Enter, 02_VII-A-ST-v2, 2026, pp. 1-43

VII-A-ST: Plateau intertwiners on a prescribed conical spacetime

Supported classical descent, cutoff comparison, and finite destructive-clock certificates

Ngo Cheung

8 November 2026 (version 2; request t433u; book: Observation Boundaries and Finite Instruments: Series VII; wired=false)

Abstract

We construct a supported local spacetime adaptation of the plateau intertwiner of Manuscript VII-A. The physical background is the regular part of I-B's prescribed conical Lorentzian product, not global Minkowski spacetime. A developing chart supports a precisely specified switched scalar action, unswitched finite-time harmonic coordinates, and formal diffeomorphisms supported inside a switch plateau. We prove the complete second-order scalar and coordinate intertwiners, including the density transformation and every switch derivative, without imposing a field equation on the metric coefficients. The construction restricts to an explicitly defined, nonempty Einstein–scalar coupling jet.

The repair is deliberately relative. For general compact gauge supports we derive the exact first-order residual $E_m \mathscr{D}^{(m)}_{(1-g)K\xi}\varphi_0$, construct a strictly negative smeared witness, and prove that no higher coupling coefficient or positive $\hbar$-order removes the fixed classical gap. We also prove causal dependence on the truncated observation past and a unique Cauchy-data-preserving comparison cocycle between switches. An explicit example shows why equality on an observation plateau alone is insufficient.

The additional contribution is a finite operational realization that records both the repaired coefficients and the unrepaired gap. A sourced massless family supplies a nontrivial evaluation table; a complete destructive Enter

instrument reads its finite encoding, admits a quantitative complete-channel approximation bound, and transports the payload and its classical control record along a prescribed causal route. This separation of classical covariance, preparation memory, and finite readout may provide a useful reproducible interface for later analytic work. It is not field acquisition or a quantum-gravity measurement construction. The classical plateau gate is closed on the stated domain; no quantum product, quantum Ward identity, radiative coefficient, or counterterm separator is constructed.

Bibliographic record

Title	VII-A-ST: Plateau intertwiners on a prescribed conical spacetime
Author	Cheung, Ngo
Publication date	2026
Institution	Enter
Report number	02_VII-A-ST-v2
Publisher	Cheung Ngo Medical Limited
First page	1
Last page	43
Language	en

---

par **Release boundary** par This is a local Grade S construction on supplied geometry. The classical intertwiner and its larger-support obstruction are attributed to VII-A and are reproved here. The spacetime adaptation and finite evaluation interface do not derive the metric, lapse, deficit, or cone from records.

The regular cone is not globally hyperbolic. All analytical inverses below belong to a supported developing presentation. The quantum certificate remains RG-open. par

Introduction and the Enter interface discipline

The problem is to keep three statements separate:

plateau-supported classical covariance, larger-support classical failure, finite operational readout.

The last statement must neither erase the failure nor supply an unconstructed quantum field observable.

Manuscript VII-A proves a classical repair for a specified action-level switch, fixed harmonic Cauchy prescription, and restricted gauge group [1]. Its repair does not extend to every compact gauge generator. We give the local proofs needed to place that construction in the conical laboratory of I-B [2]. VI supplies a documentary comparison for the unrestricted obstruction, not a premise of our argument.

Relational observables and their perturbative expansions have established antecedents [6, 7]. In particular, neither the existence of relational constructions nor previously computed gauge-invariant quantum correlation functions is claimed as a discovery of this paper. Our object has its own finite-time boundary data, switch prescription, and gauge domain.

Background and philosophy of Enter

Cheung's Enter calculus treats runtime quantum names as access rights to tensor factors. A destructive readout consumes the measured names and returns a classical record; unmeasured factors may remain [3, 4]. The philosophical distinction is between an output interface and an unrestricted claim about the fate of all implementing physical degrees of freedom. Destructive readout, quantum recovery, a thermodynamic implementation, and a geometric identification are different tasks [5].

We adopt the specified finite Born instrument and prove its complete channel formula. We do not rederive the Enter characterization from an abbreviated axiom list or promote it to a field-instrument theorem.

I-B attaches a finite clock, local rods, and causal transport permissions to a prescribed conical spacetime [2]. Consuming that clock does not consume the geometric time axis. The manifold, worldsheet defect, and future cone remain input data.

Definition (Local Grade S). A local Grade S package specifies and establishes:

1. a prescribed Lorentzian background, local rods, and a supported analytical laboratory;

2. named classical equations and proved descent identities on that laboratory;

3. a finite destructive clock with a complete recorded instrument;

4. an explicit finite encoding of selected classical evaluations;

5. reference-preserving transport whose complete dependencies respect the prescribed causal relation. Grade E would additionally require a construction determining geometric data from operational records. It is not asserted.

The supported-presentation pattern is comparable with III-B and V-B. Their theorems are not substituted for the arguments below.

Prescribed geometry and the supported Cauchy presentation

Fix

$$c > 0, \qquad 0 < \mu < 2\pi, \qquad \alpha = 1 - \frac{\mu}{2\pi}.$$

The physical smooth spacetime is

$$M = \mathbb{R}_T \times C_\mu^\circ \times \mathbb{R}_z, \qquad \bar{g} = -c^2 \mathrm{d}T^2 + \mathrm{d}r^2 + \alpha^2 r^2 \mathrm{d}\varphi^2 + \mathrm{d}z^2,$$

where $r > 0$ and $\varphi \in \mathbb{R}/(2\pi\mathbb{Z})$. The completion has singular locus

$$\mathscr{W} = \mathbb{R}_T \times \{o\} \times \mathbb{R}_z.$$

It is a worldsheet, not a worldline. No smooth Einstein tensor is asserted on $\mathscr{W}$.

Proposition (Geometry, rods, and time orientation). *The metric has signature* $(-,+,+,+)$*. Choose the orientation for which* ∂_T *is future directed. A nonzero future-causal vector* $a\partial_T + w$ *satisfies*

$$a > 0, \qquad |w|_{\text{spatial}} \le ca.$$

Static observers have proper-time increment $\mathrm{d}\tau = \mathrm{d}T$.

On a sufficiently small lifted angular interval,

$$\mathrm{dev}\,(T, r, \varphi, z) = (T, r\cos(\alpha\varphi), r\sin(\alpha\varphi), z)$$

is a local isometry to Minkowski space. Its three spatial coordinates are local rods.

Proof. The diagonal metric matrix has one negative and three positive entries. Its causal inequality is $-c^2a^2 + |w|^2_{\text{spatial}} \le 0$. A nonzero causal vector cannot have $a = 0$, and the chosen orientation selects $a > 0$. The static proper-time formula follows by setting $w = 0$. Finally,

$$\mathrm{d}x^2 + \mathrm{d}y^2 = \mathrm{d}r^2 + \alpha^2 r^2 \mathrm{d}\varphi^2.$$

The angular deck transformation changes the developed angle by $2\pi - \mu$. In the inverse-deck convention the gluing is rotation by μ. Thus local flatness does not remove the global conical identification.

Proposition (The regular product is not globally hyperbolic). *The spacetime M has a noncompact causal diamond.*

Proof. Fix $r_0 > 0$, one angle, and $z = 0$. Take events p, q at that spatial point with times $-2r_0/c$ and $2r_0/c$. For any $r_n \mathrm{downarrow}\, 0$, the events $(0, r_n, \varphi, 0)$ belong to $J^+(p) \cap J^-(q)$, by radial causal travel. They have no convergent subsequence in M, because the apex is excluded.

No global Cauchy theorem is inferred from local flatness. Global Green-operator results have additional hypotheses [8].

The laboratory

Choose a regular spatial chart

$$\chi : \mathscr{V} \to V \subset \mathbb{R}^3$$

whose image is convex and contains $\overline{B}_R$ in its interior. Translate the spatial coordinates if necessary, and set

$$t = c(T - T_{\text{in}}), \qquad \eta = \mathrm{diag}\,(-1, 1, 1, 1).$$

For $0 < b < R$, use the shrinking domain

$$\mathscr{D} = \{(t,x) : 0 \le t \le b,\ |x| < R - t\}, \qquad \Sigma_0 = \{0\} \times B_R.$$

Its open positive-time part is denoted $\mathscr{D}_+^\circ$. Fields are smooth up to the initial surface on neighborhoods of the portions used.

Definition (Supported presentation). The analytical data consist of:

1. the chart, $\mathscr{D}$, Σ_0, and the fixed initial data prescriptions;

2. compact switches, tests, and gauge generators in $\mathscr{D}_+^\circ$;

3. a relatively compact open plateau USubset $\mathscr{D}_+^\circ$, with its closure separated from Σ_0;

4. compact truncated past cones for all evaluations, with positive margin inside the developing laboratory.

Solutions are determined from their stated initial data, with no independent incoming lateral-boundary data.

Supportedness is a dependence condition. It does not require the metric coefficients themselves to have compact support or compact Cauchy data.

The domain $\mathscr{D}$ is backward-cone closed relative to Σ_0: if (s,z) lies between 0 and a point $(t,x) \in \mathscr{D}$, with $|z-x| \le t-s$, then

$$|z| \le |x| + t - s < R - s.$$

This is the property used by all local inverses.

Lemma (Zero-Cauchy inverses). *For $m \ge 0$, define*

$$P_m = -\partial_t^2 + \Delta - m^2, \qquad \Omega_m = (-\Delta + m^2)^{1/2}.$$

There is a unique smooth solution of $P_m u = F$ on $\mathscr{D}$ with prescribed smooth Cauchy data. The zero-data inverse E_m is locally represented by

$$(\mathrm{E}_m F)(t) = -\int_0^t \frac{\sin\left((t-s)\Omega_m\right)}{\Omega_m} F(s)\,\mathrm{d}s.$$

It has finite propagation and is continuous in local smooth topologies on compact truncated cones.

If u has zero Cauchy data, then

$$\mathrm{E}_m P_m u = u.$$

For general u,

$$\mathrm{E}_m P_m u = u - H_m[u], \qquad H_m[u](t) = \cos(t\Omega_m)u|_0 + \frac{\sin(t\Omega_m)}{\Omega_m}\dot{u}|_0.$$

Proof. For compact spatial data and sources, spatial Fourier transformation reduces the equation to forced oscillators. Solving them gives and the displayed homogeneous solution.

Finite propagation and smooth uniqueness follow from the energy identity on a truncated backward cone: the outward lateral flux is nonnegative, and zero data and zero source give zero energy. Differentiated energy estimates and local Sobolev estimates give smooth dependence.

For a compact target in $\mathscr{D}$, cut off and extend the required data and source from its truncated past to compact spatial data. Different extensions agree on the target by the preceding uniqueness argument. Exhaustion by compact targets defines the smooth local solution. Subtracting $H_m[u]$ proves and .

The flat Fourier formula is an auxiliary realization of the specified local problem, not a declaration that all of $\mathbb{R}^{1,3}$ is physical spacetime. After construction the result pulls back to the regular conical laboratory. No intrinsic global conical inverse is selected.

Switching before variation

Work in $C^\infty(\mathscr{D})[[\kappa]]/(\kappa^3)$, without factorials in the coefficient expansion:

$$\gamma = \eta + \kappa h + \kappa^2 k \bmod \kappa^3.$$

The prescribed background $\bar{g}$ and the formal unknown γ have different roles. The former supplies the laboratory and apparatus cone. The latter is an input to the coefficient equations. No record-dependent metric update is introduced.

Raise coefficient indices with η. Define

$$a(h) = \frac{1}{2}\mathrm{tr}_{\eta} h, \qquad b(h) = \frac{1}{8}(\mathrm{tr}_{\eta} h)^2 - \frac{1}{4} h_{\mu\nu} h^{\mu\nu},$$

$$A^{\mu\nu}(h) = a(h)\eta^{\mu\nu} - h^{\mu\nu}, \; B^{\mu\nu}(h) = h^{\mu}{}_{\rho} h^{\rho\nu} - a(h) h^{\mu\nu} + b(h)\eta^{\mu\nu}.$$

Writing

$$\rho_{\gamma} = \sqrt{-\det \gamma}, \qquad \mathscr{A}_{\gamma}^{\mu\nu} = \rho_{\gamma} \gamma^{\mu\nu},$$

matrix inversion and determinant expansion give

$$\rho_{\gamma} = 1 + \kappa a(h) + \kappa^2 (a(k) + b(h)) \bmod \kappa^3,$$

$$\mathscr{A}_{\gamma}^{\mu\nu} = \eta^{\mu\nu} + \kappa A^{\mu\nu}(h) + \kappa^2 (A^{\mu\nu}(k) + B^{\mu\nu}(h)) \bmod \kappa^3.$$

Indeed,

$$\gamma^{-1} = \eta^{-1} - \kappa h^{\sharp} + \kappa^2 (h^{\sharp} h^{\sharp} - k^{\sharp}),$$

and $\rho_{\gamma} = \exp\left(\frac{1}{2}\mathrm{tr}\log(\eta^{-1}\gamma)\right)$; multiplication proves .

Definition (Plateau and restricted gauge data). Fix

$$g \in C_c^{\infty}(\mathscr{D}_{+}^{\circ}), \qquad 0 \le g \le 1, \qquad \overline{U} \subset \mathrm{int}\,\{g = 1\}.$$

The test is real $f \in C_c^{\infty}(U)$. Let

$$\mathfrak{g}_U = C_c^{\infty}(U; T\mathscr{D}).$$

The admitted formal transformations are

$$F_{\kappa}^{*} = \exp(\kappa \mathscr{L}_{\xi} + \kappa^2 \mathscr{L}_{\zeta}) \bmod \kappa^3, \qquad \xi, \zeta \in \mathfrak{g}_U.$$

They are formal jets of orientation-preserving diffeomorphisms generated inside U. Their group is denoted $\mathscr{G}_U$.

The Lie bracket preserves $\mathfrak{g}_U$, and the truncated Baker–Campbell–Hausdorff formula preserves the class .

Including ζ is necessary for this convenient composition-stable parametrization. Every admitted actual flow is the identity outside a compact subset of U, preserves g, and is the identity near Σ_0.

Define the switched coefficients

$$\mathscr{A}_g[\gamma] = (1-g)\cdot\mathscr{A}_\eta + g\cdot\mathscr{A}_\gamma, \qquad \rho_g[\gamma] = (1-g) + g\rho_\gamma.$$

Our scalar action and Euler operator are

$$S_g^{\mathrm{sc}}[\gamma,\varphi] = -\frac{1}{2}\int\Big(\mathscr{A}_g[\gamma]^{\mu\nu}\partial_\mu\varphi\partial_\nu\varphi + m^2\rho_g[\gamma]\varphi^2\Big)\mathrm{d}^4x,$$

$$\mathscr{D}_g[\gamma]\varphi = \partial_\mu\Big(\mathscr{A}_g[\gamma]^{\mu\nu}\partial_\nu\varphi\Big) - m^2\rho_g[\gamma]\varphi.$$

The action is variationally defined with compact variations; its numerical value need not be finite on every smooth input. Its Euler output represents a scalar density relative to d^4x.

For a symmetric tensor H, put

$$\mathscr{Q}_H^{(m)}u = \partial_\mu(A^{\mu\nu}(H)\partial_\nu u) - m^2 a(H)u,$$

$$\mathscr{T}_h^{(m)}u = \partial_\mu(B^{\mu\nu}(h)\partial_\nu u) - m^2 b(h)u.$$

Then

$$\mathscr{D}_g[\gamma] = P_m + \kappa V_g[h] + \kappa^2 W_g[h,k] \bmod \kappa^3,$$

where

$$V_g[h] = \mathscr{Q}_{gh}^{(m)},$$

$$W_g[h,k]u = \partial_\mu\Big(g(A^{\mu\nu}(k) + B^{\mu\nu}(h))\partial_\nu u\Big) - m^2 g(a(k)+b(h))u.$$

In particular,

$$V_g[h]u = g\mathscr{Q}_h^{(m)}u + (\partial_\mu g)A^{\mu\nu}(h)\partial_\nu u,$$

$$W_g[h,k]u = g(\mathscr{Q}_k^{(m)} + \mathscr{T}_h^{(m)})u + (\partial_\mu g)(A^{\mu\nu}(k) + B^{\mu\nu}(h))\partial_\nu u.$$

The quadratic metric vertex has one factor g, not g^2. The iterated first-order response below contains two switch insertions for a different reason.

The scalar assignment

Fix a real smooth free scalar $P_m\varphi_0 = 0$ with declared Cauchy data. Define

$$\varphi_g[\gamma;\varphi_0] = \varphi_0 + \kappa u_{1,g} + \kappa^2 u_{2,g} \bmod \kappa^3,$$

$$u_{1,g} = -\mathrm{E}_m V_g[h]\varphi_0,$$

$$u_{2,g} = \mathrm{E}_m V_g[h]\mathrm{E}_m V_g[h]\varphi_0 - \mathrm{E}_m W_g[h,k]\varphi_0.$$

Both positive-order coefficients have zero Cauchy data.

Proposition (Existence and uniqueness of the scalar assignment). *The expression uniquely solves*

$$\mathcal{D}_g[\gamma]\varphi_g = 0 \bmod \kappa^3$$

with the stated leading data and zero positive-order data. It is defined for arbitrary smooth h, k.

Proof. The two coefficient equations are

$$P_m u_{1,g} = -V_g[h]\varphi_0, \qquad P_m u_{2,g} = -V_g[h]u_{1,g} - W_g[h,k]\varphi_0.$$

Apply Lemma successively. Substituting the first solution gives .

Unswitched harmonic labels and the relational coefficients

Define

$$\mathscr{C}^\mu[h] = \partial_\nu h^{\nu\mu} - \frac{1}{2}\partial^\mu \mathrm{tr}_\eta h = -\partial_\nu A^{\nu\mu}(h).$$

The harmonic labels are four scalar functions

$$X^\mu_\gamma = x^\mu + \kappa w^\mu + \kappa^2 v^\mu \bmod \kappa^3$$

satisfying the *unswitched* equation

$$\partial_\alpha(\mathscr{A}^{\alpha\beta}_\gamma \partial_\beta X^\mu_\gamma) = 0 \bmod \kappa^3$$

and data $X^\mu_\gamma|_0 = x^\mu|_0$, $\partial_t X^\mu_\gamma|_0 = \partial_t x^\mu|_0$.

Proposition (Harmonic Cauchy construction). *The unique coefficients are*

$$w^\mu[h] = \mathrm{E}_0 \mathscr{C}^\mu[h],$$

$$v^\mu[h,k] = \mathrm{E}_0\Big(\mathscr{C}^\mu[k] - \partial_\alpha B^{\alpha\mu}(h) - \mathscr{Q}^{(0)}_h w^\mu[h] \Big).$$

Proof. At first order the equation is $\mathrm{Box}_\eta\, w^\mu = \mathscr{C}^\mu[h]$. At second order it is

$$\mathrm{Box}_\eta\, v^\mu = \mathscr{C}^\mu[k] - \partial_\alpha B^{\alpha\mu}(h) - \mathscr{Q}^{(0)}_h w^\mu.$$

Both have zero data, so Lemma applies.

The index μ labels the four scalar functions. It does not make the labels the components of a globally defined conical vector field.

Their formal inverse is

$$Y^\mu_\gamma(y) = y^\mu - \kappa w^\mu(y) + \kappa^2\Big(w^\nu \partial_\nu w^\mu - v^\mu \Big)(y) \bmod \kappa^3.$$

Substitution in $X_\gamma(Y_\gamma(y))$ proves the formula and uniqueness order by order.

Define

$$\Phi_g[\gamma;\varphi_0] = \varphi_g[\gamma;\varphi_0] \circ Y_\gamma, \qquad \mathscr{O}_f[g](\gamma,\varphi_0) = \int f(y)\Phi_g[\gamma;\varphi_0](y)\, \mathrm{d}^4 y.$$

The smearing uses the fixed label density, not $\rho_\gamma \mathrm{d}^4 y$. No global numerical invertibility of X_γ is required.

Taylor expansion gives

$$\Phi_g = \varphi_0 + \kappa A^{(g)}_1 + \kappa^2 A^{(g)}_2 \bmod \kappa^3,$$

$$A^{(g)}_1 = u_{1,g} - w^\mu \partial_\mu \varphi_0,$$

$$A_2^{(g)} = u_{2,g} - w^\mu \partial_\mu u_{1,g} + (w^\nu \partial_\nu w^\mu - v^\mu)\partial_\mu \varphi_0 + \frac{1}{2} w^\mu w^\nu \partial_\mu \partial_\nu \varphi_0.$$

Write

$$C_r[g](h, k; \varphi_0, f) = \int f A_r^{(g)} \, \mathrm{d}^4 y, \qquad r = 1, 2.$$

In particular, the complete second coefficient is

$$A_2^{(g)} = \mathrm{E}_m V_g \mathrm{E}_m V_g \varphi_0 - \mathrm{E}_m W_g \varphi_0 + X_w \mathrm{E}_m V_g \varphi_0$$

$$+ (w^\nu \partial_\nu w^\mu - v^\mu)\partial_\mu \varphi_0 + \frac{1}{2} w^\mu w^\nu \partial_\mu \partial_\nu \varphi_0.$$

All five displayed contributions are retained.

First-order repair and the larger-support residual

For a vector field ξ, let

$$(K\xi)_{\mu\nu} = \partial_\mu \xi_\nu + \partial_\nu \xi_\mu, \qquad X_\xi = \xi^\mu \partial_\mu, \qquad D_\xi = X_\xi + \partial_\mu \xi^\mu.$$

Here D_ξ is the Lie derivative on scalar densities represented in the fixed chart.

Lemma (Two linear identities). *For smooth ξ, u,*

$$\mathscr{C}[K\xi] = \mathrm{Box}_\eta \, \xi,$$

$$\mathscr{D}^{(m)}_{K\xi} u = D_\xi P_m u - P_m X_\xi u.$$

If ξ vanishes near Σ_0, then $w[K\xi] = \xi$. On $P_m \varphi_0 = 0$,

$$\mathscr{D}^{(m)}_{K\xi} \varphi_0 = -P_m (X_\xi \varphi_0).$$

Proof. The trace of $K\xi$ is $2\partial_\rho \xi^\rho$; the mixed derivative cancels in $\mathscr{C}[K\xi]$. The zero-data left-inverse identity then gives $w[K\xi] = \xi$.

For the second formula,

$$A^{\mu\nu}(K\xi) = (\partial_\rho \xi^\rho)\eta^{\mu\nu} - \partial^\mu \xi^\nu - \partial^\nu \xi^\mu, \qquad a(K\xi) = \partial_\rho \xi^\rho.$$

Its divergence is $-\mathrm{Box}_\eta\, \xi^\nu$. Thus

$$\mathscr{Q}^{(m)}_{K\xi} u = (\partial_\rho \xi^\rho) P_m u - (\mathrm{Box}_\eta\, \xi^\nu)\partial_\nu u - 2(\partial^\mu \xi^\nu)\partial_\mu \partial_\nu u.$$

This is $D_\xi P_m u - P_m X_\xi u$.

Theorem (Exact first-order plateau cancellation). *For every smooth h, every free φ_0, and $\xi \in \mathfrak{g}_U$,*

$$gK\xi = K\xi, \qquad u_{1,g}[h + K\xi] - u_{1,g}[h] = X_\xi \varphi_0, \qquad w[h + K\xi] - w[h] = \xi.$$

Consequently $A_1^{(g)}$, and hence $C_1[g]$, is invariant. No metric field equation is required.

Proof. All derivatives of ξ have support in the plateau. Linearity and give

$$\delta_\xi u_{1,g} = -\mathrm{E}_m \mathscr{Q}^{(m)}_{K\xi} \varphi_0 = \mathrm{E}_m P_m (X_\xi \varphi_0) = X_\xi \varphi_0.$$

The last equality uses the vanishing near Σ_0, not an unrestricted inverse identity. The coordinate identity follows from Lemma . Substitution in cancels the two variations.

Proposition (Exact defect for the larger compact class). *Let $\xi \in C_c^\infty(\mathscr{D}_+^\circ; T\mathscr{D})$, without the plateau support restriction. Under the unchanged-free-input comparison $(h, \varphi_0) \mapsto (h + K\xi, \varphi_0)$,*

$$A_1^{(g)}[h + K\xi; \varphi_0] - A_1^{(g)}[h; \varphi_0] = \mathrm{E}_m \mathscr{Q}^{(m)}_{(1-g)K\xi} \varphi_0.$$

Proof. The difference is

$$-\mathrm{E}_m \mathscr{Q}^{(m)}_{gK\xi} \varphi_0 - X_\xi \varphi_0.$$

The zero-data identity and give $X_\xi \varphi_0 = -\mathrm{E}_m \mathscr{Q}^{(m)}_{K\xi} \varphi_0$. Linearity in the tensor argument proves .

For comparison with an expanded retarded formula, write $\overline{H}^{\mu\nu} = H^{\mu\nu} - \frac{1}{2}\eta^{\mu\nu}\mathrm{tr}_\eta H$. Then

$$\delta_\xi A_1^{(g)} = (g - 1) X_\xi \varphi_0$$

$$+\mathrm{E}_m\Big((\partial_\mu g)\overline{K\xi}^{\mu\nu}\partial_\nu\varphi_0 - [P_m, g]X_\xi\varphi_0\Big),$$

$$[P_m, g]u = (\mathrm{Box}_\eta g)u + 2(\partial^\mu g)\partial_\mu u.$$

Indeed, expand $\mathscr{Q}_{gK\xi}$, and use $\mathrm{E}_m P_m(gX_\xi\varphi_0) = gX_\xi\varphi_0$. This independently reproduces the classical mechanism compared with VI.

Proposition (A normalized negative witness). *For every $m \geq 0$, an admitted packet exists with $f \geq 0$, $\int f = 1$, and a compact larger-support generator ξ, constant near* $\operatorname{supp} g$*, such that*

$$g = 1\mathrm{nearsupp}\, f, \qquad gK\xi = 0,$$

but

$$\Delta = C_1[g](h + K\xi; \varphi_0, f) - C_1[g](h; \varphi_0, f) \leq -\frac{1}{2}.$$

The gap is independent of the baseline h.

Proof. Choose an interior event $(t_*, 0)$ and free scalar data at $t = t_*$ equal to x^1 near zero, with zero time derivative, and smoothly compactly supported in space. The resulting free solution satisfies $\partial_1\varphi_0(t_*, 0) = 1$. Choose a small plateau neighborhood U where $\partial_1\varphi_0 \geq 1/2$, and a unit-integral nonnegative test f there. Choose $g = 1$ near $\overline{U}$.

A compact smooth χ_ξ, supported after 0, can be chosen equal to one near the entire $\operatorname{supp} g$. Set $\xi = \chi_\xi\partial_1$. All derivatives of ξ vanish near $\operatorname{supp} g$, so $gK\xi = 0$. The scalar response has zero variation, while the coordinate response changes by ξ. Therefore

$$\Delta = -\int f\,\partial_1\varphi_0\,\mathrm{d}^4x \leq -\frac{1}{2}.$$

The cutoff of ξ occurs outside the plateau containing the observation. Its support is not contained in U.

Corollary (No higher-order repair of the fixed residual). *With $A_1^{(g)}$, the free input, and the larger-support identification fixed, no regular addition beginning at κ^2 makes the observable invariant under all those compact generators. Terms of positive $\hbar$-degree cannot cancel the nonzero $\kappa\hbar^0$ residual either.*

Proof. Equality of formal series with nonnegative powers is coefficientwise. Extract the coefficient of $\kappa\hbar^0$ and use

.

This is an existential obstruction to extending the theorem to the full compact class. It is not a claim that every generator outside the chosen U produces a nonzero residual. For example, additional generators supported in another part of $\{g = 1\}^\circ$ may also satisfy the cancellation.

The defect is classical, not a loop anomaly. Restricting the gauge domain does not refute the unrestricted obstruction.

Density covariance and the second-order intertwiner

Expansion of the metric pullback gives

$$h' = h + K\xi,$$

$$k' = k + \mathscr{L}_\xi h + K\zeta + \frac{1}{2}\mathscr{L}_\xi^2 \eta.$$

Holding k fixed while changing h by $K\xi$ is generally not this transformation.

Lemma (Plateau covariance of the density operator). *For an admitted actual diffeomorphism F, and hence coefficientwise for ,*

$$\mathcal{D}_g[F^*\gamma](F^*u) = F^*_{\mathrm{dens}}(\mathcal{D}_g[\gamma]u).$$

The density pullback is $F^*_{\mathrm{dens}} r = (\det DF)(r \circ F)$.

Proof. The inverse-metric density $\mathscr{A}_\gamma$ is a contravariant tensor density, and ρ_γ is a scalar density. Their coordinate transformation laws follow by matrix inversion and the determinant chain rule.

Because $F^*g = g$, the discrepancy between $F^*\mathscr{A}_g[\gamma]$ and $\mathscr{A}_g[F^*\gamma]$ is

$$(1 - g)(F^*\mathscr{A}_\eta - \mathscr{A}_\eta).$$

Inside U, $1 - g = 0$. Outside U, F and its derivative are the identity. The discrepancy therefore vanishes. The same argument applies to ρ_g.

For completeness, divergence of a vector density is natural: pair it against a compact scalar test, integrate by parts, and change variables by F. The transformed integral is exactly the integral of the pulled-back divergence.

Applying this fact to $\mathscr{A}_g[\gamma]^{\mu\nu}\partial_\nu u$ and adding the mass density proves . Formal expansion gives the coefficient identity.

This lemma concerns the full divergence-form operator. It does not delete the terms in , and by itself it is not the scalar intertwiner.

Proposition (Scalar and coordinate Cauchy intertwiners). *For $\xi, \zeta \in \mathfrak{g}_U$,*

$$\varphi_g[F_\kappa^*\gamma; \varphi_0] = F_\kappa^*\varphi_g[\gamma; \varphi_0] \bmod \kappa^3,$$

$$X_{F_\kappa^*\gamma} = X_\gamma \circ F_\kappa \bmod \kappa^3.$$

In coefficient form,

$$u'_{1,g} = u_{1,g} + X_\xi \varphi_0,$$

$$u'_{2,g} = u_{2,g} + X_\xi u_{1,g} + X_\zeta \varphi_0 + \frac{1}{2} X_\xi^2 \varphi_0,$$

$$w' \wedge \mu = w^\mu + \xi^\mu,$$

$$v' \wedge \mu = v^\mu + \xi^\nu \partial_\nu w^\mu + \zeta^\mu + \frac{1}{2}\xi^\nu \partial_\nu \xi^\mu.$$

The free input φ_0 is unchanged.

Proof. Lemma shows that the pulled-back scalar solves the transformed equation. The pullback is the identity near Σ_0, so all its prescribed Cauchy data agree with those of the transformed scalar assignment. Proposition proves equality.

The unswitched massless density equation is natural by the same change-of-variables argument, without the switch

discrepancy. Each pulled-back harmonic label has the prescribed initial data. Proposition therefore identifies it with the transformed coordinate solution. Expansion proves .

An operator audit of the density terms

Let V, W and V', W' be the operators before and after . Put

$$X = X_{\xi}, \quad Y = X_{\zeta} + \frac{1}{2}X_{\xi}^{2}, \quad D = D_{\xi}, \quad Z = D_{\zeta} + \frac{1}{2}D_{\xi}^{2}.$$

Expanding gives the off-shell identities

$$V' + P_{m}X = V + DP_{m},$$

$$W' + V'X + P_{m}Y = W + DV + ZP_{m}.$$

These retain the density divergence in D and the terms proportional to P_{m}.

One can verify the second scalar law without appealing further to a covariance slogan. Set $a = u_{1,g}$, $b = u_{2,g}$, and $b_{\mathrm{cand}} = b + Xa + Y\varphi_{0}$. Using $P_{m}a = -V\varphi_{0}$, $P_{m}b = -Va - W\varphi_{0}$, and ,

$$P_{m}b_{\mathrm{cand}} = -V'(a + X\varphi_{0}) - W'\varphi_{0}.$$

The candidate has zero Cauchy data because the gauge generators vanish near Σ_{0}. Uniqueness gives the second scalar law.

Theorem (Second-order plateau descent). *For arbitrary smooth h, k, the pointwise relational scalar and its fixed-label smearing satisfy*

$$\Phi_{g}[F_{\kappa}^{*}\gamma;\varphi_{0}] = \Phi_{g}[\gamma;\varphi_{0}] \bmod \kappa^{3}, \qquad \mathscr{O}_{f}[g](F_{\kappa}^{*}\gamma,\varphi_{0}) = \mathscr{O}_{f}[g](\gamma,\varphi_{0}) \bmod \kappa^{3}$$

under $\mathscr{G}_{U}$. In particular, $C_{1}[g]$ and $C_{2}[g]$ descend under this restricted formal action.

Proof. The coordinate intertwiner implies

$$Y_{F_{\kappa}^{*}\gamma} = F_{\kappa}^{-1} \circ Y_{\gamma} \bmod \kappa^{3}.$$

Composing with the scalar intertwiner gives

$$\varphi_g[F_\kappa^* \gamma; \varphi_0] \circ Y_{F_\kappa^* \gamma} = (\varphi_g[\gamma; \varphi_0] \circ F_\kappa) \circ F_\kappa^{-1} \circ Y_\gamma = \Phi_g[\gamma; \varphi_0] \bmod \kappa^3.$$

The fixed label density gives the smeared identity. Appendix checks the second coefficient directly.

For a pure-gauge pullback of the flat metric,

$$h = K\xi, \qquad k = K\zeta + \frac{1}{2}\mathscr{L}_\xi^2 \eta,$$

the first and second relational corrections vanish. The metric family $\eta + \kappa K\xi$ with $k = 0$ does not generally have this property: it omits part of the pullback.

The named plateau Einstein–scalar coupling jet

The off-shell intertwiner does not require gravitational equations. To state its intended on-shell restriction, fix the normalization

$$G_{\mu\nu}[\gamma] = \kappa^2 T_{\mu\nu}[\gamma, \varphi].$$

This is VII-A's normalization. A coefficient such as the 1/4 used in another action convention must not be transferred without rescaling the coupling.

Define

$$G[\eta + \kappa h + \kappa^2 k] = \text{kappaG}^{(1)}[h] + \kappa^2 (G^{(1)}[k] + G^{(2)}[h, h]) \bmod \kappa^3.$$

The differential definition is given in Appendix . The leading stress tensor is

$$T^{(0)}_{\mu\nu}[\varphi_0] = \partial_\mu \varphi_0 \partial_\nu \varphi_0 - \frac{1}{2}\eta_{\mu\nu}\left(\partial^\rho \varphi_0 \partial_\rho \varphi_0 + m^2 \varphi_0^2\right).$$

Definition (Plateau coupling jet). Let $\mathscr{J}_g^2$ consist of smooth tuples

$$(h, k, \varphi_0, u_{1,g}, u_{2,g})$$

with $P_m \varphi_0 = 0$, the scalar assignment , and

$$G^{(1)}[h] = 0, \qquad G^{(1)}[k] + G^{(2)}[h,h] = T^{(0)}[\varphi_0].$$

No zero-data condition is imposed on h or k. Their gravitational constraints are not replaced by zero-data wave evolution.

The metric equations are unswitched at this order, whereas the scalar equation is switched. On the plateau the scalar operator equals the unswitched curved density operator, so these are the Einstein–scalar coefficient equations there. Outside it, no nonlinear completion or switched gauge-fixed gravitational action is claimed.

A nonzero φ_0 is a coupling-expansion coefficient. It is not an assertion that (η, φ_0) is an exact nonzero-scalar Minkowski solution at nonzero coupling.

Proposition (Stability of the named jet). *The transformations and preserve $\mathscr{J}^2_g$. The relational coefficients therefore descend on its $\mathscr{G}_U$-orbit set.*

Proof. The scalar equations and data are preserved by Proposition .

For the metric, pullback preserves the Levi–Civita connection because it preserves torsion freedom and metric compatibility. It therefore preserves the curvature and Einstein tensor. Taking coefficients gives

$$G^{(1)}[h'] = G^{(1)}[h],$$

$$G^{(1)}[k'] + G^{(2)}[h', h'] = G^{(1)}[k] + G^{(2)}[h,h] + \mathscr{L}^{(1)}_{\mathrm{xiG}}[h].$$

The last term vanishes on . The leading scalar remains φ_0, so its order-two source is unchanged. The final assertion follows from Theorem .

Proposition (A nonempty sourced massless subclass). *For $m = 0$, let $a_\mu \neq 0$ be constant and put*

$$\varphi_0 = a_\mu x^\mu, \qquad h = 0, \qquad T_{\mu\nu} = a_\mu a_\nu - \frac{1}{2}\eta_{\mu\nu} a_\rho a^\rho, \qquad T = \eta^{\mu\nu} T_{\mu\nu}.$$

Define

$$\sigma(x) = \left(-\frac{1}{4}T_{\alpha\beta} + \frac{1}{12}\eta_{\alpha\beta}T\right)x^\alpha x^\beta, \qquad k_{\mu\nu} = 2\sigma\eta_{\mu\nu}.$$

Together with the assigned switched scalar coefficients, this is a nonzero-source member of $\mathscr{J}_g^2$.

Proof. The leading scalar is free and its stress is the displayed constant nonzero tensor. Direct linearized curvature gives

$$G^{(1)}[2\sigma\eta]_{\mu\nu} = -2\partial_\mu\partial_\nu\sigma + 2\eta_{\mu\nu}\mathrm{Box}_\eta\,\sigma.$$

Here

$$\partial_\mu\partial_\nu\sigma = -\frac{1}{2}T_{\mu\nu} + \frac{1}{6}\eta_{\mu\nu}T, \qquad \mathrm{Box}_\eta\,\sigma = \frac{1}{6}T.$$

Thus $G^{(1)}[k] = T$. The scalar coefficients exist by Proposition ; $u_{1,g} = 0$ and $u_{2,g} = -\mathrm{E}_0\mathscr{Q}^{(0)}_{gk}\varphi_0$.

This polynomial local example imposes neither asymptotic flatness nor compact metric Cauchy data. It proves nonvacuity of the stated equations, not Einstein dynamics derived from records.

Causal support, switch equality, and classical comparison

For a nonzero test f, define its truncated flat past

$$\mathscr{D}_f = J_\eta^-(\mathrm{supp}\,f) \cap \{t \geq 0\}.$$

Because supp fSubset $\mathscr{D}_+^\circ$, this set is compact, lies inside the supported laboratory, and may meet Σ_0.

Proposition (Coefficientwise causal dependence). *For fixed free input* φ_0*, the coefficients of* $\mathscr{O}_f[g]$ *through order two depend on* h, k, g *only through their restrictions to every neighborhood of* $\mathscr{D}_f$.

In particular, their functional support in the metric variables is contained in $\mathscr{D}_f$*. Equality with all of* $\mathscr{D}_f$ *is not asserted.*

Proof. First-order scalar and coordinate solutions at y use only their sources in the truncated past of y. All coefficient operators are local differential operators.

A nested second-order term has an intermediate point z in the past of y. Every further point affecting that term is in

the past of *z*, hence in the past of *y*. The same reasoning applies to *v*, including $\mathscr{D}_h^{(0)} w$. Taking the union over $y \in \operatorname{supp} f$ proves the statement. Agreement on a neighborhood includes the derivatives occurring in these formulas.

The developing map pulls each causal segment in this argument back to a $\bar{g}$-causal segment. Consequently the local metric dependence is contained in the prescribed conical past. This does not identify functional dependence with operational signalling, or supply the full global conical past.

Proposition (Equality under causal switch agreement). *Fix h, k, φ_0 and the harmonic Cauchy prescription. If $g_1 = g_2$ on a neighborhood of $\mathscr{D}_f$, then*

$$\mathscr{O}_f[g_1] = \mathscr{O}_f[g_2] \bmod \kappa^3.$$

Proof. The scalar coefficient operators agree there, including their switch derivatives. Proposition gives identical scalar evaluations on $\operatorname{supp} f$. The coordinates do not depend on the switch.

Agreement only near $\operatorname{supp} f$ is insufficient. At first order,

$$A_1^{(g_2)} - A_1^{(g_1)} = -\mathrm{E}_m \mathscr{D}^{(m)}_{(g_2 - g_1)h} \varphi_0.$$

The following is an explicit example, not merely a support warning.

Proposition (Preparation memory despite a common plateau). *There are two admitted switches sharing an observation plateau, the same metric coefficients, the same free scalar, and the same harmonic prescription, for which $C_1[g_1] \neq C_1[g_2]$. The example can be chosen in the massless coupling-jet class.*

Proof. Take $m = 0$, $\varphi_0 = t$, and $h = 2\eta$. Then $A(h) = 2\eta$, $\mathscr{C}[h] = 0$, and $w = 0$. Choose a compact spatial cutoff equal to one near the spatial projection of $\mathscr{D}_f$. On that causal region let $g_i(t, x) = q_i(t)$, with q_i compactly supported after 0 and equal to one near all observation times.

Since

$$V_{g_i}[h]t = -2\dot{q}_i(t),$$

the zero-data solution is

$$u_{1,g_i}(t,x) = -2\int_0^t q_i(s)\,\mathrm{d}s \quad \text{on}\,\mathscr{D}_f.$$

Choose $q_2 = q_1 + \varepsilon p$, where $p \geq 0$ is a nonzero smooth pulse strictly before the observation plateau and supported where $q_1 = 0$. Choose $\varepsilon > 0$ small enough to keep $0 \leq q_2 \leq 1$. For $\int f = 1$,

$$C_1[g_2] - C_1[g_1] = -2\varepsilon\int p(s)\,\mathrm{d}s \neq 0.$$

To impose the metric equations, choose k from for $\varphi_0 = t$. The constant h has vanishing linear and quadratic Einstein coefficients, so the same k works for both switches.

Thus late agreement of sources or local operators is not agreement of their responses. The comparison with XVI-B is methodological only; its prepared-source witness is not used here.

A unique comparison, rather than false equality

Fix a metric jet and two switches. Write

$$\mathcal{D}_i = P_m + \kappa V_i + \kappa^2 W_i.$$

Let Sol_i be its formal scalar solution space through order two, with arbitrary smooth formal Cauchy data. Define

$$\mathrm{G}_i = \mathrm{E}_m - \kappa \mathrm{E}_m V_i \mathrm{E}_m + \kappa^2\big(\mathrm{E}_m V_i \mathrm{E}_m V_i \mathrm{E}_m - \mathrm{E}_m W_i \mathrm{E}_m\big) \bmod \kappa^3.$$

Multiplication gives $\mathcal{D}_i \mathrm{G}_i = \mathrm{id} \bmod \kappa^3$ on smooth sources. Every coefficient output has zero Cauchy data.

Proposition (Classical Cauchy comparison and cocycle). *The map*

$$r_{21}[\gamma]\psi = \psi - \mathrm{G}_2(\mathcal{D}_2 - \mathcal{D}_1)\psi \bmod \kappa^3$$

takes Sol_1 *to* Sol_2 *and preserves formal Cauchy data. For each source solution it is the unique target solution with those data. Hence it is the unique map between these solution spaces with those properties, and*

$$r_{32} r_{21} = r_{31}, \qquad r_{12} r_{21} = \mathrm{id} \bmod \kappa^3.$$

If a gauge transformation is supported in a common plateau,

$$r_{21}[F_\kappa^* \gamma](F_\kappa^* \psi) = F_\kappa^*(r_{21}[\gamma]\psi) \bmod \kappa^3.$$

Proof. For $\mathcal{D}_1 \psi = 0 \bmod \kappa^3$,

$$\mathcal{D}_2 r_{21}\psi = \mathcal{D}_2\psi - (\mathcal{D}_2 - \mathcal{D}_1)\psi = \mathcal{D}_1\psi = 0 \bmod \kappa^3.$$

The correction has zero data. Coefficientwise uniqueness follows successively from Lemma . The composites in the cocycle assertions solve the same final equation with the same initial data, so uniqueness proves them.

For , both sides solve the transformed target equation by plateau covariance and have the same Cauchy data, since the transformation is the identity near Σ_0. Apply uniqueness again.

The comparison also transports the corresponding $\mathscr{J}^2_{g_1}$ to $\mathscr{J}^2_{g_2}$, since it changes neither the metric coefficients nor the leading scalar source.

For an observable B_1 on Sol_1, its transport is

$$\alpha^{\mathrm{cl}}_{21} B_1 = B_1 \circ r_{12}.$$

This need not be the unchanged evaluation formula on Sol_2. Proposition already detects that distinction.

The map is classical. It does not construct the quantum algebraic cutoff comparison, which requires an admitted product domain and additional locality hypotheses [9, 10].

An explicit finite table from actual coupling jets

We now make the finite encoding nonvacuous. Specialize to $m = 0$, a unit-integral $f \geq 0$ supported in a small cylindrical plateau U, and

$$g(t, x) = q(t)\chi(x),$$

where $\chi = 1$ near the spatial projection of $\mathscr{D}_f$ and $q = 1$ near the observation times. All cutoffs are compactly supported within the laboratory.

Let $\varphi_{0} = t$, let $k = 2\sigma\eta$ be the tensor of , and for real λ put

$$h_{\lambda} = 2\lambda\eta.$$

Here

$$T_{00} = \frac{1}{2}, \qquad T_{ij} = \frac{1}{2}\delta_{ij}, \qquad \sigma = -\frac{5t^{2} + |x|^{2}}{24}.$$

The metric coefficients satisfy for every λ: h_{λ} is constant, and $G^{(1)}[k] = T^{(0)}[t]$.

Set

$$Q(t) = \int_{0}^{t} q(s)\,\mathrm{d}s, \qquad J(t) = \int_{0}^{t} q(s)^{2}\,\mathrm{d}s.$$

For constant conformal h_{λ}, direct substitution in gives

$$A(h_{\lambda}) = 2\lambda\eta, \qquad B(h_{\lambda}) = 0, \qquad w = 0, \qquad v = \mathrm{E}_{0}\,\mathscr{C}[k].$$

On $\mathscr{D}_{f}$, zero-data uniqueness gives

$$u_{1,g} = -2\lambda Q(t), \qquad u_{2,g} = 4\lambda^{2}J(t) - \mathrm{E}_{0}\mathscr{Q}^{(0)}_{gk}t.$$

For example, in the temporally homogeneous portion, $V_{g}[h_{\lambda}]u = -2\lambda(\dot{qu})'$; inserting $u_{1,g}$ proves the $4\lambda^{2}J$ term. The cutoff outside $\mathscr{D}_{f}$ cannot affect these evaluations.

Define the finite real calibration constants

$$b_{1} = -2\int f Q(t)\,\mathrm{d}^{4}x < 0,$$

$$b_{2} = 4\int f J(t)\,\mathrm{d}^{4}x > 0,$$

$$\beta = \int f\big(-\mathrm{E}_{0}\mathscr{Q}^{(0)}_{gk}t - v^{0}\big)\mathrm{d}^{4}x.$$

Thus

$$C_{1}[g](h_{\lambda}, k; t, f) = \lambda b_{1}, \qquad C_{2}[g](h_{\lambda}, k; t, f) = \beta + \lambda^{2}b_{2}.$$

These are evaluations of actual members of the named coupling jet, not merely off-shell placeholders.

For a larger-support generator $\xi_{\mathrm{out}} = \chi_{\mathrm{out}}\partial_t$, with $\chi_{\mathrm{out}} = 1$ near $\operatorname{supp} g$,

$$gK\xi_{\mathrm{out}} = 0, \qquad \Delta_{\mathrm{out}} = -\int f X_{\xi_{\mathrm{out}}}\, t\, \mathrm{d}^4x = -1.$$

Choose also any nonzero $\xi_{\mathrm{in}} \in \mathfrak{g}_U$. The second-order covariance residual of its complete metric pullback is exactly zero.

Use four samples $\lambda_a = a$, $a = 0, 1, 2, 3$, and four settings $s = 0, 1, 2, 3$:

$$b_{sa} = \begin{cases} a\, b_1, & s = 0 \quad \text{(first plateau coefficient)}, \\ \beta + a^2 b_2, & s = 1 \quad \text{(second plateau coefficient)}, \\ -1, & s = 2 \quad \text{(larger-support first-order gap)}, \\ 0, & s = 3 \quad \text{(restricted second-order covariance residual)}. \end{cases}$$

Rows $0, 1$ are descended evaluations. Row 2 records the failure of a different, larger-support identification; it is not relabelled as a descended observable. Row 3 records an identity already proved for the restricted group.

Finite sample logic

If defined functions $q, n_1, \ldots, n_L$ are sampled at finitely many points, yielding a vector q_S and a column matrix N_S, then exactly one alternative holds:

$$q_S = N_S c \text{for some} c, \quad \text{or} \quad z^{\mathrm{T}} N_S = 0, \quad z^{\mathrm{T}} q_S \neq 0 \text{for some} z.$$

To prove this, project q_S orthogonally onto $\operatorname{im} N_S$. If the residual is nonzero, use it as z.

A finite fit is not a global identity. For example, $q(x) = x$ and $n_1(x) = 1$ fit at $x = 0$ but not globally. Injective evaluation on the stated finite-dimensional function span is sufficient to promote a fit to an identity, because it annihilates no nonzero difference. It is not necessary: $q = 1, n_1 = 1, n_2 = x$ has a global fit even though evaluation at 0 is noninjective.

These are finite-table distinctions comparable with II and II-B. They do not provide a complete quantum counterterm catalogue or a renormalization separator.

Finite encoding and the destructive-clock instrument

Let the sample payload be two qubits,

$$\mathscr{H}_X = \mathbb{C}^4, \qquad \mathrm{A}_s = \sum_{a=0}^{3} b_{sa} \mathrm{proj}\, a_X.$$

The sample basis labels classical entries of ; it is not a one-particle basis of a scalar or gravitational field.

Choose a declared real calibration

$$\Lambda > 2 \max_{s,a} |b_{sa}|.$$

Define a binary table probe by

$$E_{s,y} = \frac{1}{2}(I + y\mathrm{A}_s/\Lambda), \qquad M_{s,y} = E_{s,y}^{1/2}, \qquad y = \pm 1.$$

These satisfy

$$\sum_y M_{s,y}^\dagger M_{s,y} = I, \qquad \sum_y \Lambda y E_{s,y} = \mathrm{A}_s.$$

On input proj a at setting s, the score Λy has mean b_{sa}.

The finite constants are prescribed real metadata. Their appearance in a finite model does not assert that arbitrary real calibration data have been obtained exactly in finite physical precision.

Clock and complete recorded map

Let the clock consist of two qubits,

$$\mathscr{H}_C = \mathbb{C}^4, \qquad \{|\tau_s\rangle\}_{s=0}^{3} \text{orthonormal}, \qquad P_s = |\tau_s\rangle\langle\tau_s|.$$

Apply a fixed basis change $B_C|\tau_s\rangle = |s\rangle$, then destructive computational readout of both clock names. Put

$$D_s = \langle\tau_s|_C \otimes I_X.$$

The clock record is R, and the score record is Y.

Theorem (Complete destructive readout). *The clock channel is*

$$\mathscr{M}_C(Z) = \sum_s \operatorname{proj} s_R \otimes D_s Z D_s^\dagger$$

$$= \sum_s \operatorname{proj} s_R \otimes \operatorname{Tr}_C [(P_s \otimes I_X) Z (P_s \otimes I_X)].$$

The clock-selected table instrument is

$$\mathscr{I}(Z) = \sum_{s,y} \operatorname{proj} s_R \otimes \operatorname{proj} y_Y \otimes M_{s,y} D_s Z D_s^\dagger M_{s,y}^\dagger.$$

Both maps are completely positive and trace preserving, including every untouched reference extension.

For $\sigma_s = D_s \rho D_s^\dagger$ *and* $p_s = \operatorname{Tr} \sigma_s > 0$,

$$\mathbb{E}[\Lambda y \mid s] = \frac{\operatorname{Tr}(A_s \sigma_s)}{p_s}.$$

The measured clock names are consumed. No quantum clock factor is returned.

Proof. The clock Kraus operators are $|s\rangle_R \otimes D_s$, and their squared moduli sum to $\sum_s P_s \otimes I_X = I_{CX}$. Expanding Z in the τ-basis proves the partial-trace expression.

For the full instrument use

$$L_{s,y} = |s\rangle_R \otimes |y\rangle_Y \otimes M_{s,y} D_s.$$

Equation gives $\sum_{s,y} L_{s,y}^\dagger L_{s,y} = I_{CX}$. These are operator identities, so tensoring with any reference identity proves the complete statements. The score formula follows from . The output interface contains R, Y, X, not quantum C.

A finite probe realization is explicit. Allocate one fresh qubit A, apply the isometry

$$\psi \operatorname{longmapsto} \sum_{y=\pm 1} |y\rangle_A \otimes M_{s,y} \psi,$$

extend it to a unitary on the finite input space with the specified blank ancilla, then destructively read A.

Completeness proves that the displayed map is isometric. Its unitary extension follows by completing orthonormal bases.

This is an abstract finite unitary permission, not a compiled hardware circuit or a compact field–probe coupling.

Proposition (Clock limits and observation boundaries). *The following hold:*

1. *$\mathscr{M}_C$ has no universal left inverse.*

2. *Its record marginal alone does not certify the residual.*

3. *Discarding its clock record gives* $\mathrm{Tr}_R \mathscr{M}_C(Z) = \mathrm{Tr}_C Z$*, including references.*

4. *No finite matrices obey* $[T_C, H_C] = iI_C$.

5. *A record-only channel followed by a preparation decoder cannot recover every input of a quantum code of dimension at least two.*

Proof. With the same payload, the two clock states

$$(|\tau_0\rangle + |\tau_1\rangle)/\sqrt{2}, \qquad (|\tau_0\rangle - |\tau_1\rangle)/\sqrt{2}$$

have identical destructive outputs, proving (i). Inputs $P_0 \otimes \rho_X$ and $P_0 \otimes \rho_X^{'}$ have the same deterministic record and different residuals, proving (ii). Summing diagonal clock blocks proves (iii). Taking traces of the proposed commutator proves (iv).

For (v), a channel factoring through a classical register has measure-and-prepare form

$$\rho \mathrm{longmapsto} \sum_j \mathrm{Tr}\,(E_j \rho)\tau_j.$$

On one half of a maximally entangled code-reference state, its output is separable. A separable state has overlap at most $1/d < 1$ with that maximally entangled state: on a product state the overlap is $\mathrm{Tr}\,(\sigma^{\mathrm{T}}\tau)/d \le 1/d$, and the inequality is preserved by convex combinations. It cannot be the identity channel.

Record agreement is weaker than residual-instrument agreement. For example, identity and dephasing have the same one-outcome record law but send proj + to different states. The complete instrument, not just its effects, is our comparison target. These distinctions parallel VII-E, VII-G, and En09-A [18, 19, 20, 21, 22]. No stationarity or clock-covariance hypothesis is imposed here; En09-A's additional relational-evolution interpretation is not

claimed.

Three declared dictionary maps

Choose distinct geometric history times

$$\theta_0 < \theta_1 < \theta_2 < \theta_3$$

and a sender port $x_A \in \mathscr{V}$. The dictionary is:

1. *Clock map:* $s \mapsto (\theta_s, \text{rowsof})$, with history event $\kappa(s) = (\theta_s, x_A)$. The readout event is specified independently.

2. *Rod map:* each live carrier has an assigned spatial port $x(a)$, and rod coordinates $\chi(x(a))$.

3. *Causal map:* every complete scheduled dependency edge, including classical control, is assigned future-causal input and output ports in $(M, \bar{g})$. These maps are supplied, not inferred from probabilities.

Proposition (Calibration and geometric nonuniqueness). *At a fixed event e, exact event calibration*

$$p_s > 0 \Rightarrow \theta_s = T(e)$$

with distinct labels forces one deterministic outcome, or admits no normalized input if $T(e)$ *is not a label.*

The abstract instrument does not uniquely determine its history times, rod frame, or the global conical deficit.

Proof. Distinctness permits at most one supported index, and total probability is one. If $p_s = 1$, positivity implies support in $P_s \otimes I_X$.

For nonuniqueness, retain every finite matrix and reassign the history labels, or rotate and translate the local rod frame with corresponding port coordinates. Different prescribed deficits also admit isometric small regular laboratories carrying the same finite instrument. The finite record law is unchanged.

A clock-basis change generally changes the clock observable; it is not automatically a spacetime coordinate transformation. Likewise, consuming the clock does not remove T or $\mathscr{W}$.

A controlled finite-compression limit

Proposition (Fixed-table approximation). *Suppose finite diagonal tables* $\mathrm{A}_s^{(n)}$ *satisfy*

$$\varepsilon_n = \max_s \left\| \mathrm{A}_s^{(n)} - \mathrm{A}_s \right\| \to 0.$$

Use a common Λ *such that every effect considered has spectrum in* $[1/4, 3/4]$. *The corresponding complete instruments satisfy*

$$d_\diamond(\mathscr{I}_n, \mathscr{I}) \le \min\{1, 4\varepsilon_n/\Lambda\} \to 0, \qquad d_\diamond = \frac{1}{2}\|\cdot\|_\diamond.$$

Smooth convergence of the classical inputs on common compact dependency neighborhoods gives such entrywise table convergence.

Proof. For diagonal positive matrices with spectra in $[1/4, 3/4]$, the scalar square-root identity gives

$$\left\| M_{s,y}^{(n)} - M_{s,y} \right\| \le \frac{\varepsilon_n}{2\Lambda}.$$

For contraction Kraus operators,

$$\left\| \mathrm{Ad}_L - \mathrm{Ad}_{\widehat{L}} \right\|_\diamond \le 2 \left\| L - \widehat{L} \right\|,$$

by inserting and subtracting $L Z \widehat{L}^{\dagger}$, also after a reference extension. Sum over the eight recorded branches and divide by two to obtain .

The classical continuity assertion follows from Lemma , finite differentiation, multiplication, and compact integration in the explicit coefficient formulas.

The norm and channel language are standard [12]; the needed estimate has been proved here. The limit concerns one fixed finite catalogue. It is not a finite-dimensional one-particle space, a finite-qubit field instrument, or a continuum-field limit.

No acquisition map from an unknown scalar–metric configuration to $\mathscr{H}_X$ has been supplied. The returned finite

word does not determine an arbitrary real coefficient exactly in one shot. Its scored mean realizes a declared finite evaluation. Local field measurements require a separately specified coupling and dynamical comparison [11].

Schedule locality and causal certificate transport

A complete finite schedule includes every quantum input, classical control, record, guard, and routing decision actually used. At each tick the complete channel factors over disjoint declared blocks.

For terminal region Y, define backward block sets by

$$N_n(Y) = Y, \qquad N_s(Y) = \bigcup \{B : B \text{is a tick-sblock and} B \cap N_{s+1}(Y) \neq \varnothing\}.$$

Theorem (Complete schedule locality). *The schedule channel obeys*

$$\Phi^*(\mathscr{A}(Y)) \subseteq \mathscr{A}(N_0(Y)).$$

Hence its output on Y, together with any untouched reference E, depends only on the input reduction to $N_0(Y)E$.

If every scheduled dependency edge has future-causal ports in $(M, \bar{g})$*, scheduled ancestors lie in the output's metric past. Operational intervention influence is contained in scheduled ancestry, but need not equal it.*

Proof. On a block disjoint from the current backward support, the observable is the identity. A trace-preserving channel's adjoint fixes that identity. A block that meets the support can enlarge it only within its declared union. Backward induction proves the algebra inclusion.

Equal input reductions therefore give equal expectations for every output observable, including referenced observables. Causal transitivity gives metric containment along each dependency path.

Replacing an operation outside the backward region acts only on identity factors and cannot change the output. Strictness is possible: a scheduled input to a replacement channel is an ancestor even though that channel ignores it.

Thus scheduled reachability, intervention influence, and the supplied metric relation are three different objects. This is the split compared with VII-J, En03-A, and En05-A. It is independent of the scalar intertwiner proof.

A target-adapted route

Choose sender and receiver $x_A, x_B \in \mathscr{V}$ with

$$L = |\chi(x_B) - \chi(x_A)| > 0,$$

and a straight developed segment inside the regular convex laboratory. Install sites

$$x_j = \chi^{-1}\Big(\chi(x_A) + \frac{j}{n}(\chi(x_B) - \chi(x_A))\Big), \qquad j = 0, \dots, n.$$

Each site has a two-qubit payload register X_j. Initialize $X_1, \dots, X_n$ in a fixed pure blank ω.

At hop j, transmit the contents of X_{j-1} to X_j and the blank contents back to X_{j-1}, giving the endpoint SWAP channel. Allocate duration

$$\delta T = \frac{L}{nc}$$

to that hop. Both directions have causal ports; equivalently, this is an admitted finite communication block with all input-output dependencies causally certified.

Theorem (Complete transport on the prescribed route). *After hop j, every payload-reference input has state*

$$\rho_{X_j E} \otimes \mathrm{bigotimes}_{\mathrm{substack}\, 0 \le i \le n}$$

The logical channel from X_0 to X_n is the identity, including all references. Arrival is at $T_{\mathrm{d}} + L/c$. All communication dependencies remain in the prescribed cone.

Proof. SWAP transfers the complete input factor and every one of its reference correlations into the next independent blank. Induction proves the displayed state identity.

Each hop has length $L/n = c\delta T$. The developed connecting paths are null, and convexity keeps them inside the chart. Their pullbacks are therefore causal in $(M, \bar{g})$.

Read the clock before departure. The transported payload may then be correlated with both its classical code R and an untouched reference E. The theorem applies with RE as the reference system.

To perform the code-selected score probe remotely, reserve a two-bit classical register at each site and forward the code along the same causal hops. Apply $M_{s,y}$ only after both payload and code arrive. Copying a diagonal classical code is not cloning an unknown quantum state.

This composition equals , with the payload relocated. It does not assume instantaneous remote record control.

Proposition (No zero-duration remote SWAP). *A complete identity transmission or SWAP between distinct spacelike ports cannot be an admitted zero-duration remote operation in the causal contract.*

Proof. Changing a sender input between two orthogonal states changes the receiver output under identity transmission or SWAP. There is operational influence. The causal contract requires a future-causal dependency for that influence, whereas distinct simultaneous spatial ports are spacelike.

For n hops the laboratory resource ledger is

$l\|l$item	charge
hline payload storage	$n+1$two-qubit registers
clock	2qubits, then consumed
table probe	1fresh qubit after clock consumption
payload communication	$n$endpoint SWAPs
classical route storage	$2(n+1)$bits
score record	1bit

With all route sites reserved in advance,

$$Q_{\mathrm{lab}} \le 2(n+1)+2, \qquad C_{\mathrm{lab}} \le 2(n+1)+1.$$

External reference storage is charged separately.

The exact theorem uses a target-adapted installed chain, not exact null attainment on every endpoint of one fixed lattice. It supplies no continuous relativistic Hamiltonian for a spatially extended SWAP. Its model is a finite network of admitted causal communication channels, not a continuum field simulation.

For implemented compatible channels, replacing one factor at a time and using complete trace-norm contraction gives

$$d_{\diamond}(\widetilde{\Phi}, \Phi) \le \min\left\{1, \varepsilon_{\mathrm{enc}} + \sum_j \varepsilon_j + \varepsilon_{\mathrm{dec}}\right\}.$$

This is a conditional error ledger, not reported experimental performance or an executed compilation.

Release and limits of the construction

Theorem (VII-A-ST local Grade S release). *On the supported presentation and finite interface above:*

1. *the specified action-level switch and unswitched harmonic Cauchy prescription define unique scalar and coordinate coefficients through second order;*

2. *the first-order plateau cancellation and second-order intertwiner hold under $\mathscr{G}_U$, with the full transformation of k;*

3. *the larger compact class retains the exact defect , a negative witness, and the coefficientwise no-higher-repair obstruction;*

4. *the named plateau coupling jet is stable and has an explicit nonempty sourced subclass;*

5. *metric and switch dependence obey the truncated-past bound; causal switch agreement gives equality, while a common observation plateau alone does not;*

6. *the Cauchy-data-preserving classical comparison map is unique and satisfies its cocycle and common-plateau equivariance;*

7. *the finite evaluation table has a complete destructive instrument, declared dictionaries, a controlled compression limit, and reference-preserving causal transport;*

8. *no quantum product, quantum Ward identity, radiative coefficient, or counterterm-separation certificate is supplied. Items (i)–(vii) satisfy Definition . The repair remains plateau-restricted.*

Proof. Propositions and give (i). Theorem , Lemma , and Theorem give (ii).

Propositions , , and Corollary give (iii). Propositions and give (iv).

Propositions , , and prove (v). Proposition proves (vi). Sections – prove (vii).

Every field-theoretic construction used in these proofs is a classical smooth coefficient construction. The

additional quantum objects named in (viii) have not been defined or evaluated here. This is a release limit, not a theorem excluding all future constructions.

What is added, and what is not a novelty claim

The classical plateau intertwiner and larger-support defect are those of VII-A [1]. The additional contribution is their supported conical realization, together with:

• a domain on which no global conical Cauchy premise is needed;

• an explicit separation of the apparatus metric from the formal metric input;

• a sourced finite table with nontrivial first- and second-order entries;

• a complete finite readout and a quantitative instrument-level approximation;

• a causal route carrying both the payload and its classical control record. The possible usefulness is that a correct restricted identity and a surviving unrestricted failure can be carried through one operational interface without confusing either with a quantum anomaly or a field measurement.

Quantum and microlocal boundaries

A classical density identity is not a quantum Master Ward identity. It neither supplies time-ordered products nor classifies their renormalization freedom. The general retarded-product and locally covariant frameworks retain their own admission hypotheses [10, 9].

For a smooth multiplier g,

$$\mathrm{WF}(gu) \subseteq \mathrm{WF}(u),$$

with local equality where $g \neq 0$, by multiplication with the smooth reciprocal there. That elementary observation does not construct the retarded quantum coefficient or remove the finite-initial-surface singularities discussed in the comparison records [18].

In particular:

• VII-B, VII-C, VII-D, and VII-I concern separate sharp admission, product, finite-part, and finite-width questions. The present intertwiner does not select their product domains, remove a logarithmic triple, or turn a finite part into an algebra.

• VII-H's free susceptibility is not $C_2[g]$ and is not the inherited characteristic coefficient.

• IX-A through IX-E, X-G, and XI-G address different carriers, variational questions, or free-shell classes. No missing nonlocal one-loop product is defined here.

The quantum certificate therefore remains **RG-open**. The finite table in Section is not an evaluated quantum response matrix. Finite linear algebra cannot define a missing distributional product.

Named non-identifications

The following documentary separations are retained:

• III's four equation spaces and its unconstructed sourced successor are not identified with $\mathscr{J}_g^2$. The retained metric equations here are unswitched.

• VII-F's three-to-six particle slicing event is not this plateau and is not a dynamical source. The defect of our background is the worldsheet $\mathscr{W}$.

• VIII-A through VIII-C do not select our prescribed deficit. Symmetry, conservation, and zero trace are not a derivation of Einstein dynamics.

• Em02-E, XX-A, and XIX-A keep a relational lapse, harmonic-coordinate coefficients, clock prescriptions, and event-time labels distinct.

• En08-A's scheduler consistency does not select the cone. En08-B's null-boundary approximation is not the exact installed chain proved above.

• IV and IV-B's represented readouts have their own completion and apparatus permissions. A timestamp is not a compact causal realization of a global apparatus, and a Ramsey contrast is not automatically a field measurement.

• Oai282-A's finite local Ward residual uses its own improvement data. It is not this classical intertwiner and is not a gravitational quantum Ward identity.

• The OpenAI catalogue is not a premise or a verification of this construction. No family supplies the cone, plateau, or clock. A static area law is not this intertwiner or a Page curve.

• The Hawk, Psy, and Em packet sheets named in the supplied dossier are not identified with this plateau scalar.

Analytical stops and standing refusals

We do not alter the historical H2 verdict of XIV-H. The narrower internal amplitude constructed at I2 in XIV-I must nevertheless be acknowledged: it is not withdrawn by calling the full characteristic programme unresolved. That internal amplitude is not the missing full joint map at I3/J2.

No result here closes that joint map, its remainder and extension obligations, or its quantum coefficient admission. ``XV-B is not opened'' means that the downstream quantum admission exit is not activated; it does not deny the existence of a technical manuscript with that identifier.

XVI-N is not discharged. Within the XVI-O prescription and the scope of this release,

$$O.1 = \text{texttt detokenize}\, NOT_C LOSED.$$

Separately scoped subsector reports with enlarged prescriptions do not update that statement or admit the inherited insertion.

The construction is not spacetime emergence, Grade E, a global conical Cauchy theorem, an intrinsic cone field theory, Einstein dynamics derived from records, quantized relational time without external scheduling, a Page curve, an island, an interior, an ultraviolet completion, or an interacting Hilbert-space construction.

The clock encoding is not the geometric time axis. A complete channel does not specify work, heat, a bath, reset cost, or the physical fate of all implementation degrees of freedom. No quantum field coefficient is admitted and no compilation is asserted.

appendix

Direct second-order cancellation

Write

$$d^{\mu} = w^{\nu}\partial_{\nu} w^{\mu} - v^{\mu}.$$

From ,

$$d'^{\wedge}\mu = d^{\mu} + w^{\nu}\partial_{\nu}\xi^{\mu} + \frac{1}{2}\xi^{\nu}\partial_{\nu}\xi^{\mu} - \zeta^{\mu}.$$

Substitute this, $w' = w + \xi$, and the scalar transformations in .

Terms differentiating $u_{1,g}$ cancel between $X_{\xi}u_{1,g}$ and the changed transport term. Terms proportional to $\partial_{\mu}\varphi_{0}$ have coefficient

$$\zeta^{\mu} + \frac{1}{2}\xi^{\nu}\partial_{\nu}\xi^{\mu} - (w^{\nu} + \xi^{\nu})\partial_{\nu}\xi^{\mu} + w^{\nu}\partial_{\nu}\xi^{\mu} + \frac{1}{2}\xi^{\nu}\partial_{\nu}\xi^{\mu} - \zeta^{\mu} = 0.$$

The remaining Hessian coefficient is the symmetric contraction of

$$\frac{1}{2}\xi^{\mu}\xi^{\nu} - (w^{\mu} + \xi^{\mu})\xi^{\nu} + \frac{1}{2}\left(w^{\mu}\xi^{\nu} + \xi^{\mu}w^{\nu} + \xi^{\mu}\xi^{\nu}\right),$$

which vanishes against $\partial_{\mu}\partial_{\nu}\varphi_{0}$. Thus $A_{2}^{(g)'} = A_{2}^{(g)}$ directly.

This check requires both the inverse-coordinate displacement $w \cdot \partial w - v$ and the quadratic Taylor term. Omitting either would invalidate the cancellation.

Explicit Einstein-tensor coefficient convention

For a symmetric h, set

$$H_{\mu\nu\sigma} = \partial_{\mu} h_{\nu\sigma} + \partial_{\nu} h_{\mu\sigma} - \partial_{\sigma} h_{\mu\nu},$$

$$\Gamma^{\rho}_{1\mu\nu} = \frac{1}{2}\eta^{\rho\sigma}H_{\mu\nu\sigma}, \qquad \Gamma^{\rho}_{2\mu\nu} = -\frac{1}{2}h^{\rho\sigma}H_{\mu\nu\sigma}.$$

Define

$$R_{1,\mu\nu} = \partial_\rho \Gamma^\rho_{1\mu\nu} - \partial_\nu \Gamma^\rho_{1\mu\rho},$$

$$R_{2,\mu\nu} = \partial_\rho \Gamma^\rho_{2\mu\nu} - \partial_\nu \Gamma^\rho_{2\mu\rho}$$

$$+\Gamma^\rho_{1\rho\lambda}\Gamma^\lambda_{1\mu\nu} - \Gamma^\rho_{1\nu\lambda}\Gamma^\lambda_{1\mu\rho}.$$

Then

$$G^{(1)}[h]_{\mu\nu} = R_{1,\mu\nu} - \frac{1}{2}\eta_{\mu\nu}\eta^{ab}R_{1,ab},$$

$$G^{(2)}[h,h]_{\mu\nu} = R_{2,\mu\nu} - \frac{1}{2}\eta_{\mu\nu}\left(\eta^{ab}R_{2,ab} - h^{ab}R_{1,ab}\right)$$

$$-\frac{1}{2}h_{\mu\nu}\eta^{ab}R_{1,ab}.$$

These are obtained by expanding the Christoffel and Ricci formulas with the displayed Ricci convention. Terms linear in k give $G^{(1)}[k]$.

As a direct check,

$$G^{(1)}[2\sigma\eta]_{\mu\nu} = -2\partial_\mu\partial_\nu\sigma + 2\eta_{\mu\nu}\mathrm{Box}_\eta\,\sigma.$$

Also,

$$\partial^\mu T^{(0)}_{\mu\nu}[\varphi_0] = (P_m\varphi_0)\partial_\nu\varphi_0 = 0.$$

This necessary conservation law does not imply that arbitrary zero metric Cauchy data satisfy the gravitational constraints.

Prescription and scope audit

Initial data. Every use of $\mathrm{E}_m P_m = \mathrm{id}$ in the proof concerns a function with zero Cauchy data, usually one vanishing near Σ_0. For unspecified data the correct identity is .

Subtraction. A chartwise retarded subtraction modifies the specified prescription. It does not become a tensorial operation on the whole cone by being written in a developing chart. In particular,

$$[P_m, X_\xi] \neq 0$$

for general compact ξ; a fixed inverse need not commute with an arbitrary pullback. The plateau proof supplies a specific intertwining construction, not an unrestricted commutation rule.

Support. The proven bound is containment in $\mathscr{D}_f$, not equality of functional support with $\mathscr{D}_f$. Special inputs and cancellations can shrink the actual support. Nor can this bound generally be replaced by $\operatorname{supp} f$, as Proposition demonstrates.

Gauge domain. The data defining g, U, Σ_0, and the harmonic prescription are fixed. Restricting to $\mathscr{G}_U$ changes the admitted identification; it does not repair the old larger identification without changing its domain.

Classical comparison. The comparison cocycle is unique on the specified solution spaces because the Cauchy problem is unique. It is not a statement that every off-shell extension of that map is unique, or that unchanged observable formulas agree at different switches.

Finite encoding. The encoding is defined after the finite classical evaluations are supplied. A coherent payload state is not declared to be a superposition of continuum solution jets. No source-acquisition channel is hidden in its preparation.

Declarations

Authorship. The author field is intentionally empty for anonymous review. Authorized author and affiliation metadata are required for a signed submission. Registry attribution to N. Cheung and citation of Cheung's articles do not assign authorship of this adaptation.

Provenance. VII-A, version 1, supplies the source classical construction. I-B supplies the documentary spacetime-interface pattern. The mathematical assertions released here are supported by the explicit local proofs above. Companion references are comparisons and source records, not unprinted theorem premises.

Verification and implementation. No successful pdflatex execution, proof-assistant verification, independently executed symbolic or numerical calculation, physical circuit compilation, experiment, independent referee certification, or journal acceptance of this adaptation is asserted.

Book expansion notes (t433u)

This conical adaptation belongs to *Observation Boundaries and Finite Instruments: Series VII*. A windowed comparison with the I-B-G transfer statement is recorded only as a named comparison: equality of kernels is asserted only before the first extra arrival; after that arrival the conical and product presentations diverge. This sheet is not a repair of the VII-A first-order defect and is not a premise of VII-A [1]. The regular product remains not globally hyperbolic. Dedicated observation-boundary source record: [18].

Standing ledger. Not spacetime emergence; not Einstein dynamics; not a Page curve, island, bounce, vacuum-energy selection, or de Sitter state as an Enter theorem; not a derived metric. O.1 stays NOT_CLOSED. XVI-N is not discharged. XV-B is not opened. No quantum coefficient is admitted. Host C is not created. Dom (T) remains undetermined; J2 remains unresolved. Problems 6, 7, and 9 are named, not solved. Gate 0 and ST4b stay NOT_SUPPLIED. Host-A stays NAMED_COMPARISON_ONLY $\{\mathrm{GI}, \mathrm{CB}\}$. The shredder is not Gibbons–Hawking. Cited sheets are source records, not premises. Conjectures stay conjectures. wired=false.

References

[1] N. Cheung, Plateau-compatible relational scalars: a second-order classical intertwiner, in *Observation Boundaries and Finite Instruments: Series VII*, Cheung Ngo Medical Limited (2026).

[2] N. Cheung, IB-v1: A Finite Enter Spacetime, in *The Philosophy of Enter*, Cheung Ngo Medical Limited (2026), p. 78.

[3] N. Cheung, The Enter Calculus: A Linear Quantum Lambda Calculus with an Operational Characterization of Measurement, *Frontiers in Physics* **14** (2026), 1954943, doi:10.3389/fphy.2026.1954943.

[4] N. Cheung, Born–Lüders as the unique measurement strategy of a strictly linear quantum, in *The Philosophy*

of Enter, Cheung Ngo Medical Limited (2026), p. 25.

[5] N. Cheung, The Philosophy of Enter: Destructive Readout, Quantum Recovery, and the Refusal of Identification, in *The Philosophy of Enter*, Cheung Ngo Medical Limited (2026), p. 6.

[6] R. Brunetti, K. Fredenhagen, T.-P. Hack, N. Pinamonti, and K. Rejzner, ``Cosmological perturbation theory and quantum gravity," *Journal of High Energy Physics* 08 (2016), 032. DOI: \nolinkurl{10.1007/JHEP08(2016)032}. https://arxiv.org/abs/1605.02573.

[7] M. B. Fröb, ``Gauge-invariant quantum gravitational corrections to correlation functions," *Classical and Quantum Gravity* 35 (2018), 055006. DOI: \nolinkurl{10.1088/1361-6382/aaa74c}. https://arxiv.org/abs/1710.00839.

[8] C. Bär, N. Ginoux, and F. Pfäffle, *Wave Equations on Lorentzian Manifolds and Quantization*. ESI Lectures in Mathematics and Physics, European Mathematical Society, 2007. https://arxiv.org/abs/0806.1036.

[9] R. Brunetti, K. Fredenhagen, and K. Rejzner, ``Quantum gravity from the point of view of locally covariant quantum field theory," *Communications in Mathematical Physics* 345 (2016), 741–779. DOI: \nolinkurl{10.1007/s00220-016-2676-x}. https://arxiv.org/abs/1306.1058.

[10] M. Dütsch and K. Fredenhagen, ``Causal perturbation theory in terms of retarded products, and a proof of the Action Ward Identity," *Reviews in Mathematical Physics* 16 (2004), 1291–1348. DOI: \nolinkurl{10.1142/S0129055X04002266}. https://arxiv.org/abs/hep-th/0403213.

[11] C. J. Fewster and R. Verch, ``Quantum fields and local measurements," *Communications in Mathematical Physics* 378 (2020), 851–889. DOI: \nolinkurl{10.1007/s00220-020-03800-6}. https://arxiv.org/abs/1810.06512.

[12] J. Watrous, *The Theory of Quantum Information*. Cambridge University Press, 2018. Author's book interface: https://cs.uwaterloo.ca/~watrous/TQI/.

[13] N. Cheung, Black-Hole Information as an Access Problem: Enter, Quantum Recovery, and Complete Residuals, figshare (2026), doi:10.6084/m9.figshare.34335024.v1.

[14] N. Cheung, Operational Wormhole Certificates—Existence, Dimension-Dependent Scaling, Operational Functions, and Composition, figshare (2026), doi:10.6084/m9.figshare.34549575.v1.

[15] N. Cheung, Enter, Quantum Magic, and Quantum Gravity: Readout, Recovery, and the Limits of Geometric Response, figshare (2026), doi:10.6084/m9.figshare.34335582.v1.

[16] N. Cheung, Operational Consistency Does Not Select Lorentzian Geometry, figshare (2026), doi:10.6084/m9.figshare.34441758.v1.

[17] N. Cheung, Realization of Relational Time by Destructive Enter on a Clock Register, figshare (2026), doi:10.6084/m9.figshare.34442907.v1.

[18] N. Cheung, Observation boundaries for destructive quantum readout and external geometry, in *The Philosophy of Enter*, Cheung Ngo Medical Limited (2026), p. 52.

[19] N. Cheung, Completely positive observation boundaries for finite matter–geometry feedback, in *Observation Boundaries and Finite Instruments: Series VII*, Cheung Ngo Medical Limited (2026).

[20] N. Cheung, VIII-A: Affine matching and observation-boundary comparisons, Cheung Ngo Medical Limited (2026).

[21] N. Cheung, En09-A Realization of Relational Time by Destructive Enter on a Clock Register, in *The Philosophy of Enter*, Cheung Ngo Medical Limited (2026), p. 244.

[22] N. Cheung, En09-B: Relational Clock Readout, Sharp Access Limits, and Residual Return, Cheung Ngo Medical Limited (2026).