Series-ID-Enter-A Dynamical Hosts, Complete Enter, and Conditional Horizon Access

Consolidation: parent comparison, shortened cosmic reach, six sharper conjectures, and the limits of the Big Bang Analogy

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Abstract

We consolidate a self-contained documentary synthesis of two prescribed I-D-type dynamical comparison carriers: an axis-filled cylindrical geometry and a two-ended compact-axial toroidal bridge. Every local theorem is retained: smoothness and global hyperbolicity, routing and bounded-radius settling, complete destructive Enter, residual routing after settling, flagged and heralded settling, signed-energy and finite-time ledgers, the bridge null-energy deficit, moving-observer reception, axial winding deadlines, vacuum and coefficient non-selection, horizon exclusion giving replacement, and deadline–instrument separation.

Repeated cosmic reach proofs are shortened to local statements with named sibling comparisons; labels are retained. A parent-comparison table records source labels as records, not premises. Residual-routing and flagged-settling proofs are tightened, with the horizon-model disclaimer kept only in boundary prose. Nine prior physical-bridge conjectures are replaced by six sharper, testable research conjectures (cross-host residual, ledger–recovery decoupling, null-energy herald, winding key, delayed geometric response, and joint access tomography); none is promoted.

No spacetime emergence, Einstein dynamics, Page curve, island, bounce, vacuum-energy selection, or Host C is asserted. O.1 stays NOT_CLOSED; Gate 0/ST4b NOT_SUPPLIED; Dom (*T*) undetermined; J2 unresolved. All

standing programme boundaries are unchanged.

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Routing, philosophy, and standing scope

Identity and admissible claims

The sheet family is Series-ID-Enter-A, alias ID-Enter-A; this release is Series-ID-Enter-A-v4. It is a documentary synthesis, not a registration request:

$$\text{declaredPath} = \text{null}, \qquad \text{wired} = \text{false}.$$

Standing boundary. No spacetime emergence, derived metric, Einstein dynamics, Page curve, island, cosmological bounce, de Sitter quantum state, vacuum-energy selection, inherited characteristic quantum coefficient, compilation, or Host C is claimed. O.1 stays NOT_CLOSED. Gate 0 and ST4b stay NOT_SUPPLIED. XV-B is not opened; XVI-N is not discharged; Dom (T) remains undetermined; J2 remains unresolved; Problems 6, 7, and 9 are named, not solved. Programme Host-A stays NAMED_COMPARISON_ONLY. Cited Cheung and

OpenAI records are source records, not premises. declaredPath=null; wired=false.

Three roles are kept separate:

1. *Supplied data*: manifolds, metric coefficients, profiles, switches, finite instruments, access cuts, clocks, source normalizations, and allowed continuations printed in this file.

2. *Locally proved consequences*: mathematical implications proved below from those explicit data.

3. *Named comparisons*: source records giving provenance and context without transferring their theorems as hidden premises.

A theorem is a mathematical implication on its displayed domain. A physical prediction additionally needs a matched preparation, interaction, acquisition, clock calibration, causal routing, apparatus model, and complete implementation-error allowance. A research conjecture concerns such a missing physical bridge and is not used in a proof.

Host-name discipline. The symbols $M_{\mathrm{A}}, M_{\mathrm{B}}$ below name *local classical comparison carriers of I-D type*. They do not open the separately locked programme Host-A, add programme tags, or create Host C. The fact that a mathematical comparison carrier is specified is not a registry or quantum-admission operation.

Profile-completeness discipline. The supplied I-D excerpts identify the host topologies, comparison metrics, switch-settling conditions, and late tails. Section prints a sufficient local profile class realizing those forms, together with explicit nonempty examples. This is the adoption contract for every proof here. No equality with an unprinted source profile, spectral realization, or later source classification is inferred. A specialization to a particular versioned I-D instance requires checking equality of its full displayed data with this contract.

Enter and spacetime Enter

Enter is interpreted as destructive readout of an owned finite quantum name [1, 3]. Its output contains a classical code and the unmeasured quantum survivors, not a quantum return of the measured name. This is an access and continuation-type statement, not annihilation of all microscopic apparatus degrees of freedom.

Spacetime Enter locates the finite process on a *supplied* time-oriented metric [3, 5]. Worldlines, ports, routes, event calibration, survivor ownership, failure labels, and complete environments must be declared. Neither a readout instruction nor a classical word returns a new metric as a quantum output. Consumption of a clock encoding does not consume η, proper time, a spatial axis, or a worldsheet.

A stochastic history label is not automatically the time coordinate of the one event at which its register is read. Relational unitary evolution requires additional stationarity and clock-covariance hypotheses; it does not follow from the bare instrument identity [17].

The Shredder Philosophy

The Shredder Philosophy asks which *complete* outputs remain available to a decoder [4, 23]. If

$$\mathcal{M}(\rho) = \sum_r \mathrm{proj}\, r_R \otimes \mathcal{N}_r(\rho),$$

then its classical marginal

$$\mathcal{C}(\rho) = \mathrm{Tr}_K \mathcal{M}(\rho)$$

is a different access contract whenever K remains accessible.

Consequently:

report agreement ≠ complete instrument agreement,
clock consumption ≠ payload consumption,
accessible loss ≠ global destruction,
readout ≠ reset ≠ reservoir heat,
settled geometry ≠ terminal ownership.

A quantum residual that looks locally random may still carry recoverable information jointly with an available classical key. Conversely, its declared dimension alone is not a certificate that any information survives.

The Big Bang Analogy and Big01–Big05

The Big-series analogy compares a declared fixed-size resource account with an observer-dependent causal region on a prescribed classical host [7, 8, 9, 10, 11]. Big01 provides the named horizon-access and coefficient-sensitive

label comparison; the Big02–Big05 records retain their own account, source, coefficient, and interpretation questions. Only that documentary organization is used here.

The comparison becomes mathematical only after specifying:

1. the geometric region and its observer;

2. the unknown code and complete accessible output;

3. the time interval or communication deadline;

4. the supplied constants and source-account convention;

5. the proposed map between the different objects. No such identification is supplied merely by calling a causal region a "box."

An initial resource allocation is not a cosmological singularity. A settling switch is not a selected cosmic expansion law. A smooth bridge is not a cosmological bounce. A finite-radius region is not a finite-dimensional Hilbert space. Neither the normal-observer source ledger nor a recovery error is Gibbons–Hawking entropy.

The analogy is therefore used to expose missing interfaces, not to derive a universe from a finite instruction.

Named source components

toprule Source Named local object Boundary retained

midrule endhead I-D, v5 def:host-A, def:host-B, thm:GH, prop:nonGH, thm:settling, thm:energy, thm:instrument Host forms and provenance only; local data and proofs are printed here [5].

I-D-Deadline-A, v2 thm:DL-cut, thm:DL-capacity, thm:DL-flrw Capacity, deadlines, and complete readout have different targets [6].

Big01-A, v7 thm:Bexact, thm:Bsharp, thm:vacfibre, cor:P5, thm:Hcert, thm:P1–thm:P6 Separate prescribed-host comparison, not state selection [7].

Earlier synthesis sheets Conical reporting, finite clocks, shredder floors, flagged recovery, and conditional cosmic

reach Style and documentary comparison only; source labels are version-local [21, 22].

Series-IC-Enter-A thm:imperfect-flag, thm:approximate-reset-spectrum, thm:heralded-cut, thm:private-key-resource Style only for flagged recovery, spectral reset, and heralded cuts; not premises [21, 22].

Series-I-IB-Enter-A lem:pure-branch-marginal, lem:no-ccr, prop:gaussian-cross Style only: pure branch ≠ pure marginal; bandwidth ≠ CCR [21, 22].

Big-Vac-A / Big06-B Vacuum non-selection and residual source account No vacuum value, particle, or constitutive law is selected [12, 13, 14].

Standing analytic and source records J2, downstream admission, and source-domain obligations No analytic gate is discharged [27, 28, 29, 30, 31, 32, 33, 34, 35].

OpenAI catalogue Mathematical-physics documentary catalogue No family is used to supply an expansion law, host identification, or missing coefficient [43].

bottomrule

Source-local labels are not local references in this manuscript. In particular, a comparison to a source's imperfect-flag result requires that source's actual flag calibration and output contract; none is silently imported.

Parent-comparison table (local theorems to named sources)

Not a premise notes for Big02–Big05, standing records, and Series syntheses live in this parent-comparison table only (book pass t415u).

The following table maps retained local theorems to named parent records. Every cited Cheung or OpenAI label is a *source record*; local hypotheses are printed independently and are not transferred as unstated premises.

toprule Local theorem Named parent / extension Retained boundary

midrule endhead thm:hosts I-D def:host-A, def:host-B Separate manifolds

thm:GH I-D thm:GH Full adopted carriers only

thm:residual-routing Series-IC thm:E (style only) Prefix non-selection; not a premise

thm:flagged-settling Series-IC thm:imperfect-flag (style) Not a horizon model

thm:finite-time-ledger I-D thm:energy Static limit ≠ finite-time integral

thm:bridge-null-ledger I-D thm:energy Assigned geometric source only

thm:horizon-access Big01-A thm:Bexact Prescribed host only

bottomrule

The two adopted dynamical comparison carriers

Shared profiles and switches

Fix

$$c > 0, \quad 0 < \alpha < 1, \quad \beta = 1 - \alpha, \quad 0 < r_0 < r_1, \quad b > r_0, \quad L_z > 0,$$

and switch durations $\tau_a, \tau_f > 0$, with $a_\infty > 1$.

Let $A, S \in C^\infty(\mathbb{R}; [0,1])$ be nondecreasing smooth steps:

$$A(u) = S(u) = 0 \quad (u \le 0), \qquad A(u) = S(u) = 1 \quad (u \ge 1).$$

Define the shared scale and travelling switch

$$a(\eta) = 1 + (a_\infty - 1)A(\eta/\tau_a), \qquad s(\eta, r) = S\left(\frac{\eta - r/c}{\tau_f}\right).$$

Thus $1 \le a \le a_\infty$. The switch arguments and the prescribed c are data, not derived operational constants.

Choose smooth profiles $q, v : [0,\infty) \to [0,1]$ satisfying

$$q = 0 \text{ on } [0, r_0], \qquad q = 1 \text{ on } [r_1, \infty), \qquad q' \ge 0,$$
$$v(0) = 0, \qquad v = 1 \text{ on } [r_0, \infty), \qquad v' \ge 0.$$

Require v to have a smooth odd extension near zero and $v'(0) > 0$. The odd-extension condition is a smoothness

condition at the bridge neck, not a distributional matching rule.

Put

$$\begin{aligned} Q(r) &= \int_0^r q(u)\mathrm{mathop\,d}u, & W(r) &= b + \int_0^r v(u)\mathrm{mathop\,d}u, \\ \rho_c &= \int_0^{r_1} (1 - q(u))\mathrm{mathop\,d}u, & d_0 &= b - \int_0^{r_0} (1 - v(u))\mathrm{mathop\,d}u. \end{aligned}$$

In particular,

$$0 \le Q(r) \le r \le W(r), \qquad d_0 > b - r_0 > 0,$$

and

$$Q(r) = r - \rho_c, \qquad W(r) = r + d_0 \quad (r \ge r_1).$$

Explicit nonempty realization. For a smooth step one may take

$$\chi(u) = \frac{\theta(u)}{\theta(u) + \theta(1-u)}, \qquad \theta(u) = \begin{cases} e^{-1/u}, & u > 0, \\ 0, & u \le 0. \end{cases}$$

Set $A = S = \chi$ and $q(r) = \chi((r - r_0)/(r_1 - r_0))$. To construct v, take the even bump

$$w(r) = \begin{cases} C\exp\left(-\dfrac{1}{1 - (r/r_0)^2}\right), & |r| < r_0, \\ 0, & |r| \ge r_0, \end{cases} \qquad \int_0^{r_0} w(r)\mathrm{mathop\,d}r = 1,$$

and let $v(r) = \int_0^r w(u)\mathrm{mathop\,d}u$ for $r \ge 0$. Then v has the required odd extension and $v'(0) > 0$. All constants and profiles are fixed before the calculations.

Numerical profile pair (not a new theorem). Fix the bridge radii $r_0 = 1$, $r_1 = 2$, neck parameter $b = 1.5$, and the smooth profiles of – with the explicit bump construction above. Then

$$\rho_c = \int_0^{r_1} (1 - q) = \int_0^1 1\,\mathrm{mathop\,d}u + \int_1^2 (1 - q) = 1 + \int_0^1 (1 - \chi(s))\,\mathrm{mathop\,d}s,$$

and with the standard smooth step χ one obtains the numerical pair

$$\rho_c \approx 1.500, \qquad d_0 = b - \int_0^{r_0} (1 - v) \approx 1.500 - 0.500 = 1.000$$

(using $\int_0^{r_0} v = 1/2$ for the normalised even bump). The profile bounds become $d_0 > b - r_0 = 0.5 > 0$ and $0 \le Q(r) \le r \le W(r)$, saturated in the tails by $Q(r) = r - \rho_c$ and $W(r) = r + d_0$. Host A (axis-filled) and Host B (bridge) therefore share a concrete numerical profile pair $(\rho_c, d_0) \approx (1.5, 1.0)$ before any residual-routing or null-energy ledger is evaluated. No Host C is defined, and the six research conjectures remain research claims. Repeating the quadrature with $(r_0, r_1, b) = (0.5, 1.5, 1.2)$ yields a second numerical pair $(\rho_c, d_0) \approx (1.00, 0.95)$ under the same bump normalisation. The two pairs

$$(1.5, 1.0) \quad \text{and} \quad (1.0, 0.95)$$

are the profile-pair audit requested for the book expansion. Both satisfy $d_0 > b - r_0 > 0$ and the tail identities . Host A and Host B remain the only two carriers; the numerical pairs label concrete instances of the shared profile data, not a third host. Residual-routing and flagged-settling theorems later in the sheet inherit these numbers only as fixed background, never as derived physical scales.

Local host definitions

Definition (Axis-filled comparison carrier). Let

$$M_{\mathrm{A}} = \mathbb{R}_{\eta} \times \mathbb{R}^2_{x,y} \times \mathbb{R}_z.$$

Use polar coordinates r, φ on $\mathbb{R}^2 \setminus \{0\}$, with φ of period 2π. Set

$$\begin{aligned} F_{\mathrm{A}}(\eta, r) &= r - \beta s(\eta, r) Q(r), \\ g_{\mathrm{A}} &= a(\eta)^2 \left[-c^2 \mathrm{mathop\,d}\eta^2 + \mathrm{mathop\,d}r^2 + F_{\mathrm{A}}(\eta, r)^2 \mathrm{mathop\,d}\varphi^2 + \mathrm{mathop\,d}z^2 \right]. \end{aligned}$$

The metric at the axis is its smooth Cartesian extension. The axis is included in the manifold.

Definition (Compact-axial toroidal comparison carrier). Let

$$M_{\mathrm{B}} = \mathbb{R}_{\eta} \times \mathbb{R}_{\ell} \times (\mathbb{R}/2\pi\mathbb{Z})_{\varphi} \times (\mathbb{R}/L_z\mathbb{Z})_z, \qquad r = |\ell|.$$

Set

$$\begin{aligned} F_{\mathrm{B}}(\eta, \ell) &= W(|\ell|) - \beta s(\eta, |\ell|) Q(|\ell|), \\ g_{\mathrm{B}} &= a(\eta)^2 \left[-c^2 \mathrm{mathop\,d}\eta^2 + \mathrm{mathop\,d}\ell^2 + F_{\mathrm{B}}(\eta, \ell)^2 \mathrm{mathop\,d}\varphi^2 + \mathrm{mathop\,d}z^2 \right]. \end{aligned}$$

The coordinate circles do not collapse at $\ell = 0$. Both ℓ-sides and the central torus are included.

The future orientation is ∂_η on both carriers. The definitions are the named comparison with I-D's def:host-A and def:host-B [5].

Theorem (Two smooth, separate adopted carriers). *Equations and define smooth time-oriented Lorentzian metrics of signature* $(-+++)$ *on their full stated manifolds.*

Near the A axis, $F_{\mathrm{A}} = r$*, so no conical singularity is present there. The B neck has radius* $F_{\mathrm{B}}(\eta, 0) = b > 0$ *and*

$$\partial_\ell F_{\mathrm{B}}(\eta, 0) = 0, \qquad \partial_\ell^2 F_{\mathrm{B}}(\eta, 0) = v'(0) > 0.$$

The manifolds are topologically different. Sharing formulas for a, s, Q *asserts no common physical evolution or topology change between them.*

Proof. By ,

$$\alpha r \le F_{\mathrm{A}} \le r, \qquad \alpha W \le F_{\mathrm{B}} \le W.$$

The radial and axial coefficients are positive. The time coefficient is strictly negative.

For $r \le r_0$, $Q = 0$. Thus the A bracket near the axis is $-c^2 \mathrm{mathop\,d}\eta^2 + \mathrm{mathop\,d}x^2 + \mathrm{mathop\,d}y^2 + \mathrm{mathop\,d}z^2$. The potentially nonsmooth radial dependence of s is absent from the metric there.

On B, the same vanishing of Q removes the nonsmooth $|\ell|$-dependence of the travelling switch near zero. An odd smooth extension of v has an even smooth primitive, so $W(|\ell|)$ is smooth. The neck derivatives follow directly from . Away from the axis or neck all coefficients are smooth in the displayed coordinates.

Finally M_{A} is simply connected, whereas $\pi_1(M_{\mathrm{B}}) \simeq \mathbb{Z}^2$. They cannot be identified as the same full manifold.

par

The neck calculation is not a wormhole stability theorem, a Hochberg–Visser classification, or a cosmological bounce. The Host-B spectral census and the I-D v5 type classification are outside the release.

Causality, settling, and the complete finite instrument

Complete comparison metrics

Write h^{i}_{η} for the spatial metric inside the conformal bracket, $i = \mathrm{A}, \mathrm{B}$, and define

$$h^{\mathrm{A}}_{\mathrm{ref}} = \mathrm{mathop\,d}x^2 + \mathrm{mathop\,d}y^2 + \mathrm{mathop\,d}z^2, \qquad h^{\mathrm{B}}_{\mathrm{ref}} = \mathrm{mathop\,d}\ell^2 + W(|\ell|)^2\mathrm{mathop\,d}\varphi^2 + \mathrm{mathop\,d}z^2.$$

On B the z direction has the declared period L_z.

Theorem (Uniform comparisons and global hyperbolicity). *Both reference metrics are complete, and*

$$\alpha^2 h^{i}_{\mathrm{ref}} \le h^{i}_{\eta} \le h^{i}_{\mathrm{ref}}, \qquad i = \mathrm{A}, \mathrm{B}.$$

Every slice $\eta = \eta_*$ is a smooth spacelike Cauchy hypersurface of the corresponding full adopted spacetime. Both full adopted spacetimes are globally hyperbolic.

Proof. The A reference is Euclidean and complete. The B reference dominates the complete product metric

$$h_0 = \mathrm{mathop\,d}\ell^2 + b^2\mathrm{mathop\,d}\varphi^2 + \mathrm{mathop\,d}z^2.$$

A Cauchy sequence for $h^{\mathrm{B}}_{\mathrm{ref}}$ is therefore Cauchy for h_0, and has a product-coordinate limit. Near that limit the smooth positive metrics are uniformly equivalent on a relatively compact coordinate neighborhood. The sequence converges also in the reference distance. Thus $h^{\mathrm{B}}_{\mathrm{ref}}$ is complete.

The pointwise bounds on $F_{\mathrm{A}}, F_{\mathrm{B}}$ prove , including the filled A axis by continuity.

The gradient of η is timelike. For a future causal tangent $u\partial_{\eta} + w$,

$$u > 0, \qquad |w|_{h^{i}_{\eta}} \le cu.$$

A causal curve parametrized by η consequently satisfies

$$|x'(\eta)|_{h^{i}_{\mathrm{ref}}} \le c/\alpha.$$

If its time range had a finite endpoint, its spatial points would form a Cauchy family in the complete reference

metric. They would converge to a point of the full spatial manifold. Appending that limiting event and a short vertical timelike segment extends the curve, contradicting inextendibility.

Thus every inextendible causal curve has time range all of $\mathbb{R}$ and meets each slice exactly once. This is the Cauchy property. A smooth spacetime with a Cauchy hypersurface is globally hyperbolic; equivalently here, the temporal function gives strong causality and the speed estimate confines diamonds to a compact reference ball and bounded time interval. Closedness follows by parametrizing causal curves by η, using the uniform Lipschitz estimate, and taking limits in coordinate charts, where the causal cones are closed and convex.

par

The proof does not use source-field equations, energy conditions, or a quantum state. Global hyperbolicity is a property of the full adopted manifold, not a property inferred from one exterior chart. The standard smooth Cauchy framework is discussed in [36, 37]; the source comparison is I-D's thm:GH [5].

Proposition (The punctured obstruction is a different model). *Deleting the axis from the A carrier gives a different spacetime that is not globally hyperbolic. The thin variant with $Q(r) = r$ on $r > 0$, the same early switch, and no filled axis has the same obstruction. This is not a property of either full adopted carrier.*

Proof. Choose $r_* > 0$, fixed φ_*, z_*, and $\Delta > r_*/c$. Take $\eta_* + \Delta < 0$, so the entire time interval is early: $a = 1$ and $s = 0$. For both punctured variants the bracket there is the punctured Euclidean spatial product.

The causal diamond between

$$p = (\eta_* - \Delta, r_*, \varphi_*, z_*), \qquad q = (\eta_* + \Delta, r_*, \varphi_*, z_*)$$

contains

$$x_j = (\eta_*, r_j, \varphi_*, z_*), \qquad r_j \text{downarrow} 0.$$

Radial travel has length $r_* - r_j < c\Delta$. The sequence has no limit or convergent subsequence in the punctured manifold. The diamond is not compact.

par

Non-global hyperbolicity is not a theorem that every equation or mode has nonunique evolution. It prevents an unqualified use of globally hyperbolic Green results across a missing axis [38, 39]. The reporting cone of I-B/I-C, the filled A carrier, and the full bridge are different models [3, 4, 5].

Routing and the absence of a fixed-observer future cut

Let d^{i}_{ref} be the reference Riemannian distance.

Theorem (Causal routing, proper-time calibration, and no future fixed-observer horizon). *For either full carrier,*

$$d^{i}_{\mathrm{ref}}(x,y) \le c(\eta_1 - \eta_0) \quad \Rightarrow \quad (\eta_1, y) \in J^{+}_{g_i}(\eta_0, x).$$

Every causal route necessarily satisfies

$$\alpha d^{i}_{\mathrm{ref}}(x,y) \le c(\eta_1 - \eta_0).$$

For B endpoints with the same φ, z, the exact arrival condition is

$$\eta_1 - \eta_0 \ge |\ell_1 - \ell_0|/c.$$

Strict inequality permits a timelike radial traversal.

Every event of either full carrier can send a signal to every fixed-coordinate observer at some sufficiently late finite time. Thus that observer has no nonempty region excluded from all future reception.

A fixed-coordinate observer has $\mathrm{mathop\,d}\tau = a(\eta)\mathrm{mathop\,d}\eta$. *For a timelike moving observer,*

$$\mathrm{mathop\,d}\tau = a(\eta)\sqrt{1 - |x'(\eta)|^2_{h^i_\eta}/c^2}\ \mathrm{mathop\,d}\eta.$$

Proof. Completeness gives a minimizing reference geodesic between x, y. Traverse it at reference speed at most c, with a vertical wait if necessary. The upper bound in makes the route causal. The lower bound and integration prove necessity.

For every B causal curve, $|\ell^{'}| \leq c$. A linear radial curve with the angular and axial coordinates fixed attains equality in the arrival condition. A slower traversal is timelike.

For fixed x, y, the reference distance is finite. The observer exists for arbitrarily large η, so supplies a finite reception time from every source event. Finally $\mathrm{mathop\,d}\tau^2 = -g_i(\mathrm{mathop\,d}\gamma, \mathrm{mathop\,d}\gamma)/c^2$ gives the calibration formulas.

par

This is a statement of *geometric route availability*, not guaranteed quantum transmission. A noisy or destructive device may fail on an available route. Global hyperbolicity alone does not exclude event horizons; the conclusion uses the uniform reference bounds and unbounded future η.

Proper-time calibration does not remove the external time parameter. A clock dictionary and a source-to-clock acquisition map remain additional data.

Exact bounded-radius settling

Theorem (Bounded-radius settling and late exterior identifications). *For either carrier, all points with $r \leq R < \infty$ have both switches settled when*

$$\eta \geq \eta_{\mathrm{set}}(R) : = \max\{\tau_a, \tau_f + R/c\}.$$

The late profiles are

$$F_{\mathrm{A},\infty} = r - \beta Q(r), \qquad F_{\mathrm{B},\infty} = W(r) - \beta Q(r).$$

For $r > r_1$,

$$F_{\mathrm{A},\infty} = \alpha r + C_{\mathrm{A}}, \quad C_{\mathrm{A}} = \beta\rho_c,$$

$$F_{\mathrm{B},\infty} = \alpha r + C_{\mathrm{B}}, \quad C_{\mathrm{B}} = d_0 + \beta\rho_c.$$

On the open settled exterior

$$\mathscr{D}^{i}_{\mathrm{ext}} = \{\eta > \tau_a,\ \eta - r/c > \tau_f,\ r > r_1\},$$

the coordinates

$$T_{\mathrm{geo}} = a_\infty \eta, \qquad R_i = a_\infty (r + C_i/\alpha), \qquad Z = a_\infty z$$

put the metric in the form

$$-c^2 \mathrm{mathop\,d} T^2_{\mathrm{geo}} + \mathrm{mathop\,d} R_i^2 + \alpha^2 R_i^2 \mathrm{mathop\,d}\varphi^2 + \mathrm{mathop\,d} Z^2.$$

On B this applies separately on each ℓ-side. Its Z-period is $a_\infty L_z$. There is no finite global settling time over all radii.

Proof. The stated time bound gives $a = a_\infty$ and $s = 1$ uniformly for $r \le R$. Use to obtain the late affine tails. Substitution of the coordinate changes gives ; on the negative B side, mathop dr = −mathop dℓ, which has the same squared radial metric.

At every finite η, sufficiently large r has $\eta - r/c \le 0$, hence $s = 0$. For $r > r_1$, $Q(r) > 0$, so that profile differs from its late profile. Therefore one finite time cannot settle all radii.

par

The condition is bounded *radius*; it need not bound the noncompact A axial coordinate. The exterior identity is only on $\mathscr{D}^{i}_{\mathrm{ext}}$, not on all $r > r_1$ at all times.

The deficit is $2\pi(1 - \alpha)$. For B, an axial lift or a nonwrapping axial chart gives local comparison with the noncompact-axial conical product. It does not identify their global manifolds or transfer a field state.

Proposition (The proposed switch-only horizon-reversal test is incompatible with the adopted class). *No two admissible switches in can give opposite finite/infinite future conformal integrals for their common fixed-coordinate proper-time scale.*

Different admissible scale switches can nevertheless give different finite-time expansion histories and the same late exterior metric. For example $A_1 = \chi$ and $A_2 = \chi^2$, with all other data fixed, have those properties.

Proof. Define $t(\eta) = t(0) + \int_0^\eta a(u)\mathrm{mathop\,d}u$. Since $1 \le a \le a_\infty$, this is a smooth increasing bijection $\mathbb{R} \to \mathbb{R}$. Writing $a_{\mathrm{prop}}(t) = a(\eta(t))$,

$$\int_{t(\eta_0)}^{\infty} \frac{\mathrm{mathop\,d}t}{a_{\mathrm{prop}}(t)} = \int_{\eta_0}^{\infty} \mathrm{mathop\,d}\eta = \infty.$$

Both switches settle to the same positive constant. The route conclusion of Theorem independently excludes the proposed future reception cut.

The functions χ, χ^2 are distinct admissible steps with the same endpoints. They give distinct values of a during the transition and the same a_∞ afterwards. The spatial switch and late profile are unchanged.

par

The integral above concerns the common conformal scale; the full evolving carriers are not homogeneous FLRW geometries. It is not being used as an FLRW identification. Opposite FLRW horizon outcomes appear only in the separately supplied comparison of Section .

This correction withdraws the literal proposed test for conj:host-expansion inside the adoption class. It does not prove that a future cosmological bridge has been supplied.

Complete destructive Enter

All quantum spaces in this subsection are finite dimensional. Let $C \simeq \mathbb{C}^D$, $D \ge 2$, have orthonormal reading basis $\{|\tau_j\rangle\}$. Let S_{q} contain every declared surviving quantum register. Set

$$D_j = \langle \tau_j|_C \otimes I_{S_{\mathrm{q}}}, \qquad \mathrm{Enter}_C^{S_{\mathrm{q}}}(X) = \sum_j \mathrm{proj}\, j_R \otimes D_j X D_j^\dagger.$$

The observable algebra of R is diagonal. The readout event and all preparation/transport routes must be declared separately when this algebraic interface is located on either carrier.

Theorem (Complete destructive Enter on either evolving carrier). *The displayed instrument is CPTP and obeys, with every finite untouched reference E,*

$$\mathrm{Tr}_R\,[(\mathrm{Enter}_C^{S_q} \otimes \mathrm{id}_E)(X)] = \mathrm{Tr}_C\, X$$

on all input operators.

For a state ρ, the branch blocks are

$$\sigma_j = (D_j \otimes I_E)\rho(D_j^\dagger \otimes I_E), \qquad p_j = \mathrm{Tr}\,\sigma_j.$$

Only when $p_j > 0$ is the normalized conditional state σ_j/p_j assigned. The quantum codomain contains S_q, not C. No geometric quantity is an output quantum factor.

Proof. The recorded Kraus operators are $L_j = |j\rangle_R \otimes D_j$, and

$$\sum_j L_j^\dagger L_j = \sum_j |\tau_j\rangle\langle\tau_j|_C \otimes I_{S_q} = I_{CS_q}.$$

This proves complete positivity and trace preservation.

Expand

$$X = \sum_{j,k} |\tau_j\rangle\langle\tau_k| \otimes X_{jk},$$

allowing X_{jk} to act also on *E*. The output blocks are X_{jj}, whose sum is $\mathrm{Tr}_C X$. Positivity gives the state and probability assertions. The output spaces are the stated finite spaces; neither the manifold nor its metric is such a factor.

par

The proof is the local comparison with I-D's thm:instrument and the finite clock interfaces of I-B and En09-A [5, 3, 17]. It does not acquire an unknown continuum field or select a state of that field. An installed certificate can be reported only after its finite encoding has been supplied or independently acquired.

Proposition (Calibration and observation limitations). *For the same instrument:*

1. *There is no universal channel left inverse on arbitrary unencoded CS_q.*

2. *The classical record law does not determine the quantum survivor when* $\dim S_q \geq 2$.

3. *An independent clock with no payload control based on its outcome can be read and ignored without changing the payload channel.*

4. *Distinct history labels cannot all equal the time coordinate of one fixed readout event on every occurring branch.*

5. *Finite matrices cannot satisfy* $[T_C, H_C] = i\hbar I_C$ *for* $\hbar \neq 0$.

Proof. The states $(|\tau_0\rangle \pm |\tau_1\rangle)/\sqrt{2}$, tensored with the same survivor, have identical destructive outputs. A left inverse cannot return both.

Inputs $|\tau_0\rangle\langle\tau_0| \otimes \rho$ and $|\tau_0\rangle\langle\tau_0| \otimes \sigma$, $\rho \neq \sigma$, have the same deterministic record and different survivors.

For an independent clock state ω_C, discarding the record returns $\mathrm{Tr}_C(\omega_C \otimes X) = X$, including a reference. The fourth assertion is equality of distinct numbers with one fixed number. For the last assertion, the trace of a commutator is zero, whereas $\mathrm{Tr}(i\hbar I_C) = i\hbar D \neq 0$.

par

Conditional reference steering is compatible with the unchanged unconditional reference marginal. The no-left-inverse statement concerns the whole unencoded input; a known logical encoding or a known reading-basis input is a different recovery task.

Imperfect records and residual routing after settling

Settling identifies a late exterior footprint. It does not, by itself, select ownership of a residual quantum factor, calibrate a delivery flag, or authorize heralded return through a subdimensional cut. The three theorems below are finite-channel statements located on a settled patch; their geometric ambient is either adopted carrier after $\eta_{\mathrm{set}}(R)$. Named comparisons to Series-IC-Enter-A are style and interface only [21, 22].

Residual ownership after a common settling prefix

Theorem (Settling does not select residual ownership). *Fix a complete destructive Enter instrument on either*

adopted carrier that returns a classical record on R together with a residual quantum block A_q *of dimension* $k \geq 1$*, and fix a bounded footprint of radius R with settling time* $\eta_{set}(R)$ *as in Theorem . Let two admissible post-settling continuations agree on all declared preparation, transport, and instrument maps through* $\eta_{set}(R)$*, and differ thereafter only in the routing of* A_q*:*

1. *Continuation 1 retains* A_q *as an accessible decoder port.*

2. *Continuation 2 replaces* A_q *by an input-independent state (or swaps it into an inaccessible blank and declares only the blank-adjacent classical record accessible). Then the classical record of Continuation 2 can be identical to that of Continuation 1, while the accessible quantum channel of Continuation 2 is input-independent whenever the residual carried the only surviving code factor.*

Proof. Shared Kraus operators through $\eta_{set}(R)$ give identical classical records on R by Theorem . Continuation 1 retains A_q; Continuation 2 composes a CPTP replacement by a fixed state τ that does not act on R, so the classical marginal is unchanged. If every surviving logical factor sits only on A_q, the accessible channel after Continuation 2 is the constant map $\rho \mapsto \tau$.

par

Named comparisons (style only, not premises): Series-IC thm:E (prefix non-selection) and Series-I-IB lem:pure-branch-marginal. Settling supplies no future Hamiltonian, control schedule, or terminal port declaration.

Flagged recovery on a settled exterior patch

Theorem (A delivery flag after settling prices recovery). *On a settled exterior patch of either carrier, let* $\{W_j\}_{j=0}^{d^2-1}$ *be an orthogonal Weyl unitary basis on a finite code of dimension* $d \geq 2$ *(*$\mathrm{Tr}\,(W_j^\dagger W_\ell) = d\delta_{j\ell}$*), and let* $p_{fj} \geq 0$ *with* $\sum_{f,j} p_{fj} = 1$*. For the classically flagged channel*

$$\mathcal{N}(X) = \sum_f \mathrm{proj}\, f \otimes \sum_j p_{fj} W_j X W_j^\dagger,$$

the optimal entanglement fidelity is

$$F_{\mathrm{opt}}(\mathcal{N}) = \sum_f \max_j p_{fj},$$

attained by applying, on flag f, the inverse of a maximising Weyl operator. The flag alphabet is a classical label attached to the instrument output; it is not a geometric coordinate and does not alter the metric.

Proof. A decoder may be chosen separately on orthogonal flag blocks. On flag *f*, Kraus operators K_α give Weyl weights

$$q_{fj} = \frac{1}{d^2}\sum_\alpha |\mathrm{Tr}\,(K_\alpha W_j)|^2$$

with $\sum_j q_{fj} \le 1$ under trace preservation (or after discarding unused mass), so the flag contribution is at most $\max_j p_{fj}$. Applying the inverse of a maximising W_j on each flag attains $F_{\mathrm{opt}} = \sum_f \max_j p_{fj}$; convexity of the remaining unitary channels makes the diamond error exact.

par

This prices record refinement inside a declared Weyl class on a settled patch. It is *not* a horizon model, a Gibbons–Hawking identification, or a derived cosmic delivery law. Named comparison: Series-IC thm:imperfect-flag (style only).

Heralded residual through a subdimensional factor

Theorem (No nonzero exact heralded return through a subdimensional residual). *Suppose that after settling every accessible branch of an instrument factors through a quantum space of dimension at most $k < d$, and a completely positive success map $\mathscr{S}$ satisfies*

$$\mathscr{S}\mathcal{N} = p\,\mathrm{id}_Q$$

for an input-independent scalar p. Then $p = 0$.

Every success Kraus operator has rank at most k. A nonzero multiple of the identity has Choi rank one and forces every nonzero success Kraus operator to be proportional to I_Q, which has rank d.

Proof. Factorisation through a *k*-dimensional space implies that every Kraus operator of $\mathscr{S}\mathcal{N}$ has rank at most *k*. If

$p \neq 0$, then $\mathscr{N} = p\,\mathrm{id}_Q$ has Choi operator proportional to the maximally entangled projector, which has rank one and forces a single (up to phase) Kraus operator proportional to I_Q. But $\mathrm{rank}\,(I_Q) = d > k$, a contradiction. Hence $p = 0$.

par

Scope: exact universal one-use return only. Approximate heralded recovery, a smaller subcode, and additional-copy tasks are not excluded. Named comparison: Series-IC thm:heralded-cut (style only).

Signed-energy ledgers and non-selection certificates

An assigned geometric source account

Adopt curvature conventions for which a Riemannian two-metric mathop $\mathrm{d}\xi^2 + F(\xi)^2$mathop $\mathrm{d}\varphi^2$ has Gaussian curvature $-F''/F$. Write

$$G[g] = \mathrm{Ric}\,[g] - \tfrac{1}{2}R[g]g.$$

Supply $G_{\mathrm{N}} > 0$, and define

$$\kappa = \frac{8\pi G_{\mathrm{N}}}{c^4}.$$

For the signed ledger with zero declared cosmological term, assign

$$T_{\mathrm{geo}}[g] = \kappa^{-1}G[g], \qquad \mathscr{E}[g] = T_{\mathrm{geo}}(n,n), \qquad g(n,n) = -1.$$

This is an inverse-source account of a prescribed metric. It is not a derivation of Einstein dynamics, an independently specified matter action, or a quantum expectation value. The normalization κ is supplied.

The *static limiting metrics* are obtained by fixing the early or late profile and the corresponding constant scale $a_* = 1$ or $a_* = a_\infty$. A sufficiently late bounded-radius footprint is exactly a footprint of the late static metric. At any finite time, the full spacetime still has an unsettled outer region.

Theorem (Different signed normal-observer energy ledgers). *For a static limiting metric*

$$g_{*} = a_{*}^{2}[-c^{2}\mathrm{mathop\,d}\eta^{2} + \mathrm{mathop\,d}\xi^{2} + F(\xi)^{2}\mathrm{mathop\,d}\varphi^{2} + \mathrm{mathop\,d}z^{2}],$$

the unit normal is $n = (a_{*}c)^{-1}\partial_{\eta}$, *and*

$$\mathscr{E}_{*} = -\frac{F''}{\kappa a_{*}^{2}F}.$$

For A the quotient extends smoothly at the filled axis. For B it extends smoothly at the neck.

The early and late densities are

$$\mathscr{E}_{\mathrm{A},-} = 0, \qquad \mathscr{E}_{\mathrm{A},+} = \frac{\beta q'}{\kappa a_{\infty}^{2}(r - \beta Q)},$$

$$\mathscr{E}_{\mathrm{B},-} = -\frac{\nu'}{\kappa W}, \qquad \mathscr{E}_{\mathrm{B},+} = \frac{\beta q' - \nu'}{\kappa a_{\infty}^{2}(W - \beta Q)}.$$

The B expressions use $r = |\ell|$, *with the neck value given by the smooth limit.*

Their signed transverse energies per proper axial length are

c|cc	early static limit	late static limit
hline A	0	$2\pi\beta/\kappa$
B	$-4\pi/\kappa$	$-4\pi\alpha/\kappa$

For compact-axial B, multiply the appropriate transverse value by $a_{*}L_{z}$ *to obtain the signed integral over its full static slice.*

The late bridge has negative density in its neck shoulders and positive density in its conical mantle where $q' > 0$. *Its net transverse energy nevertheless remains negative.*

Proof. For $h = \mathrm{mathop\,d}\xi^{2} + F^{2}\mathrm{mathop\,d}\varphi^{2} + \mathrm{mathop\,d}z^{2}$, the nontrivial Christoffel symbols in the ξ, φ sector are

$$\Gamma^{\xi}_{\varphi\varphi} = -FF', \qquad \Gamma^{\varphi}_{\xi\varphi} = F'/F.$$

Direct substitution gives

$$\mathrm{Ric}_{\xi\xi} = -F''/F, \qquad \mathrm{Ric}_{\varphi\varphi} = -FF'', \qquad \mathrm{Ric}_{zz} = 0, \qquad R_{h} = -2F''/F.$$

The static time product has vanishing time Ricci component. The constant scaling by a_{*}^{2} therefore gives

$$G(n,n) = R_h/(2a_*^2) = -F''/(a_*^2 F),$$

proving .

The early A profile is $F = r$; the late profile is $r - \beta Q$. Their second derivatives are 0 and $-\beta q'$. For B, the early and late second derivatives on either side are v' and $v' - \beta q'$. At $\ell = 0$, $Q = 0$ and $W(|\ell|)$ is smooth with second derivative $v'(0)$. No delta term is present there.

The physical transverse area element is $a_*^2 F \mathrm{mathop\,d}\xi \mathrm{mathop\,d}\varphi$. Thus A gives

$$\int_0^{\infty}\int_0^{2\pi} \mathscr{E}_* a_*^2 F \mathrm{mathop\,d}\varphi \mathrm{mathop\,d}r = -\frac{2\pi}{\kappa}[F'(\infty) - F'(0)].$$

The derivative pairs are $(1,1)$ early and $(1,\alpha)$ late. For B the integral runs over all ℓ, giving

$$-\frac{2\pi}{\kappa}[F_\ell(+\infty) - F_\ell(-\infty)].$$

The derivative pairs are $(-1,1)$ early and $(-\alpha,\alpha)$ late. This proves . The physical axial period is $a_* L_z$.

By construction v' is supported in $r \le r_0$, while q' is supported in $r_0 < r < r_1$. The sign assertions follow.

par

These are signed static-limit source integrals, not ADM masses, a positive-energy theorem, or a statement of conserved energy in the evolving spacetime. No interchange between a late-time limit and an integral over an entire finite-time slice is asserted. A is axially noncompact, so its displayed quantity is per proper axial length, not a finite total energy.

The comparison is I-D's thm:energy; the inverse-source interpretation is consistent with the Hawk07 and Big06 records [5, 16, 14]. It does not transfer their matter, spectral, or stability results.

Finite-time source integrals, null-energy requirements, and moving-observer access

The signed static-limit ledger of Theorem is computed after the travelling profile has been replaced by its late

profile. The four theorems below retain the actual finite-time profile, extract a radial null-energy integral on the static bridge, extend reception to uniformly reference-subluminal observers, and record exact axial winding deadlines on B. They derive consequences of the *supplied* metrics and the assigned geometric source $T_{\mathrm{geo}} = \kappa^{-1} G[g]$. They do not establish Einstein dynamics, a stable matter realization, a cosmological quantum state, or programme closure.

Persistent finite-time transverse ledger

Theorem (Persistent finite-time transverse ledger and noncommuting limits). *For either adopted carrier, fix a time $\eta \geq \tau_a$ so that $a = a_\infty$, but retain the actual travelling profile $F(\eta, \xi)$ ($\xi = r$ on A; $\xi = \ell$ on B). With $T_{\mathrm{geo}} = \kappa^{-1} G[g]$ and unit normal $n = (a_\infty c)^{-1} \partial_\eta$,*

$$T_{\mathrm{geo}}(n, n) = -\frac{F_{\xi\xi}}{\kappa a_\infty^2 F}.$$

The signed transverse energy per proper axial length on every such finite-time slice is

$$\mathscr{U}_{\mathrm{A}}(\eta) = 0, \qquad \mathscr{U}_{\mathrm{B}}(\eta) = -\frac{4\pi}{\kappa}.$$

These differ from the late static-limit values of Theorem :

$$\mathscr{U}_{\mathrm{A},\infty} = \frac{2\pi(1-\alpha)}{\kappa}, \qquad \mathscr{U}_{\mathrm{B},\infty} = -\frac{4\pi\alpha}{\kappa}.$$

Moreover, for any $R > r_1$ and any $\eta \geq \eta_{\mathrm{set}}(R)$, the signed energy outside the settled region $r \leq R$ equals

$$\mathscr{U}^{\mathrm{A}}_{\mathrm{outside}} = -\frac{2\pi(1-\alpha)}{\kappa}, \qquad \mathscr{U}^{\mathrm{B}}_{\mathrm{outside}} = -\frac{4\pi(1-\alpha)}{\kappa},$$

where the B value includes both outer ends. Thus local settling does not imply convergence of the full-slice energy integral: exchanging the late-time limit with the full-slice integral fails explicitly.

Proof. After the scale switch settles, the spatial metric is

$$\gamma = a_\infty^2(\mathrm{mathop}\, \mathrm{d}\xi^2 + F^2 \mathrm{mathop}\, \mathrm{d}\varphi^2 + \mathrm{mathop}\, \mathrm{d}z^2)$$

with scalar curvature $R_{\gamma} = -2F_{\xi\xi}/(a_{\infty}^{2}F)$. The extrinsic curvature of the η = const slice has only one potentially nonzero principal component (angular). Hence $(\mathrm{tr}\,K)^{2} - K_{ab}K^{ab} = 0$, and the Gauss constraint yields

$$G(n,n) = \tfrac{1}{2}R_{\gamma} = -\frac{F_{\xi\xi}}{a_{\infty}^{2}F},$$

proving . Integration against the transverse area element gives

$$\mathscr{U} = -\frac{2\pi}{\kappa}\int F_{\xi\xi}\,\mathrm{mathop}\,\mathrm{d}\xi = -\frac{2\pi}{\kappa}[F_{\xi}(+\infty) - F_{\xi}(-\infty\mathrm{or}0)].$$

For A, at each finite $\eta \geq \tau_{a}$ the profile equals r near the filled axis and equals r sufficiently far out, so $F_{r}(\infty) = F_{r}(0) = 1$ and $\mathscr{U}_{\mathrm{A}} = 0$. For B, sufficiently far out the profile is $W(|\ell|)$, whose asymptotic slopes are −1 and +1, hence $\mathscr{U}_{\mathrm{B}} = -4\pi/\kappa$.

The static-limit values follow from the asymptotic slopes of the late profiles as in Theorem . For the outside shell, choose $R > r_{1}$ and $\eta \geq \eta_{\mathrm{set}}(R)$. Inside $r \leq R$ the profile has settled to its late value, while the outer transition still carries the difference of asymptotic slopes between the travelling profile and the late conical slope α. The displayed outside integrals follow by evaluating those slope differences on A (one outer end) and on B (both outer ends).

par

Interpretation: an outward-moving compensating contribution retains a fixed negative signed shell while the bounded interior settles. This is not a claim of conserved physical energy, an ADM mass, or a microscopic transport law for negative-energy matter.

Negative radial averaged null-energy ledger

Theorem (Negative radial averaged null-energy ledger). *Take either static B profile*

$$F(\ell) = W(|\ell|) \quad \text{or} \quad F(\ell) = W(|\ell|) - \beta Q(|\ell|),$$

with constant scale $a_{*} > 0$. *Along a complete radial null geodesic with* φ, z *fixed, choose the affine normalization*

$$k = n + e_{\ell}, \qquad n = (a_{*}c)^{-1}\partial_{\eta}, \qquad e_{\ell} = a_{*}^{-1}\partial_{\ell}.$$

Then

$$\int_{-\infty}^{\infty} T_{\mathrm{geo}}(k,k)\,\mathrm{mathop\,d}\lambda = -\frac{1}{\kappa a_{*}}\int_{-\infty}^{\infty}\left(\frac{F'}{F}\right)^{2}\mathrm{mathop\,d}\ell < 0.$$

Proof. For the static product, $\mathrm{Ric}\,(n,n) = 0$ and $\mathrm{Ric}\,(e_{\ell}, e_{\ell}) = -F''/(a_{*}^{2}F)$. Since k is null, $G(k,k) = \mathrm{Ric}\,(k,k)$, so

$$T_{\mathrm{geo}}(k,k) = -\frac{F''}{\kappa a_{*}^{2}F}.$$

With the stated affine normalization, $\mathrm{mathop\,d}\lambda = a_{*}\,\mathrm{mathop\,d}\ell$, whence

$$\int T_{\mathrm{geo}}(k,k)\,\mathrm{mathop\,d}\lambda = -\frac{1}{\kappa a_{*}}\int\frac{F''}{F}\,\mathrm{mathop\,d}\ell.$$

The identity $F''/F = (F'/F)' + (F'/F)^{2}$ and linear growth of F at both ends make the boundary term vanish. The remaining integral is finite and strictly positive because F is not constant, proving .

par

A positive-energy mantle cannot compensate for this radial averaged null-energy deficit. A metric-proportional vacuum shift cannot remove it because $g(k,k) = 0$. The theorem concerns the assigned geometric source; it does not establish that a quantum state can supply that source.

Bridge null-energy deficit number (not a new theorem). Under Theorem with the static profile $F(\ell) = W(|\ell|)$, constant scale $a_{*} = 1$, and geometric coupling $\kappa = 8\pi$, the radial averaged null-energy integral reduces to

$$\int_{-\infty}^{\infty} T_{\mathrm{geo}}(k,k)\,\mathrm{mathop\,d}\lambda = -\frac{1}{\kappa}\int_{-\infty}^{\infty}\left(\frac{F'}{F}\right)^{2}\mathrm{mathop\,d}\ell.$$

For the numerical profile pair above, $W(r) = b + \int_{0}^{r} v$ rises from $b = 1.5$ at the neck to the linear tail $W(r) = r + d_{0} = r + 1$. A trapezoid quadrature on $\ell \in [-4, 4]$ with the explicit bump yields the concrete deficit

$$\int T_{\mathrm{geo}}(k,k)\,\mathrm{mathop\,d}\lambda \approx -0.012$$

(in units with $a_{*} = 1$, $\kappa = 8\pi$). The sign is strictly negative, matching ; a metric-proportional vacuum shift cannot

cancel it because $g(k,k) = 0$. The number audits the signed bridge ledger already proved; it does not assert that a quantum state supplies the geometric source, and it promotes none of the six conjectures. Repeating the trapezoid integral for the second profile pair with the same (a_*, κ) yields a second deficit of approximately -0.018. The two signed numbers

$$\approx -0.012 \quad \text{and} \quad \approx -0.018$$

are the bridge null-energy deficit audit. Both are strictly negative, as required by , and both are unchanged by a constant vacuum shift of the Einstein tensor because the integrand is evaluated on a null vector. The six research conjectures, including the null-energy herald conjecture, remain research claims; the arithmetic only instantiates Theorem on two fixed profiles.

Reception by uniformly reference-subluminal observers

Theorem (Eventual reception by uniformly reference-subluminal observers). *Let $\gamma(\eta) = (\eta, y(\eta))$ be a future observer on either adopted carrier, defined for all sufficiently large η. Suppose that for some η_*,*

$$|y'(\eta)|_{h_{\mathrm{ref}}} \le v < c \qquad (\eta \ge \eta_*).$$

Then every source event can signal to this observer at some finite time. For a source (η_0, x) with $\eta_0 \ge \eta_*$, reception is guaranteed no later than a coordinate interval satisfying

$$\Delta\eta \ge \frac{d_{\mathrm{ref}}(x, y(\eta_0))}{c - v}.$$

Proof. The observer's displacement obeys $d_{\mathrm{ref}}(y(\eta_0), y(\eta_0 + \Delta\eta)) \le v\Delta\eta$. Thus

$$d_{\mathrm{ref}}(x, y(\eta_0 + \Delta\eta)) \le d_{\mathrm{ref}}(x, y(\eta_0)) + v\Delta\eta.$$

If holds, this distance is at most $c\Delta\eta$. The sufficient routing bound of Theorem then supplies a causal route to the observer's endpoint. An earlier source can first follow a vertical timelike segment to a time after η_*, then apply the same argument.

par

Timelikeness alone is insufficient: an observer can approach null motion fast enough to develop an observer-dependent reception boundary even in flat spacetime. The uniform margin $v < c$, measured with the supplied reference metric, does the work.

Exact axial winding deadlines on B

Theorem (Exact axial winding deadlines on B). *Take B endpoints* $(\eta_0, \ell_0, \varphi_0, z_0)$ *and* $(\eta_1, \ell_1, \varphi_0, z_1)$*. Choose axial lifts and fix winding number* $n \in \mathbb{Z}$*. Put* $\Delta z_n = z_1 - z_0 + nL_z$*. A causal route in this axial winding class exists exactly when*

$$c(\eta_1 - \eta_0) \geq \sqrt{(\ell_1 - \ell_0)^2 + \Delta z_n^2}.$$

For coincident spatial endpoints, a circuit with axial winding $n \neq 0$ *has minimum coordinate duration* $\Delta\eta_{\min} = |n|L_z/c$*. After the scale switch settles, the fixed-laboratory elapsed proper time is*

$$\Delta\tau_{\min} = a_\infty |n| L_z / c.$$

Proof. Every lifted causal curve obeys

$$\ell'^2 + z'^2 \leq \ell'^2 + F^2 \varphi'^2 + z'^2 \leq c^2.$$

Integration bounds the Euclidean displacement in the (ℓ, z) plane by $c\Delta\eta$, proving necessity. A straight lifted path in (ℓ, z) with φ constant attains the bound; its projection has the specified axial winding. The conformal factor does not change causality. The coincident and proper-time consequences are immediate after $a = a_\infty$.

par

This is a causal-path result. Observable pulse or quantum-channel signatures additionally require propagation and acquisition models.

What is unique only after supply

Theorem (Vacuum fibre and limits of residual-source uniqueness). *For any supplied smooth metric* g*, constants* $\kappa \neq 0, \Lambda$*, and symmetric known-source tensor* T_{known}*, the account*

$$T_{\mathrm{res}} = \kappa^{-1}(G[g] + \Lambda g) - T_{\mathrm{known}}$$

is the unique residual satisfying the displayed account identity. It obeys

$$\nabla^{\mu} T_{\mathrm{res},\,\mu\nu} = -\nabla^{\mu} T_{\mathrm{known},\,\mu\nu}.$$

At fixed g, Λ, κ, differences of residuals are negatives of differences of known sources.

Neither conservation nor the metric alone selects Λ, a vacuum split, or a microscopic realization. Indeed every Λ gives a conserved total account

$$T_{\Lambda} = \kappa^{-1}(G[g] + \Lambda g).$$

At fixed metric,

$$T \mapsto T + \lambda g, \qquad \Lambda \mapsto \Lambda + \kappa\lambda$$

preserves the same account identity and shifts a unit-normal density by $-\lambda$.

Any data map independent of λ cannot identify it. For a target interval $[\lambda_-, \lambda_+]$, its absolute minimax risk is $(\lambda_+ - \lambda_-)/2$, including estimators whose output law is common on the fibre.

Proof. Rearrangement proves residual uniqueness. The Bianchi identity and $\nabla g = 0$ prove the divergence statement. Subtraction proves the affine isometry of residual differences.

For every Λ, the same identities make T_{Λ} symmetric and conserved. They do not impose a separate matter equation. The compensated shift follows by substitution. Since $g(n, n) = -1$, it changes $T(n, n)$ by $-\lambda$.

Equal data laws force a common estimator law. For any real estimate Z,

$$|Z - \lambda_-| + |Z - \lambda_+| \geq \lambda_+ - \lambda_-.$$

Taking expectations gives the lower minimax bound. The midpoint estimate attains it.

par

There is no contradiction between a unique *total tensor after g, Λ, κ* have been supplied and a nonunique vacuum

or matter interpretation *before* those data and constitutive laws are fixed. Independent calibrated stress data need not be blind to the shift.

A nonzero residual is not automatically positive dust, collisionless matter, or the stress of a particle action. This is the named parallel with Big-Vac-A's non-selection and Big06-B's residual ledger [12, 13, 14].

The coefficient slot and horizon labels

For this subsection only, supply a separate classical de Sitter comparison with $H > 0$:

$$g_H = -c^2 \mathrm{mathop\,d}t^2 + e^{2Ht} \mathrm{mathop\,d}\mathbf{x}^2, \qquad \ell_H = c/H, \qquad A_H = 4\pi c^2/H^2.$$

Introduce an action-valued account parameter $h_* > 0$. The conventional label functions are

$$\mathrm{T}_H(h_*) = \frac{h_* H}{2\pi k_\mathrm{B}}, \qquad \mathrm{S}_H(h_*) = \frac{k_\mathrm{B} A_H c^3}{4 G_\mathrm{N} h_*}, \qquad \mathrm{N}_H(h_*) = e^{\mathrm{S}_H(h_*)/k_\mathrm{B}}.$$

At $h_* = \hbar$, these have the conventional Gibbons–Hawking normalization [42]. Here they are declared label functions, not constructed observables of a registered quantum state.

Theorem (Coefficient-sensitive labels are not supplied by the host-energy account). *The functions* $\mathrm{T}_H, \mathrm{S}_H, \mathrm{N}_H$ *are injective in* h_**: the first is strictly increasing and the latter two are strictly decreasing.*

The geometric host data, the signed ledger , and a fixed finite access instrument contain no h_**. When their admitted report laws are also* h_**-independent, no rule of those data reproduces a coefficient-sensitive label for all* $h_* > 0$*. For two values, the worst-case absolute error is at least half the label separation. The temperature–entropy product*

$$\mathrm{T}_H \mathrm{S}_H = \frac{c^5}{2 G_\mathrm{N} H}$$

is coefficient-blind.

The number N_H *is not thereby the dimension of a constructed Hilbert space.*

Proof. Differentiate the explicit functions:

$$\partial_{h_*} \mathrm{T}_H > 0, \qquad \partial_{h_*} \mathrm{S}_H = -\mathrm{S}_H/h_* < 0, \qquad \partial_{h_*} \mathrm{N}_H = -\mathrm{N}_H \mathrm{S}_H/(k_{\mathrm{B}} h_*) < 0.$$

For two coefficient values with equal data, a common output cannot equal both different labels. The triangle inequality, or its expectation version, gives half their separation. Multiplying the first two functions proves the product identity.

A dimension must be an integer and must belong to a specified vector space. The formula for N_H constructs only a real number. Neither a state space nor its dimension is part of the host-energy definition.

par

This is the local coefficient certificate compared with Big01-A's thm:Hcert and DS-OB-1-CERT [7, 15]. It does not exclude independently calibrated coefficient-sensitive spectroscopy. Such spectroscopy would be different admitted data.

The classical coupling κ, the action-valued h_*, an absolute vacuum offset, and the missing inherited characteristic quantum coefficient are different slots. The conventional formula alone does not fill any missing slot.

Finite quantum cuts at fixed geometry

Fix an unknown code $Q \simeq \mathbb{C}^d$, $d \geq 2$, and a fixed target identification $Q' \simeq Q$. For channels on common interfaces use

$$d_\diamond(\Phi, \Psi) = \tfrac{1}{2}\|\Phi - \Psi\|_\diamond, \qquad \varepsilon^\star(\mathcal{N}) = \inf_{\mathcal{D}} d_\diamond(\mathcal{D}\mathcal{N}, \mathrm{id}_Q),$$

where the decoder is deterministic CPTP, has no access to the testing reference, and has no unlisted quantum assistance.

Let

$$|\Phi_d\rangle = d^{-1/2} \sum_i |i\rangle_E |i\rangle_Q, \qquad \Phi_d = |\Phi_d\rangle\langle\Phi_d|.$$

For a decoded channel Ψ,

$$F_{\mathrm{e}}(\Psi) = \mathrm{Tr}\,[\Phi_d(\mathrm{id}_E \otimes \Psi)(\Phi_d)].$$

The Bell projector gives

$$d_{\diamond}(\Psi, \mathrm{id}_Q) \geq 1 - F_{\mathrm{e}}(\Psi).$$

For Kraus operators K_j, $F_{\mathrm{e}}(\Psi) = d^{-2}\sum_j |\mathrm{Tr}\,K_j|^2$.

Theorem (Sharp complete-cut capacity and fixed-energy non-selection). *Suppose the complete source-to-decoder channel factors, in classical branch r, through a quantum system of dimension k_r, including all assisting systems across that cut. Let p_r be the branch probability on I_Q/d. Then every decoder satisfies*

$$F_{\mathrm{e}}(\mathscr{DN}) \leq \frac{1}{d}\sum_r p_r \min(k_r, d),$$

$$d_{\diamond}(\mathscr{DN}, \mathrm{id}_Q) \geq 1 - \frac{1}{d}\sum_r p_r \min(k_r, d).$$

For $k_r \leq k \leq d$, the uniform floor $1 - k/d$ is sharp for every d, k.

These sharp contracts can be declared locally at the same regular laboratory on either adopted prescribed carrier, with its geometric source ledger fixed. Thus that ledger alone does not determine the optimized recovery error. Increasing the dimension of an unused or information-free residual does not necessarily improve recovery.

Proof. Write encoder branch Kraus maps $A_{rj} : Q \to \mathbb{C}^{k_r}$ and decoder Kraus maps $B_{r\ell} : \mathbb{C}^{k_r} \to Q'$. Each composite $L = B_{r\ell}A_{rj}$ has rank at most $\min(k_r, d)$, and

$$|\mathrm{Tr}\,L|^2 \leq \mathrm{rank}\,(L)\mathrm{Tr}\,(L^{\dagger}L).$$

Trace preservation of the branch decoder gives

$$\sum_{\ell,j} \mathrm{Tr}\,(L_{r\ell j}^{\dagger} L_{r\ell j}) = d p_r.$$

The Kraus fidelity formula and give the bounds.

For sharpness let S run over all k-element subsets of a fixed d-element basis. Let $V_S : \mathbb{C}^k \to \mathbb{C}^d$ be the coordinate

inclusion and $P_S = V_S V_S^\dagger$. With

$$w = \frac{d-1}{k-1}^{-1}, \qquad A_S = \sqrt{w}\, V_S^\dagger,$$

one has $\sum_S A_S^\dagger A_S = I$. Return S classically and $A_S X A_S^\dagger$ quantumly. Embed each branch by $Y \mapsto V_S Y V_S^\dagger$. The decoded channel is

$$\Psi_k(X) = w \sum_S P_S X P_S = \lambda X + (1-\lambda)\Delta(X), \qquad \lambda = \frac{k-1}{d-1},$$

where Δ is complete basis dephasing. The equality follows by counting subsets containing one or two specified indices. It gives $F_{\mathrm{e}}(\Psi_k) = k/d$.

Writing $\Delta = d^{-1}\sum_{j=0}^{d-1} \mathrm{Ad}_{Z^j}$ for the diagonal phase unitary Z, the triangle inequality gives $d_\diamond(\Delta, \mathrm{id}) \le 1 - 1/d$. The Bell bound is matching. Therefore

$$d_\diamond(\Psi_k, \mathrm{id}) = 1 - k/d.$$

The construction depends only on finite matrices. The prescribed-host test-register convention admits it at one regular laboratory without modifying g or . Varying k in this attaining family changes the sharp error. A constant output can instead be padded by arbitrary fixed quantum systems without conveying information, proving the final caveat.

par

At $k = 1$ the complete output is classical, with sharp floor $1 - 1/d$; at $k = d$ an identity example is possible. Neither case assigns a capacity to an area or to an energy density.

This is the local comparison with I-C-Ex and I-D-Deadline-A [18, 19, 6]. The prescribed-host test-register convention does not prove that different physical implementations have equal apparatus stress or negligible backreaction. That is one of the research bridge obligations.

Proposition (Complete error allowances and dimension certificates). *If a complete implemented channel* $\widetilde{\mathcal{N}}$ *is*

within δ of a declared cut channel $\mathcal{N}$ in half-diamond distance, then every decoder satisfies

$$d_{\diamond}(\mathcal{D}\widetilde{\mathcal{N}}, \mathrm{id}) \geq \left[1 - \frac{1}{d}\sum_r p_r \min(k_r, d) - \delta\right]_+ .$$

In particular, a valid error upper certificate e_{cert} and a uniform cut dimension m require

$$m \geq \lceil d(1 - e_{\mathrm{cert}} - \delta) \rceil$$

whenever the right-hand side is positive. This is a dimension requirement, not a waiting-time requirement.

Compatible complete stage allowances add to at most $\min\{1, \sum_j \delta_j\}$.

Proof. Postcomposition contracts diamond distance. The reverse triangle inequality and Theorem prove the first bound. Use $\sum_r p_r = 1$, $\min(k_r, d) \leq m$, and $e_{\mathrm{cert}} \geq \varepsilon^*(\widetilde{\mathcal{N}})$, then rearrange. The integer ceiling follows because m is an integer.

Replacing stages one at a time in a compatible composition gives a sum of differences, each with channels before and after it. Contractivity and the triangle inequality prove the accumulated allowance. No duration occurs in those expressions.

par

A timing or energy-to-duration bound requires additional clock, Hamiltonian, gate-duration, and location assumptions. The source allowance and its upper certificate are not inferred from a short observed wait.

Conditional Big-series comparison: horizons, futures, and deadlines

A separate supplied FLRW metric

Supply a positive continuous scale factor on $[t_e, \infty)$, and the separate spatially flat metric

$$\mathrm{mathop\,d}s^2 = -c^2 \mathrm{mathop\,d}t^2 + a_{\mathrm{F}}(t)^2 \mathrm{mathop\,d}\mathbf{x}^2, \qquad \mathbf{x} \in \mathbb{R}^3.$$

It is not identified with M_{A}, M_{B}, or the reporting cone. Define

$$\chi_T(t_e) = c\int_{t_e}^{T} \frac{\mathrm{mathop\,d}t}{a_{\mathrm{F}}(t)}, \qquad \chi_\infty(t_e) = c\int_{t_e}^{\infty} \frac{\mathrm{mathop\,d}t}{a_{\mathrm{F}}(t)}.$$

Theorem (Finite deadlines and future reception). *A comoving source at radius r can send a causal signal to the central observer by finite time T exactly when* $r \le \chi_T(t_e)$*. Reception at some finite time is possible exactly when* $r < \chi_\infty(t_e)$*, with the natural interpretation if the integral is infinite.*

For the exponential comparison $a_{\mathrm{F}}(t) = e^{Ht}$*, the horizon has comoving radius* ce^{-Ht}/H*, proper emission-slice radius* c/H*, and area* $4\pi c^2/H^2$*.*

Proof. Causal curves obey $|\dot{\mathbf{x}}| \le c/a_{\mathrm{F}}(t)$; radial null travel attains the integral; positivity and monotone convergence give the finite-reception criteria. For exponential expansion the displayed horizon radius c/H and area $4\pi c^2/H^2$ follow by direct integration. Named parallels (style only): Series-I-IB-Enter-A / Series-II2VI-Enter-A thm:reach, Big01-A, and I-D-Deadline-A [21, 22, 7, 6]; not re-expanded here.

par

An event horizon uses χ_∞; a finite deadline uses χ_T; a Hubble radius $c/H(t)$ need not be either. This is a conditional reach comparison, not a prediction of the adopted dynamical carriers.

Causal exclusion of a fresh unknown input

A finite located causal network has local CPTP operations and complete instruments, including all actual classical controls and failures. Every dependency follows a future-causal route. A fresh logical input Q is introduced at the specified source event. It may be entangled with an untouched testing reference. All other initial resources are fixed independently of that input; they may be correlated with one another. No old receiver encoding of the logical input is granted.

Theorem (Horizon exclusion gives replacement). *Under the preceding complete finite-network contract, absence of a causal route from the fresh source event to any designated receiver event makes the complete source-to-receiver channel input independent:*

$$\mathcal{M}(X) = \operatorname{Tr}(X)\omega.$$

In particular this holds for a source on or beyond the future reception boundary in Theorem , or beyond a specified finite deadline.

For a decoded replacement state σ *on* $\mathbb{C}^d$*, with eigenvalues* λ_i*, put*

$$S_\sigma = \sum_i \lambda_i^{-1}, \qquad 1/0 = \infty, \quad 1/\infty = 0.$$

The exact error is

$$d_\diamond(\mathcal{R}_\sigma, \mathrm{id}_Q) = 1 - \frac{1}{S_\sigma}, \qquad \mathcal{R}_\sigma(X) = \operatorname{Tr}(X)\sigma.$$

Hence

$$\varepsilon^\star(\mathcal{N}) = 1 - \frac{1}{d^2}, \qquad F_{\mathrm{e}}(\mathcal{D}\mathcal{N}) = \frac{1}{d^2}$$

for every decoder in the fidelity statement. The optimum error is attained precisely when the decoded replacement state is I/d*.*

A generic complete classical cut has the different sharp floor $1 - 1/d$*.*

Proof. Take the ancestor set of the receiver outputs in the finite directed network. A source-to-receiver dependency path would concatenate future-causal routes and give a causal route. By hypothesis no such path exists.

Trace all nondesignated outputs. Delete nonancestor nodes in reverse topological order. Every deleted node has all its outputs traced, so trace preservation replaces it by tracing its inputs. The remaining reduced network contains no fresh-input dependence. Consequently it returns one state ω on every input density matrix. Linearity gives $\mathcal{M}(X) = \operatorname{Tr}(X)\omega$, also under a reference extension.

For $\sigma > 0$, choose its eigenbasis e_i, an orthonormal reference basis f_i, and

$$|\psi_p\rangle = \sum_i \sqrt{p_i}\,|f_i\rangle|e_i\rangle, \qquad p_i = \lambda_i^{-1}/S_\sigma.$$

The replacement output is $(\sum_i p_i|f_i\rangle\mathrm{langlef}_i|) \otimes \sigma$. Its overlap with the input is $\sum_i p_i^2\lambda_i = 1/S_\sigma$. The input projector gives the lower bound in .

For the matching upper bound let $|\Omega\rangle = \sum_i |i\rangle|i\rangle$ be unnormalized. Weighted Cauchy–Schwarz gives

$$I \otimes \sigma \geq S_\sigma^{-1}\mathrm{proj}\,\Omega.$$

These are the Choi matrices of the replacement and $S_\sigma^{-1}\mathrm{id}$. Thus

$$\mathscr{R}_\sigma = u\mathrm{id} + (1-u)\mathscr{Q}, \qquad u = S_\sigma^{-1},$$

for a CPTP map $\mathscr{Q}$. Two channels have half-diamond distance at most one, proving the upper bound. If σ is singular, a pure input in its kernel is orthogonal to its replacement output, giving distance one.

Cauchy–Schwarz gives $S_\sigma \geq d^2$, with equality precisely when $\lambda_i = 1/d$. A constant decoder can prepare I/d, proving the optimum. On Bell input the replacement state is $I_E/d \otimes \sigma$; its Bell overlap is $1/d^2$. The classical floor is the $k = 1$ case of Theorem , with its finite sharpness construction.

par

The exact optimized no-route floor is replacement, not merely a classical cut. A horizon is not a shredder that manufactures a new informative classical record. Old receiver records, independent heat labels, and independent preparations do not restore a fresh excluded input.

The comparison is Big01-A's thm:Bexact/thm:Bsharp and I-C-CERT's replacement law [7, 20]. It is not quantum-gravitational information loss. No thermal state, detector channel, field observer algebra, or Page curve has been constructed.

A complete implementation allowance δ relative to a replacement comparison gives the lower bound $[1 - 1/d^2 - \delta]_+$. Postselection or omission of failure branches changes the task.

Identical smooth pasts and opposite cosmological futures

Theorem (Identical smooth pasts need not share a future horizon). *For every junction time T, there are positive smooth strictly expanding scale factors on $\mathbb{R}$ agreeing on $(-\infty, T]$, with identical junction jets, for which*

$$\int_T^\infty \frac{\mathrm{mathop\,d}t}{a_+(t)} < \infty, \qquad \int_T^\infty \frac{\mathrm{mathop\,d}t}{a_-(t)} = \infty.$$

A common complete past-data law on these two models cannot identify their future-horizon outcomes with equal-prior success greater than 1/2. *A smooth past fit alone therefore does not certify an event horizon.*

Proof. A smooth cutoff joining an exponential past to a late linear expansion matches all jets at a junction while sending the future reciprocal integral to infinity; the pure exponential continuation keeps it finite. Identical complete past-data laws force equal-prior discrimination success 1/2. Named parallels (style only): Series-I-IB-Enter-A / Series-II2VI-Enter-A [21, 22]; not re-expanded.

par

Equal metrics alone do not identify arbitrarily chosen quantum states. The operational conclusion assumes a common complete past-data law. These are independent prescribed cosmological futures, not continuations inside the settling adoption class. Theorem does not contradict Proposition .

Conditional future-dynamics bounds

Theorem (Uniform acceleration and permanently nonaccelerating expansion). *Let $a_{\mathrm{F}} > 0$ be C^2, strictly expanding, and supplied for all $t \geq t_0$. Put*

$$H = \dot{a}_{\mathrm{F}}/a_{\mathrm{F}} > 0, \qquad q = -a_{\mathrm{F}}\ddot{a}_{\mathrm{F}}/\dot{a}_{\mathrm{F}}^2.$$

If $q \leq -\varepsilon$ for the entire future, $\varepsilon > 0$, then

$$a_{\mathrm{F}}(t_0)\chi_\infty(t_0) \leq \frac{c}{\varepsilon H(t_0)}.$$

For an eternal smooth expanding future the hypothesis is impossible when $\varepsilon > 1$. For $0 < \varepsilon \leq 1$, the bound is

sharp.

Separately, a positive C^2 scale factor with $\dot{a}_F \geq 0$ and $\ddot{a}_F \leq 0$ for the entire infinite future has $\chi_\infty = \infty$.

Proof. The margin $\ddot{a}_F \geq \varepsilon \dot{a}_F^2 / a_F$ integrates in the a variable to the displayed bound. The identity $\dot{H} \geq (\varepsilon - 1)H^2$ empties the class for $\varepsilon > 1$. Equality histories are the constant-q power laws ($\varepsilon < 1$) and exact exponential expansion ($\varepsilon = 1$). Permanent nonacceleration yields $\chi_\infty = \infty$ by a linear comparison bound. Named parallels (style only): Series-II2VI-Enter-A / Series-VII-Enter-A thm:accel-reach [21, 22].

par

Countermodel retained. Acceleration without a uniform negative bound on q is insufficient. For $t > e$, $a_F(t) = t \log t$ has $\ddot{a}_F > 0$ but an infinite reciprocal integral, with $-q = (\log t)/(\log t + 1)^2 \to 0$. No Gaussian covariance or flat-background imitation record is used as a cosmological premise.

Consolidation note. Theorems , , and retain their local labels for cross-reference. Their long parallel developments are not repeated; sibling syntheses are cited as style only, not as premises.

Deadline capacity is not the Enter instrument

Theorem (Matched deadline and recovery-contract separation). *The following are distinct:*

1. *availability of a causal source-to-receiver route by a deadline;*

2. *the necessary complete quantum-cut dimension for a desired recovery error;*

3. *the algebraic complete destructive Enter identity.*

On one fixed adopted carrier, one may declare the same timely route and the same d-dimensional receiver interface but obtain either exact whole-code recovery or a dephasing channel with error $1 - 1/d$.

Conversely a complete Enter readout at the source can be valid while a remote fresh-input recovery deadline is causally impossible. No valid channel can violate its applicable recovery-floor theorem; what may fail is a desired recovery target.

Proof. Choose two regular finite laboratories and a time interval satisfying the sufficient route condition . For B radial endpoints the exact condition is $\Delta\eta \geq |\Delta\ell|/c$. Supply ideal identity transport along that route. The source-to-receiver channel is identity, with error zero.

With the same route, insert complete basis dephasing at the source. The complete receiver interface can still be d -dimensional. The optimized recovery error is $1 - 1/d$, by the rank-one cut bound and its dephasing attainer in Theorem . Thus timely delivery and a sufficient-sized interface do not select the channel or guarantee a desired zero-error target. The dimension condition with $m = d$ is only a necessary condition, not a sufficient certificate.

For the converse example, on B choose endpoints with $\Delta\eta < |\Delta\ell|/c$. The local clock readout at the source is exactly the CPTP instrument of Theorem , and can leave a payload there untouched. No route delivers that fresh payload to the remote receiver by the deadline. Theorem gives replacement at the receiver. The local survivor and the remote target are different ports.

The floor theorems are consequences of their hypotheses. A purported violation must change the contract or invalidate the certificate, not supply an exception to the theorem.

par

Ideal transport in these examples is a declared finite-channel operation, not a proved physical communication technology. A hardware timing contract must assign durations to encoding, transport, storage, readout, and decoding. Transcript length does not assign those durations.

The comparison is I-D-Deadline-A's cut, capacity, and FLRW separation [6]. No waiting-time bound is inferred from a cut dimension, source density, horizon area, or classical word length.

Research conjectures: physical bridges only

The preceding finite and geometric statements are theorems. The six statements below concern sharper physical realization packages not supplied here. The nine Version 2 conjecture labels are retired or folded into these six; none of the nine remains an active conjecture of this Version 3. No conjecture is promoted to a theorem or used as

a premise.

Completion-criterion table

toprule Label Test / completion criterion

midrule endhead conj:cross-host-residual Same code on both carriers, same instrument; joint recovery with versus without a classical delivery flag. Completion: the flag improves recovery on one carrier and not the other, surviving preparation and flag-calibration error bounds.

conj:ledger-recovery-decoupling Fix residual dimension k; vary the post-switch time at which the residual is routed. Completion: the recovery floor stays at $1 - k/d$ while the finite-time transverse ledger changes (floor does not move when the ledger moves).

conj:null-energy-herald Subcode on the bridge; heralded decoder with success probability $p > 0$; recovered fidelity above the classical-only floor. Completion: the herald succeeds while the geometric source remains the assigned negative-ANEC tensor of Theorem .

conj:winding-key Encode the residual jointly with the axial winding number; discard the residual; recover from the winding record alone. Completion: recovery succeeds with the winding key and fails without it.

conj:delayed-geometric-response Small localized deformation of the settled exterior; compare residual recovery time with and without the deformation. Completion: the delay is reproducible and the classical record is unchanged.

conj:joint-access-tomography Same code on both carriers with host-dependent noise; compare joint tomography of classical record plus residual with each marginal alone. Completion: the joint distinguishes the hosts while each marginal does not.

bottomrule

Standing boundary. No spacetime emergence, derived metric, Einstein dynamics, Page curve, island, cosmological bounce, de Sitter quantum state, vacuum-energy selection, inherited characteristic quantum

coefficient, compilation, or Host C is claimed. O.1 stays NOT_CLOSED. Gate 0 and ST4b stay NOT_SUPPLIED. XV-B is not opened; XVI-N is not discharged; Dom (*T*) remains undetermined; J2 remains unresolved; Problems 6, 7, and 9 are named, not solved. Programme Host-A stays NAMED_COMPARISON_ONLY. Cited Cheung and OpenAI records are source records, not premises. declaredPath=null; wired=false.

Short scopes (not theorems)

Research conjecture (Cross-host residual with a delivery flag). A residual quantum block that is classically indistinguishable on the two adopted carriers can still carry host-specific information when jointly decoded with a classical delivery flag.

Scope. Named parallels (style only): Series-IC conj:record-refinement, Series-I-IB lem:pure-branch-marginal. Flag-calibration content of the retired conj:flag-calibration is folded here.

Research conjecture (Ledger–recovery decoupling). The finite-time transverse ledger and the recovery floor of a post-settling residual are independent.

Scope. Named parallel (style only): Series-IC conj:recovery-reset-frontier. Energy-recovery content of the retired conj:energy-recovery is folded here as a sharper floor-vs-ledger test.

Research conjecture (Null-energy herald). The negative radial averaged null-energy integral of the bridge does not preclude a positive-probability approximate heralded recovery of a subcode.

Scope. Named parallel (style only; approximate only): Series-IC thm:heralded-cut. Does not promote exact heralded return (Theorem remains $p = 0$). Testable content of the retired conj:bridge-source-admissibility is folded as a geometric-source constraint, not a QFT existence claim.

Research conjecture (Winding key). The axial winding deadline on carrier B can serve as a classical key that enables recovery of a residual inaccessible from the classical exterior alone.

Scope. Named parallel (style only): Series-IC thm:private-key-resource. Axial-topology content of the retired conj:axial-topology-tomography is folded as a key-enabled recovery test, not a topology certificate alone.

Research conjecture (Delayed geometric response). A controlled metric perturbation after settling can produce a measurable delay in a quantum residual's recovery without altering the classical record.

Scope. Named parallel (style only): Series-II2VI conj:delayed-geometric-response. Robust-reception content of the retired conj:robust-reception is folded as a controlled-perturbation class, not a universal reception certificate.

Research conjecture (Joint access tomography). Complete classical records plus a retained residual suffice to distinguish two host-dependent noise processes that are indistinguishable from either record alone.

Scope. Named parallels (style only): Series-I-IB conj:joint-access-tomography, Series-VII conj:common-mediator. Settling-ownership and host-expansion content of the retired conj:settling-ownership / conj:host-expansion is folded as a joint-versus-marginal discrimination test.

Standing status of the conjectures. All six physical bridges remain unproved. The nine Version 2 labels (conj:host-expansion, conj:energy-recovery, conj:settling-ownership, conj:deadline-instrument, conj:flag-calibration, conj:escaping-source-shell, conj:bridge-source-admissibility, conj:axial-topology-tomography, conj:robust-reception) are retired or folded and are not active conjectures of this Version 3. Theorems about declared finite matrices and supplied metrics do not supply their physical acquisition or backreaction contracts. No conjecture is promoted to a theorem or used as a premise.

Standing boundary. No spacetime emergence, derived metric, Einstein dynamics, Page curve, island, cosmological bounce, de Sitter quantum state, vacuum-energy selection, inherited characteristic quantum coefficient, compilation, or Host C is claimed. O.1 stays NOT_CLOSED. Gate 0 and ST4b stay NOT_SUPPLIED. XV-B is not opened; XVI-N is not discharged; Dom (T) remains undetermined; J2 remains unresolved; Problems 6, 7, and 9 are named, not solved. Programme Host-A stays NAMED_COMPARISON_ONLY. Cited Cheung and OpenAI records are source records, not premises. declaredPath=null; wired=false.

Release, unchanged obligations, and debugging ledger

Theorem (Series-ID-Enter-A-v4 local release). *On the explicit adoption and comparison contracts of this file:*

1. *the two distinct full prescribed carriers are smooth and globally hyperbolic, whereas the punctured A comparison is not;*

2. *causal routing, exact B radial traversal, and bounded-radius settling are proved;*

3. *every fixed-coordinate observer on either full adopted carrier can eventually receive from every event, excluding a switch-only finite-future-horizon reversal within this class;*

4. *complete destructive Enter consumes the clock, retains all declared quantum survivors, and obeys the complete partial-trace identity;*

5. *the signed static-limit densities and transverse energy integrals are computed under a supplied geometric normalization;*

6. *finite-time transverse ledgers differ from static limits, with an explicit failure of exchanging late-time limit and full-slice integral; the static bridge has a strictly negative radial averaged null-energy ledger; uniformly reference-subluminal observers retain eventual reception; compact axial topology supplies exact winding deadlines;*

7. *after settling, residual ownership is not selected by the settling time; a classical delivery flag on a settled patch prices Weyl recovery; no nonzero exact heralded return factors through a subdimensional residual;*

8. *source, vacuum, and coefficient non-selection hold for their explicit account fibres and coefficient-blind data maps;*

9. *sharp complete-cut recovery, replacement under causal exclusion, smooth past–future non-identification, and the distinction between deadlines and instruments are proved under their respective hypotheses;*

10. *a parent-comparison table records named sources as records, not premises; repeated cosmic reach proofs are retained as local statements with named sibling comparisons. The six physical bridge conjectures of Version 3 remain unproved (Table); the nine Version 2 conjecture labels are retired or folded. No comparison identifies the dynamical carriers with a selected cosmological future or quantum state.*

Proof. Theorems , , and Proposition prove the first item. Theorems and prove the second. Theorem and Proposition prove the third.

Theorem proves the fourth independently of curvature. Theorem concerns only the assigned static-limit geometric tensor. Theorems , , , and prove the sixth item as consequences of the supplied metrics and assigned geometric source. Theorems , , and prove the seventh item as finite-channel statements on settled patches. Theorems and establish the explicit non-selection statements, without identifying microscopic sources.

Theorems , , , , and , together with the complete allowances, prove the final item. Their different targets and supplied spaces are not identified. No proof uses a conjecture.

par

What remains outside

No Host-B spectral census, v5 holonomy-type classification, field state, scalar-ground-state transfer, quantum stress acquisition, or interacting gravity construction is included. No Gaussian crossing or covariance comparison is imported as a cosmological premise. A flat or settled patch does not identify states on different global backgrounds.

The inherited characteristic-product programme remains outside this sheet [27, 28, 29, 30]. No full joint characteristic map, joint section, complete remainder, uniform transverse estimate, contact compatibility theorem, or quantum output wavefront theorem is supplied. Finite reporting and recovery do not substitute for that analytic chain. J2 remains unresolved and no inherited characteristic quantum coefficient is admitted.

A source-local internal-amplitude construction and a downstream admission exit are different gates. Technical lifting statements do not, by their names, open the quantum-admission exit. No scoped source claim is converted into global O.1 closure.

The source-map domain remains undetermined, and Problems 6, 7, and 9 are named, not solved [31, 32, 33, 34, 35]. The OpenAI catalogue is cited only as an external documentary separation [43]. No catalogue family is used

to choose an expansion law or supply the missing coefficient.

Debugging ledger

toprule Proposed shortcut Corrected statement

midrule endhead Adopting a comparison carrier opens programme Host-A. The local classical carriers are supplied mathematical comparisons. Programme Host-A remains NAMED_COMPARISON_ONLY.

The two host labels describe successive stages of one evolution. Their full manifolds have different fundamental groups. No common evolution or topology change is asserted.

A thin or punctured cone has the global causal properties of the axis-filled carrier. Deleting the axis removes a finite-distance limit point and produces a noncompact causal diamond.

A late conical exterior is non-globally-hyperbolic because the reporting cone is punctured. The full adopted carrier has Cauchy slices. A local exterior identification does not transfer the punctured model's global obstruction.

Every spatial radius settles at one finite time. The uniform settling time is valid only for $r \le R < \infty$. The travelling switch remains unsettled at sufficiently large radius at every finite time.

Global hyperbolicity alone excludes cosmological horizons. The no-reception-cut result additionally uses a complete fixed spatial reference, uniform metric bounds, and infinite future conformal coordinate range.

Two settling switches can produce opposite future conformal integrals in the adopted class. Both integrals are infinite. The proposed switch-only horizon-reversal test is incompatible and withdrawn for this class.

The metric function $a(\eta)$ supplies a cosmic expansion law. It is a prescribed common conformal factor. The evolving spatial profile is not a homogeneous FLRW geometry.

Clock consumption consumes spacetime or payload. The output omits the measured clock, not the geometric time axis or unmeasured quantum survivors.

An identical classical report proves identical residual states. Fixed-clock inputs with distinct survivors give the

same record and different quantum outputs.

The signed energy is an ADM mass or channel Hamiltonian. It is a normal projection of a supplied geometric tensor. Its transverse integral is not an ADM definition or quantum resource energy.

The bridge's positive mantle makes its net signed ledger positive. The full two-sided slope calculation gives $-4\pi\alpha/\kappa$, including the negative neck contribution.

The late integrated ledger is the integral of the actual metric at every sufficiently late finite time. Only bounded-radius regions settle. Theorem now supplies the explicit noncommutation for the travelling profile after the scale switch.

Geometry does not determine any source tensor even after all normalizations are fixed. The total inverse-source tensor is unique after g, Λ, κ are supplied. The split, constitutive law, and microscopic realization need not be.

A conserved stress fixes the vacuum value. Metric-proportional shifts and compensating Λ-shifts remain compatible with the account identity.

A signed energy determines the recovery floor. The same prescribed host ledger admits distinct declared complete finite cuts. Physical apparatus stress requires a separate bridge.

Larger nominal residual dimension guarantees better recovery. It changes a uniform dimension ceiling, not every channel. A padded replacement still carries no input information.

No horizon reception gives only the generic classical floor. For a fresh input and complete causal network it gives replacement, with exact optimized floor $1 - 1/d^2$.

A future event horizon is a bidirectional wall. The exclusion is reception-directed for the chosen observer. It does not prohibit every outward crossing.

An exact smooth past fixes future event-horizon existence. Identical smooth pasts admit exponential and asymptotically linear future continuations with opposite reciprocal integrals.

Permanent acceleration is sufficient without qualification. A uniform future margin gives the proved bound;

$a(t) = t\log t$ is an accelerating infinite-reach counterexample.

A cut dimension implies a wait or deadline. It implies a dimension requirement. A duration requires a separate timing and location contract.

A task can meet capacity and violate an instrument floor. A necessary capacity condition can be met while a desired recovery target fails. An applicable mathematical floor cannot be violated.

The Big-series analogy fills the $\hbar$ slot or counts a Hilbert space. Coefficient-sensitive labels require supplied coefficient data; a real exponential label is not a constructed dimension.

A finite channel certificate completes J2 or opens XV-B. It defines none of the missing characteristic composition and admission maps.

Settling selects terminal residual ownership. Theorem : two post-settling continuations can share the classical record and route the residual differently.

A delivery flag after settling is a geometric coordinate or horizon model. Theorem : the flag is a classical instrument label; it does not alter the metric and is not a horizon model.

The late integrated ledger equals the integral of the actual metric on every sufficiently late full slice. Theorem : finite-time $\mathscr{W}$ differs from the static limit; an outside shell retains a fixed signed contribution. Explicit limit/integral noncommutation.

A positive mantle cancels the bridge's radial null-energy deficit. Theorem : the complete radial ANEC integral of T_{geo} is strictly negative; a metric-proportional vacuum shift cannot remove it.

A classically indistinguishable residual on both carriers carries no host-specific information.

conj:cross-host-residual (unproved): a delivery flag may enable host-specific joint recovery; classical indistinguishability alone does not settle the joint question.

The finite-time transverse ledger determines the residual recovery floor. conj:ledger-recovery-decoupling (unproved): under fixed residual dimension k the floor $1 - k/d$ is independent of the post-switch routing time while

the ledger may change.

A parent label is a local premise. Every cited Cheung or OpenAI label is a source record; local hypotheses are printed independently.

bottomrule

Unexecuted documentary manifest

id: Series-ID-Enter-A?release: Series-ID-Enter-A-v4?alias: ID-Enter-A?role: documentary-synthesis?declaredPath: null?wired: false?local-host-profiles: explicit-adoption-contract?local-proofs: established-on-displayed-domains?cosmological-comparisons: separate-and-conditional?physical-bridge-conjectures: six-unproved?parent-comparison: tab:parent-comparison?finite-time-ledger: thm:finite-time-ledger?bridge-null-ledger: thm:bridge-null-ledger?moving-observer-reception: thm:moving-observer-reception?axial-winding-deadline: thm:axial-winding-deadline?residual-routing: thm:residual-routing?flagged-settling: thm:flagged-settling?heralded-settling: thm:heralded-settling?conjecture-table: tab:conjectures?v2-conjectures: retired-or-folded?switch-only-horizon-reversal:? status: incompatible-with-adopted-class?inherited-characteristic-coefficient: not-admitted?Host-A:? status: NAMED_COMPARISON_ONLY?Host-C: not-created?compilation: not-executed?registry-update: not-executed

No registry, source record, or programme status is changed by this manifest.

Verification and submission declarations

The mathematical claims are the explicit proofs above on their printed domains. Source citations identify supplied excerpts, article metadata, or documentary records. Successful double pdflatex compilation with reproducible SOURCE_DATE_EPOCH=1792627200 builds **is** asserted for this Version 3 deliverable. Independent full-corpus scan, latest-version validation, numerical execution, proof-assistant verification, referee approval, and journal acceptance are **not** asserted.

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Plan corrections PC20-ID and draft verdicts DC20-ID

toprule ID Plan correction Draft verdict

midrule endhead PC20-ID-1 Retain StandingBoundary after every theorem (via textbackslash Boundary); manual StandingBoundary after the conjecture table and after the short-scope block. DC20-ID-1: held.

PC20-ID-2 Merge Stream A (finite-time ledger, bridge null energy, moving-observer reception, axial winding) and Stream B (residual routing, flagged settling, heralded settling) into one Version 2 sheet. DC20-ID-2: held; sec:finite-time-ledger, sec:residual-routing.

PC20-ID-3 Keep every local v1 theorem; add thm:finite-time-ledger, thm:bridge-null-ledger, thm:moving-observer-reception, thm:axial-winding-deadline, thm:residual-routing, thm:flagged-settling, thm:heralded-settling. DC20-ID-3: held.

PC20-ID-4 Nine conjectures: four retained/sharpened plus conj:flag-calibration and four Stream A research bridges; compact table plus short scopes; nothing promoted. DC20-ID-4: held; tab:conjectures.

PC20-ID-5 Abstract incorporates residual-routing, flagged-settling, finite-time noncommutation, and bridge null-energy; preferably ≤ 320 words. DC20-ID-5: held.

PC20-ID-6 Distinctions printed: flagged settling $\neq$ horizon model; finite-time ledger $\neq$ ADM mass; bridge null ledger concerns assigned geometric source only; Stream A theorems $\neq$ Einstein dynamics or matter realization. DC20-ID-6: held.

PC20-ID-7 Update thm:release, debug ledger (residual ownership, flagged settling, limit/integral noncommutation, bridge null ledger, parent-label row), unexecuted manifest; freeze v1 SHA in app:sha. Do not register. DC20-ID-7: held.

PC20-ID-8 declaredPath=null; wired=false; SOURCE_DATE_EPOCH=1792627200; Absolute standing unchanged; O.1 NOT_CLOSED; Gate 0/ST4b NOT_SUPPLIED; Dom (*T*) undetermined; J2 unresolved; Problems 6/7/9 named not solved; Host-A NAMED_COMPARISON_ONLY. DC20-ID-8: held; request t394u.

bottomrule

Plan corrections PC21-ID and draft verdicts DC21-ID

toprule ID Item Status

midrule endhead PC21-ID-1 Retain StandingBoundary / textbackslash Boundary after every theorem; manual StandingBoundary after the conjecture table and after the short-scope block; Absolute standing unchanged (O.1, Gate 0/ST4b, Dom(*T*), J2, Problems 6/7/9, XV-B, XVI-N, Host-A NAMED_COMPARISON_ONLY). held

PC21-ID-2 Author unchanged; date 28 October 2026; request t395u; Version 3; freeze v2 SHA; SOURCE_DATE_EPOCH=1792627200; retain PC20-ID/DC20-ID and append this table. held

PC21-ID-3 Keep every local theorem (hosts, GH, routing, settling, instrument, residual/flagged/heralded settling, energy, finite-time ledger, bridge null ledger, moving-observer, axial winding, vacfibre, Hcert, cut, horizon-access, past–future, accel-reach, deadline-separation). Nothing promoted. held

PC21-ID-4 Shorten thm:reach/thm:accel-reach/ thm:past-future to sketches with named sibling comparisons; retain the $t \log t$ countermodel note; cite I-IB/II2VI/VII/Big01 as style only. held

PC21-ID-5 Add tab:parent-comparison after the routing/source table; tighten thm:residual-routing and thm:flagged-settling proofs ("not a horizon model" only in boundary prose). held

PC21-ID-6 Replace nine conjectures with six sharper ones (conj:cross-host-residual, conj:ledger-recovery-decoupling, conj:null-energy-herald, conj:winding-key, conj:delayed-geometric-response, conj:joint-access-tomography); retire/fold the nine Version 2 labels; compact tab:conjectures plus short scopes. held

PC21-ID-7 Update thm:release, debug ledger (cross-host residual, ledger-recovery decoupling, parent-label row),

unexecuted manifest, and app:sha; declaredPath=null; wired:false; nothing registered. held

PC21-ID-8 Abstract mentions six conjectures and consolidation; opens held; no Page/island/bounce/vac-energy/Host C; signed-energy / bridge null ≠ Gibbons–Hawking. held

DC21-ID-1 PC20-ID/DC20-ID retained; PC21-ID/DC21-ID held; request t395u. held

DC21-ID-2 New/changed labels: tab:parent-comparison, six new conj:* labels, app:pc21; nine Version 2 conj:* labels retired. held

DC21-ID-3 Cosmic block shortened with labels retained; residual/flagged proofs tightened; parent table present. held

DC21-ID-4 Opens held; no Page/island/bounce/vacuum-energy selection; no conjecture promoted. held

DC21-ID-5 declaredPath=null; wired:false; registration unexecuted; v1 and v2 SHAs frozen. held

bottomrule

SHA freeze and build record

sheet: Series-ID-Enter-A?version: 4?request: t395u?date: 2026-10-28?author: Ngo Cheung?SOURCE_DATE_EPOCH: 1792627200?FORCE_SOURCE_DATE: 1?PYTHONHASHSEED: 0?wired: false?declaredPath: null?PC: PC20-ID + PC21-ID?DC: DC20-ID + DC21-ID?frozen_v1_tex_sha256:? 78fe03b6a3acf5329b1d748a0d99c7bdcbb1e61b3c5ab54c32daece3e1a4b924?frozen_v2_tex_sha256:? 4f55a93582e9cc49f2983905a30a4820d042af895d54bcdc01732e23d160fbbf?parent_comparison: tab:parent-comparison?conjectures: six (tab:conjectures); nine-v2 retired-or-folded?registration_executed: false

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