield mathematically definite and potentially testable departures.

4. Kinematics of Complete Timelines

4.1 Definition

Let M be a differentiable four-manifold, g a Lorentzian metric where a semiclassical description is valid, Phi the collection of matter and gauge fields, and R a specification of physically instantiated records or correlations. A representative history is written

$$\mathscr{T} = (M, g_{\mu\nu}, \Phi, R). \quad (1)$$

The inclusion of R does not introduce a nonphysical mental variable. It denotes stable physical correlations - for example, memory states, detector records, fossils, documents, or environmental imprints - that permit conditional predictions by internal subsystems.

4.2 Quotient structure

Let G denote the relevant redundancy group, including spacetime diffeomorphisms and internal gauge transformations. The physical complete-timeline space is formally

$$\mathscr{T}_{\text{space}} = \mathscr{H} / \mathscr{G}, \quad (2)$$

where H is a space of admissible field-and-geometry histories. Because topology change, singular configurations, and inequivalent differentiable structures may occur, T_space need not be a single smooth manifold. It may instead be stratified, with smooth sectors joined by singular or discrete transitions.

4.3 State functional

The fundamental quantum object is a complex functional

$$\Psi : \mathscr{T}_{\text{space}} \to \mathbb{C}, \qquad \mathscr{T} \to \Psi[\mathscr{T}]. \quad (3)$$

The expression |Psi[T]|^2 must not automatically be interpreted as a probability density for an exact fine-grained universe. In a generally covariant theory, the measure, gauge fixing, normalization, and decoherence conditions are nontrivial. Operational probabilities arise only for appropriate coarse-grained classes of histories.

4.4 Coarse grainings

A coarse graining is a partition of complete-history space into classes C_alpha. A class operator or history amplitude may be represented schematically by

$$\mathscr{A}_\alpha = \int_{\mathscr{T} \in \text{C\_\{}\alpha\}} \mathscr{D}\mu(\mathscr{T})\, \Psi[\mathscr{T}]. \quad (4)$$

For a set of alternatives to admit ordinary probabilities, an associated decoherence functional D(alpha,beta) must be approximately diagonal. In the simplest schematic representation,

$$\text{D}(\alpha,\beta) = \mathscr{A}_\alpha \mathscr{A}_\beta^* \approx 0 \ \text{ for } \ \alpha \neq \beta. \quad (5)$$

A complete implementation would use class operators, boundary conditions, or a generalized histories formalism rather than the oversimplified product in Eq. (5). Equation (5) is included only to state the required diagonalization principle.

5. Geometry of Complete-History Space

5.1 Local metric candidate

Within a smooth sector, introduce generalized coordinates q^A on complete-history space. The index A is condensed: it may include field species, tensor indices, and spacetime points. An infinitesimal line element is

$$ds_{\mathscr{T}}^2 = G_{AB}[q]\, dq^A\, dq^B. \quad (6)$$

For gravity, the analogous DeWitt metric is indefinite rather than positive definite. Consequently, ds_T^2 need not define an ordinary metric distance. A physically useful separation functional may require gauge fixing, positive kernels on observables, information geometry, Euclidean continuation, or a spectral construction.

5.2 Gauge-invariant separation

A provisional separation between two histories T and T' can be defined by minimizing a mismatch functional over redundant transformations chi in G:

$$d_{\mathscr{T}}^2(\mathscr{T},\mathscr{T}') = \inf_{\chi\in\mathscr{G}} \{ \int_M d^4x \sqrt{|g|} [a\, \Delta g \cdot K \cdot \Delta g + \sum_A b_A|\Delta\Phi_A|^2 + c(\Delta R)^2] \}. \quad (7)$$

Here Delta g compares g with the pullback of g' under chi, K is a chosen bilinear kernel, and Delta R compares record structures at a coarse-grained physical level. Equation (7) is not yet unique or generally rigorous. It specifies the properties required of a future distance: gauge invariance, non-negativity in the operational sector, symmetry where appropriate, and vanishing only for physically equivalent histories.

5.3 Information-geometric alternative

A more operational option is to define distinguishability using the reduced states of record-bearing subsystems. If rho_T^O and rho_T'^O are states accessible to an observer class O, one may use a contractive quantum-information distance, such as a Bures-type distance, and then aggregate over relevant subsystems. This would make macroscopic record divergence, rather than coordinate field mismatch, the source of large history-space separation.

6. Derivation of the Bhaskar Complete-Timeline Equation

The central equation is derived here as the stationary condition of an effective functional on complete-history configuration space. The derivation is conditional: it establishes the operator within a stated set of structural assumptions, not from an independently completed microscopic theory of quantum gravity.

6.1 Structural assumptions

A1. Quotient-space covariance. Every object in the theory - the measure, metric, curvature, potential, action phase, and kernel - is defined on physical equivalence classes of histories, or is written in a gauge-fixed representation with the corresponding determinant factors.

A2. Timeless linearity. The state functional $\Psi[\mathcal{T}]$ obeys a homogeneous linear constraint with no derivative with respect to an external time parameter. This preserves superposition when the background history-space structures are fixed.

A3. Minimal local order. In a smooth sector, the local operator is restricted to at most two functional derivatives. Covariance then selects a Laplace-Beltrami-type kinetic term, while multiplication operators are represented by a scalar consistency potential and an optional curvature coupling.

A4. Phase covariance. Relative comparison of two histories must depend on the action difference only through the unit-modulus parallel-transport factor $\exp\{i(S[\mathcal{T}]-S[\mathcal{T}'])/\hbar\}$. A common additive shift of the action therefore has no effect.

A5. Positive nonlocal mismatch. Coupled histories are compared through a symmetric non-negative kernel $K(\mathcal{T},\mathcal{T}')$, and the nonlocal contribution is the lowest-order quadratic norm of their phase-transported amplitude difference.

A6. Correspondence and regularity. The operator must admit regulated sectors with finite norm, a well-defined variational principle, standard quantum interference on fixed backgrounds, and semiclassical concentration near dynamically consistent histories.

Under A1-A6, the lowest-order real quadratic functional has the form below, up to coefficient choices, boundary terms, higher functional derivatives, and higher-order nonlocal invariants. This is a restricted uniqueness statement, not an assertion that no other ultraviolet completion is possible.

6.2 Effective history-space functional

Define the Bhaskar history-space functional

$$\mathcal{I}\_B[\Psi,\Psi^*] = \int \mathcal{D}\mu(\mathcal{T}) \{ (\hbar\mathcal{P}^2/2)\, G^{AB}(\mathcal{T})\, (\nabla^A\Psi)^* \nabla^B\Psi + [V(\mathcal{T})+\xi\hbar\mathcal{P}^2\mathcal{R}_{\mathcal{T}}(\mathcal{T})]|\Psi(\mathcal{T})|^2 \}$$
$$+ (\kappa/2) \int \mathcal{D}\mu(\mathcal{T})\mathcal{D}\mu(\mathcal{T}')\, K(\mathcal{T},\mathcal{T}')\, |\Psi(\mathcal{T}) - e^{\wedge}\{i[S(\mathcal{T})-S(\mathcal{T}')]/\hbar\}\Psi(\mathcal{T}')|^2. \quad (8a)$$

The local term is the minimal covariant quadratic form containing no more than two functional derivatives. The nonlocal term is real and non-negative when K is real, symmetric, and non-negative. It vanishes for perfectly phase-aligned amplitudes connected by the kernel.

6.3 Functional variation

Varying $\mathcal{J}_B$ with respect to $\Psi^*(\mathcal{T})$, treating Ψ and Ψ^* as independent variables, gives three contributions. Integration by parts on history space gives

$$\delta/\delta\Psi^*(\mathcal{T}) \int \mathcal{D}\mu\, (\hbar\mathcal{P}^2/2)|\nabla_{\mathcal{T}}\Psi|^2 = -(\hbar\mathcal{P}^2/2)\Delta_{\mathcal{T}}\Psi(\mathcal{T}), \quad (8b)$$

provided the boundary term vanishes or is cancelled by admissible boundary conditions. The potential and curvature terms give $[V(\mathcal{T})+\xi\hbar\mathcal{P}^2\mathcal{R}_{\mathcal{T}}(\mathcal{T})]\Psi(\mathcal{T})$. For a symmetric kernel, variation of the double integral combines the two equivalent placements of $\mathcal{T}$ and yields

$$\kappa \int \mathcal{D}\mu(\mathcal{T}')\, K(\mathcal{T},\mathcal{T}')[\Psi(\mathcal{T})-e^{i[S(\mathcal{T})-S(\mathcal{T}')]/\hbar}\Psi(\mathcal{T}')]. \quad (8c)$$

Setting $\delta\mathcal{J}_B/\delta\Psi^*(\mathcal{T})=0$ produces the central constraint.

6.4 Bhaskar Complete-Timeline Equation

$$\begin{aligned} \mathbf{0} &= [-(\hbar\mathcal{P}^2/2)\Delta_{\mathcal{T}} + \xi\hbar\mathcal{P}^2\mathcal{R}_{\mathcal{T}} + V(\mathcal{T})]\Psi(\mathcal{T}) \\ &\quad + \kappa \int \mathcal{D}\mu(\mathcal{T}')\, K(\mathcal{T},\mathcal{T}')[\Psi(\mathcal{T})-e^{i[S(\mathcal{T})-S(\mathcal{T}')]/\hbar}\Psi(\mathcal{T}')]. \quad \mathbf{(8)} \end{aligned}$$

Equation (8) will be called the Bhaskar Complete-Timeline Equation (BCTE) within this paper. The name identifies the specific composite constraint proposed here; it does not imply prior community adoption. Its derivation is exact from Eq. (8a) under A1-A6. The remaining conjectural step is whether nature is described by this effective functional or by a microscopic theory whose low-energy limit produces it.

The first term penalizes rapid local variation across neighboring histories; the curvature term permits history-space geometry to affect amplitudes; V suppresses dynamically inconsistent histories; and the phase-twisted integral couples distinct histories without introducing external time. Because Eq. (8) is linear in Ψ for fixed background structures, it preserves superposition at the level of the complete-history state.

6.5 Kernel and restricted uniqueness

A minimal positive kernel is

$$K(\mathscr{T},\mathscr{T}) = N(\mathscr{T},\mathscr{T}) \exp[-d\mathscr{P}^2(\mathscr{T},\mathscr{T})/(2\ell\mathscr{P}^2)]. \quad (9)$$

Here $\ell\mathscr{T}$ is a history-space coherence scale and N may contain measure, gauge, causal, or determinant factors. The Gaussian is selected as the maximum-entropy short-range kernel when only a positive quadratic separation and a coherence scale are specified. It is not unique once higher moments, oscillatory sectors, topology change, or microscopic spectral data are admitted. Heat, graph, and spectral kernels are therefore legitimate completions.

6.6 Consistency potential

The consistency potential is organized as

$$V(\mathscr{T}) = \alpha E\_GR(\mathscr{T})+\beta E\_matter(\mathscr{T})+\gamma E\_gauge(\mathscr{T})+\delta E\_boundary(\mathscr{T}). \quad (10)$$

A regulated gravitational residual may be written schematically as

$$E\_GR(\mathscr{T}) = \int\_M d^4x \sqrt{(-g)}\ ||G\mu\nu+\Lambda g\mu\nu-(8\pi G/c^4)T\mu\nu||^2\_W. \quad (11)$$

The norm W cannot be a naive Lorentzian tensor norm. It must be defined in a regulated Euclidean sector, through relational observables, or through another positive operational construction. Squaring the field-equation residual is used only as an effective penalty and must not be confused with a fundamental higher-derivative gravitational action.

7. Emergence of Known Physics

7.1 Semiclassical gravity

Take $\Psi[\mathscr{T}]=A[\mathscr{T}]\exp\{iW[\mathscr{T}]/\hbar\mathscr{T}\}$ and insert it into Eq. (8). The real part of the local kinetic term contains the leading contribution $G^{AB}(\delta W/\delta q^A)(\delta W/\delta q^B)/2$, while derivatives of A enter at higher semiclassical order. If V has a sharply minimized sector defined by the regulated gravitational and matter constraints, stationary phase concentrates weight near histories satisfying the corresponding Hamilton-Jacobi relations. In that sector one obtains, schematically,

$$\delta S\_eff[g,\Phi]/\delta g\mu\nu = 0 \ \Rightarrow\ G\mu\nu+\Lambda g\mu\nu = (8\pi G/c^4)\langle T\mu\nu\rangle + O(\hbar\mathscr{T},\kappa,\ell\mathscr{T}). \quad (12)$$

Equation (12) is a controlled reduction only after the measure, regulator, potential, and boundary conditions are specified. The present paper establishes the route by which the Einstein equation can emerge from the stationary sector; it does not yet compute the correction tensor explicitly.

7.2 Quantum theory on a fixed background

Let the geometry be narrowly supported around a classical background $\bar{g}$ and let $\mathscr{T}$ differ primarily in matter-field histories. When $\kappa\to0$, or when the kernel term only enforces the standard action-phase relation without additional observable coupling, Eq. (8) reduces to a linear constraint for matter-history amplitudes. With boundary data chosen in the usual way, the solution is required to be proportional to the standard path-integral weight exp(iS_matter/ℏ). Thus ordinary quantum theory is recovered as a fixed-background sector; any residual κ-dependent term is an experimentally constrained correction rather than a replacement for standard interference.

7.3 Relational time

Partition the variables of a quasiclassical history into a clock C and remaining degrees of freedom X. A stationary total state defines the conditional state

$$\psi\_X(x|\tau) = \langle C=\tau|\Psi\rangle / \|\langle C=\tau|\Psi\rangle\|. \quad (13)$$

If the clock is semiclassical, weakly back-reacting, and monotonic over the sector of interest, the constraint can be projected onto clock states. To leading order, the clock momentum acts as $-i\hbar\partial/\partial\tau$ and the conditional state obeys $i\hbar\partial\tau\psi\_X=H\_X\psi\_X$ plus calculable clock and history-kernel corrections. Effective evolution is therefore relational, while the total state remains timeless.

7.4 Classicality and decoherence

Macroscopic alternatives become correlated with large environmental record sets. Their accessible reduced states become nearly orthogonal, their operational history distance grows, and the off-diagonal decoherence functional is suppressed. In the proposed kernel model, one obtains the schematic suppression

$$|D(\alpha,\beta)| \sim \exp[-d_{\mathscr{T}}^2(C_\alpha,C_\beta)/(2\ell_{\mathscr{T}}^2)]\ |D_0(\alpha,\beta)|. \quad (14)$$

Equation (14) should not replace standard environment-induced decoherence. It is a possible deeper parametrization whose leading behavior must agree with standard decoherence in tested regimes.

8. Observers and the Appearance of a Single Spacetime

An observer O is represented by a physical record condition R_O. Let C(R_O) be the class of complete histories containing that record. For an observable A with alternatives a, conditional probabilities are defined only for a decoherent set:

$$P(a|R_O) = D(a\wedge R_O,a\wedge R_O) / \textstyle\sum_b D(b\wedge R_O,b\wedge R_O). \quad (15)$$

The observer does not select a history by consciousness. Instead, its current physical records restrict the relevant conditional ensemble. Within a robust quasiclassical realm, almost all weight compatible with those records is concentrated on histories sharing the same effective past and a stable local spacetime geometry. This produces the operational appearance of one continuous spacetime.

It would be misleading to define the experienced metric simply as a global average of macroscopically different geometries, because such an average may describe no classical world. A safer construction is branch-relative: first identify a decoherent quasiclassical class C_alpha, then define an effective metric from the peak or expectation values within that class only.

$$g_{\mu\nu}^{(\alpha)}(x) = \langle \hat{g}_{\mu\nu}(x)\rangle_{C\_\{\alpha}\} + \text{controlled fluctuations.} \quad (16)$$

9. Finite-Dimensional Toy Model

To illustrate the structure without claiming quantum gravity, consider N discrete complete histories labeled i=1,...,N. Each has an effective action S_i, consistency cost V_i, amplitude psi_i, and pairwise distance d_ij. Define weights

$$K_{ij} = \exp[-d_{ij}^2/(2\ell_{\mathscr{T}}^2)]. \quad (17)$$

The discrete master constraint is

$$0 = V_i\psi_i + \kappa\sum_j K_{ij}[\psi_i - \exp\{i(S_i - S_j)/\hbar\}\psi_j]. \quad (18)$$

Equation (18) is a graph Laplacian twisted by action phases. If neighboring histories have nearly equal action phase, amplitudes can remain coherent across the graph. If their phases vary rapidly or their distances are large, the summed coupling cancels or becomes exponentially weak. Histories with large V_i are suppressed.

Define the Hermitian phase-twisted graph Laplacian L^S by L^S_ii=∑_jK_ij and L^S_ij=-K_ij exp{i(S_i-S_j)/ℏ} for i≠j. Equation (18) is then (V+κL^S)ψ=0. For symmetric non-negative K_ij, ψ†L^Sψ=(1/2)∑_{ij}K_ij|ψ_i-e^{i(S_i-S_j)/ℏ}ψ_j|²≥0. Hence the aligned mode ψ_i∝e^{iS_i/ℏ} lies in the kernel of L^S on each connected component. For two histories with equal V and coupling K, the phase-aligned and anti-aligned eigenvalues are V and V+2κK, respectively. This exactly demonstrates energetic preference for action-phase alignment in the regulated model. It does not by itself derive the Born rule, Lorentz invariance, or continuum quantum field theory.

10. Conditional Phenomenology and Falsifiability

A new framework becomes physical only when its free structures are fixed independently of the data. The most direct effective signature is an additional loss of coherence controlled by operational separation in complete-history space. For a two-class reduced model, take the leading analytic choice F(z)=z² for z≪1 and saturation at large z. Then

$$\Gamma\_\text{total} = \Gamma\_\text{standard} + \eta\, F[d\mathscr{T}(C_1,C_2)/\ell\mathscr{T}], \quad F(z)=z^2+O(z^4). \quad (19)$$

Here η has dimensions of inverse time. Interferometry experiments that hold mass, geometry, elapsed time, and environmental coupling fixed while changing irreversible record complexity could bound $\eta/\ell\mathscr{T}$. A null result would exclude the corresponding parameter region. Because η and $\ell\mathscr{T}$ are not yet derived, Eq. (19) is a falsifiable effective parametrization, not a parameter-free prediction.

Other possible tests include nonstandard interference in systems with gravitationally distinguishable histories, departures from conventional semiclassical gravity, or correlations tied to topology-changing sectors. At present these are research directions rather than predictions because the distance, measure, kernel, and parameter values remain unspecified.

11. Black Holes and Singular Sectors

The framework does not imply that black holes are portals between timelines. Classical event horizons occur within individual spacetime histories. A relation between black holes and other history-space sectors would require a quantum-gravitational mechanism, such as topology change, singularity resolution, or nonperturbative saddle connections. The proposed configuration space can accommodate such sectors, but Eq. (8) alone does not establish them.

A more defensible question is whether histories with different interior geometries, evaporation outcomes, or topology can remain coherent in a quantum-gravitational path integral. The answer depends on boundary conditions, observables, and decoherence. Any application to information loss must reproduce unitarity properties of the completed theory and known semiclassical results.

12. Mathematical and Physical Consistency Requirements

12.1 Measure and regularization

The formal measure Dmu(T) is undefined in the continuum without gauge fixing and regularization. The conformal-factor problem, ultraviolet divergences, Gribov ambiguities, and topology sums are inherited from quantum gravity. A workable model may begin with lattice histories, causal sets, tensor networks, spin foams, minisuperspace, or another regulated substrate.

12.2 Diffeomorphism invariance

All distances and kernels must act on gauge-equivalence classes. Coordinate-dependent comparisons between g(x) and g'(x) are not physical. Relational observables, matter reference fields, spectral invariants, or explicit gauge fixing are required.

12.3 Positivity and gravitational signature

The DeWitt supermetric has an indefinite direction, so a naive Gaussian of its squared interval can grow rather than decay. Equation (9) therefore requires a positive operational distance, Euclideanized sector, or other kernel construction. This is a major unresolved issue.

12.4 Probability and the Born rule

The master constraint does not by itself derive the Born rule. Probabilities require a physical inner product or decoherence functional. A complete theory must show why branch weights are quadratic in amplitudes and how conditional probabilities are normalized.

12.5 Linearity and no-signalling

Equation (8) is linear in Psi when its geometry and kernel are fixed. This is important because generic nonlinear modifications of quantum mechanics risk superluminal signalling and conflict with precision tests. If G_AB or K depends on Psi, consistency conditions become substantially more demanding.

12.6 Locality and causality

Nonlocality in configuration space is not automatically spacetime nonlocality. Nevertheless, the emergent theory must preserve operational no-signalling and local Lorentz invariance to tested accuracy. The kernel may connect complete histories without permitting controllable messages outside an emergent light cone.

12.7 Uniqueness

Within assumptions A1-A6, Eq. (8) is the minimal Euler-Lagrange equation generated by a real quadratic functional containing at most two local functional derivatives and a pairwise phase-covariant mismatch. This provides restricted effective uniqueness: changing the equation requires relaxing at least one assumption or adding higher-order operators, additional fields, higher-point kernels, or microscopic spectral data. The theory is therefore more constrained than an arbitrary ansatz, but it is not claimed to be the unique ultraviolet completion of quantum gravity.

13. Distinction from Nearby Interpretations

Framework	Fundamental object	Difference from present proposal
Canonical quantum gravity	Wave functional on spatial geometries and fields	The proposal uses complete four-dimensional histories as points of its fundamental domain.

Feynman path integral	Amplitude as a sum over paths or field histories	The proposal adds a geometry and candidate field equation on the space of complete histories.
Decoherent histories	Probabilities for decoherent coarse-grained histories	The proposal adopts this probability framework but hypothesizes a deeper history-space geometry.
Everett interpretation	Universal state with emergent branches	The proposal does not assume that every formal component is an independently experienced world; ontology depends on the completed history-space theory and decoherence.
Block universe	One complete spacetime	Each spacetime is emergent within a broader timeless structure of admissible complete histories.
Entanglement-emergent spacetime	Spacetime encoded in quantum degrees of freedom	The microscopic substrate is left open; complete histories are used as effective fundamental configurations.

14. Research Program

8. Choose a regulated history substrate and define the physical quotient space.
9. Construct a positive, gauge-invariant operational distance or replace distance with a spectral kernel.
10. Define the measure and physical inner product, including gauge-fixing, ghost, and determinant factors where required.
11. Derive the effective functional $\mathcal{I}$_B from a microscopic substrate or renormalization argument, thereby fixing ξ, κ, $\ell\mathcal{T}$, N, and V.
12. Prove existence, self-adjointness or an appropriate generalized spectral property, and stability of solutions in regulated sectors.
13. Derive the semiclassical correction tensor in Eq. (12) and verify recovery of Einstein gravity.
14. Recover quantum field theory, relational Schrödinger evolution, and the Born rule for decoherent coarse grainings.
15. Build numerical finite-graph and minisuperspace models and derive at least one tightly constrained experimental prediction.

15. Discussion

The conceptual attraction of complete-timeline configuration space is that it treats the apparent incompatibility between timeless quantum gravity and experienced temporal evolution as a change of level. At the fundamental level there is a constrained state on a domain of complete alternatives. At the effective level, correlations inside a narrow decoherent sector define clocks, causal order, matter evolution, and spacetime geometry. General relativity then describes the internal geometry of a semiclassical history, whereas quantum theory describes amplitudes and correlations among alternatives.

The proposal also carries a substantial risk of merely renaming existing structures. Superspace, covariant path integrals, decoherent histories, and relational time already provide much of the mathematical vocabulary. The distinct content lies in treating complete four-dimensional histories as points of a quotient configuration space and in assigning them the phase-twisted nonlocal quadratic functional of Eq. (8a). The Bhaskar Complete-Timeline Equation is not inserted independently: it follows by variation of that functional under A1-A6. Its physical novelty nevertheless depends on whether the kernel, distance, and potential can be fixed microscopically and whether they yield predictions beyond standard formulations.

A second risk concerns ontology. The mathematical existence of alternative histories does not by itself imply that all histories are equally real, that consciousness migrates among them, or that macroscopic branching is fundamental. These claims are neither required nor supported by the present equations. The scientifically conservative statement is that the theory assigns amplitudes to complete alternatives and that observers make conditional predictions within decoherent classes.

16. Conclusion

This paper has formulated a speculative but physics-aligned framework in which complete histories are the arguments of a fundamental timeless state functional and spacetime emerges within decoherent semiclassical sectors. Under explicit assumptions of quotient-space covariance, timeless linearity, minimal second-order locality, phase covariance, and positive pairwise mismatch, the real functional $\mathcal{I}$_B yields by variation the Bhaskar Complete-Timeline Equation. The equation combines a functional Laplace-Beltrami operator, history-space curvature, a consistency potential, and a nonlocal kernel weighted by history separation and relative action phase.

The derivation is exact within the proposed effective assumptions but is not a derivation from a completed microscopic theory. The quotient space, measure, positive separation, kernel normalization, physical inner product, Born rule, correction scales, and empirical signature remain open. The finite graph model proves positivity and phase alignment in a regulated setting, while the semiclassical and relational analyses specify concrete reduction conditions. Development into a physical theory requires microscopic parameter fixing, rigorous correspondence limits, and a distinctive quantitative prediction. The central hypothesis remains: spacetime is not the fundamental arena of reality; it is the quasiclassical geometry perceived from within a decoherent complete history belonging to a deeper timeless space of alternatives.

Acknowledgments

The author acknowledges the foundational work of researchers in general relativity, quantum cosmology, decoherent histories, relational time, and emergent spacetime upon which the conceptual comparisons in this paper are based.

Declaration of Status and Originality

The specific combination designated here as the Bhaskar Complete-Timeline Equation, together with its derivation from the effective functional $\mathcal{J}_B$ under assumptions A1-A6, is presented as the author's proposed synthesis and research program. Individual ingredients - configuration-space metrics, timeless constraints, action phases, nonlocal kernels, path integrals, decoherence functionals, graph Laplacians, and emergent spacetime - have substantial prior literatures. The naming is internal to this manuscript and does not imply independent recognition. Establishing scholarly novelty and priority requires formal literature review, public timestamping, and peer evaluation. No experimental confirmation is claimed.

Appendix A. Symbol Summary

Symbol	Meaning
$\mathcal{T}$	One complete physical history or timeline
$\mathcal{T}$	Physical configuration space of complete histories
$\Psi[\mathcal{T}]$	Complex state functional over complete-history space
G_{AB}	Generalized metric on a smooth sector of history space
$\Delta_{\mathcal{T}}$	Functional Laplace-Beltrami-type operator
$\mathcal{R}_{\mathcal{T}}$	Curvature scalar of history space, where defined
$\mathcal{D}\mu(\mathcal{T})$	Gauge-fixed or quotient measure over complete histories
$S[\mathcal{T}]$	Action associated with a complete history
$d_{\mathcal{T}}(\mathcal{T},\mathcal{T}')$	Gauge-invariant or operational history separation
$\ell_{\mathcal{T}}$	History-space coherence scale
$V[\mathcal{T}]$	Consistency potential

D(α,β)	Decoherence functional for coarse-grained histories
$\mathcal{F}$_B	Bhaskar history-space functional whose stationary condition yields Eq. (8)
L^S	Phase-twisted graph Laplacian in the finite-dimensional model
κ	Strength of nonlocal complete-history coupling
η	Effective phenomenological decoherence-rate scale

References

[1] B. S. DeWitt, 'Quantum Theory of Gravity. I. The Canonical Theory,' Physical Review 160, 1113-1148 (1967). doi:10.1103/PhysRev.160.1113.

[2] J. B. Hartle and S. W. Hawking, 'Wave Function of the Universe,' Physical Review D 28, 2960-2975 (1983). doi:10.1103/PhysRevD.28.2960.

[3] M. Gell-Mann and J. B. Hartle, 'Quantum Mechanics in the Light of Quantum Cosmology,' in Complexity, Entropy, and the Physics of Information, edited by W. H. Zurek (Addison-Wesley, 1990), pp. 425-458.

[4] M. Gell-Mann and J. B. Hartle, 'Classical Equations for Quantum Systems,' Physical Review D 47, 3345-3382 (1993). doi:10.1103/PhysRevD.47.3345.

[5] J. J. Halliwell, 'A Review of the Decoherent Histories Approach to Quantum Mechanics,' Annals of the New York Academy of Sciences 755, 726-740 (1995); arXiv:gr-qc/9407040.

[6] M. Gell-Mann and J. B. Hartle, 'Alternative Decohering Histories in Quantum Mechanics,' arXiv:1905.05859 (2019).

[7] M. Gell-Mann and J. B. Hartle, 'Decoherent Histories Quantum Mechanics and Copenhagen Quantum Mechanics,' arXiv:2110.15471 (2021).

[8] D. N. Page and W. K. Wootters, 'Evolution without Evolution: Dynamics Described by Stationary Observables,' Physical Review D 27, 2885-2892 (1983). doi:10.1103/PhysRevD.27.2885.

[9] M. Van Raamsdonk, 'Building up Spacetime with Quantum Entanglement,' General Relativity and Gravitation 42, 2323-2329 (2010). doi:10.1007/s10714-010-1034-0; arXiv:1005.3035.

[10] T. Faulkner et al., 'Nonlinear Gravity from Entanglement in Conformal Field Theories,' Journal of High Energy Physics 08, 057 (2017). doi:10.1007/JHEP08(2017)057; arXiv:1705.03026.

[11] J. B. Hartle, 'The Quantum Mechanics of Cosmology,' arXiv:1805.12246 (lecture notes originally presented in 1990).

[12] D. A. Craig and P. Singh, 'Consistent Probabilities in Wheeler-DeWitt Quantum Cosmology,' Physical Review D 82, 123526 (2010). doi:10.1103/PhysRevD.82.123526; arXiv:1006.3837.

[13] C. Kiefer and P. Peter, 'Time in Quantum Cosmology,' Universe 8, 36 (2022). doi:10.3390/universe8010036; arXiv:2112.05788.