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VIII-ST: Affine matching, persistent cellulation, and certified flow on a prescribed conical Enter spacetime

A unified local Grade S construction with promised source tables, a finite destructive clock, and reference-preserving transport

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Abstract

We assemble the affine matching, variable-deficit cellulation, and guarded-flow programmes of series VIII into a self-contained local Grade S package on a prescribed conical spacetime. For a compact deficit interval about $\pi/2$, an explicit polyhedral graph family has uniformly spacelike regular faces, strict temporal ordering, and exactly one transverse three-to-six particle-link incidence. We give its vertices, finite lengths, areas, adapted Lorentz-affine charts, and winding-marked peripheral certificates. A guarded five-command history preserves complete matching outputs, and finite canonical restrictions admit exact NOT–CNOT–Toffoli implementations with retained histories and clean work.

The main additional contribution is an operationally explicit assembly that keeps three otherwise easily conflated objects separate: a catalogue of prescribed conical geometries, a description-register update, and the fixed metric carrying the laboratory. A nonzero source-table replacement changes a catalogue entry, not the laboratory deficit. The source expectation is a semantic input; it is not acquired by the finite circuit. An affine-label obstruction and a finite-promise discrimination bound make that boundary quantitative.

One destructive clock controls the complete recorded protocol. Its instrument identity includes arbitrary untouched references, and a regular laboratory supports exact transport of a quantum payload together with the complete

classical certificate history, buffered across the prescribed incidence. Joint-output support is bounded by complete scheduled ancestry; a separately verified causal embedding gives physical containment. These combined certificates may provide a reproducible benchmark for testing future matter–geometry interfaces without confusing code correctness, source acquisition, or geometric consistency with gravitational dynamics. The novelty claimed is this supported assembly and its corrected interfaces, not the general principles of affine holonomy, reversible computation, channel locality, or measurement theory. No spacetime emergence, Einstein dynamics, continuum-field instrument, or inherited quantum response coefficient is constructed.

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par **Principal correction: catalogue replacement is not metric evolution** par The operational background is fixed throughout each experiment. A register may store a description of another prescribed cone. Replacing that register does not replace the metric under the apparatus. When the selected deficit differs from the host deficit, its matching certificate concerns the selected catalogue member, not an asserted new geometry of the laboratory.

Similarly, a finite computation describing the transverse incidence does not cause the incidence or measure the

singular worldsheet. All quantum registers and operational routes below remain in the regular part. par

Scope, provenance, and the Enter discipline

The three source manuscripts address different interfaces. VIII-A concerns finite affine matching and observation boundaries; VIII-B supplies a variable-deficit geometric dictionary and a promised source-table restriction; VIII-C supplies guarded composition and a computational support theorem [11, 12, 13]. I-B provides the prescribed-spacetime operational pattern [4]. This paper proves the mathematical interfaces used in their local assembly rather than treating documentary relationships as theorem premises.

What Enter contributes

In the Enter discipline, quantum names specify access to declared tensor factors. Destructive readout consumes the measured names and returns a classical record together with specified surviving factors [1, 16]. The operation does not, merely by its output type, identify a classical record with recovery of an unknown quantum state.

The philosophical distinctions are consequential here: destructive readout is not quantum recovery; a channel is not a thermal machine; and a mathematical analogy is not a physical identification [2]. The shredder access interface is the Scholar-facing I-C-v2 record [3]. We use these distinctions as scope discipline, not as new axioms from which the geometric construction is inferred.

Born finite instruments are explicitly specified below. We do not reprove the operational measurement-characterization theorem of Manuscript I from an abbreviated list of its hypotheses, nor extend it to fields.

Definition (Local Grade S). A local Grade S package consists of:

1. a prescribed classical background and a supported regular laboratory;

2. explicit classical realizations and finite acceptance certificates;

3. complete finite channels, controls, preparations, and resource reservations;

4. a finite destructive-clock instrument and stated calibration;

5. proved scheduled-support and causal-embedding statements;

6. at least one nonempty reference-preserving transport realization. A derivation of spacetime or its metric from operational data, called Grade E here, is not included.

Standing distinction. The certificate symbol Cert below denotes a five-component matching packet. It is not an Einstein tensor, a constraint algebra, a quantum Ward identity, or a field equation.

Provenance and novelty. The particle family and the principal source distinctions are adapted from the version-3 VIII records. The contribution of this manuscript is their supported 3 + 1-dimensional product assembly, explicit fixed-host interpretation, complete clock interface, finite-promise safeguard, and regular causal transport. The source's separate particle-free four-face substrate is not silently identified with the particle profile used here.

Prescribed conical products and supported presentations

Fix $c > 0$, a length unit $\ell > 0$, and a time origin T_*. Let

$$\mu_0 = \frac{\pi}{2}, \qquad I = \left[\frac{\pi}{2} - \frac{\pi}{20}, \frac{\pi}{2} + \frac{\pi}{20}\right], \qquad \alpha_\mu = 1 - \frac{\mu}{2\pi}.$$

For each prescribed $\mu \in I$, define

$$M_\mu = \mathbb{R}_T \times C_\mu^\circ \times \mathbb{R}_z, \qquad g_\mu = -c^2 \mathrm{d}T^2 + \mathrm{d}r^2 + \alpha_\mu^2 r^2 \mathrm{d}\varphi^2 + \mathrm{d}z^2,$$

where $r > 0$ and φ has period 2π. The stipulated completion has singular locus

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

Thus the defect is a worldsheet. A fixed-z section is a worldline. We do not assert a smooth Minkowski neighbourhood or a pointwise Einstein tensor on $\mathscr{W}_\mu$.

The signature is $(-, +, +, +)$. Static observers have proper time increment $\mathrm{d}T$; the lapse in T is one and the shift is zero. Use normalized coordinates

$$\tau = \frac{c(T - T_*)}{\ell}, \qquad x = (X/\ell, Y/\ell), \qquad \zeta = z/\ell.$$

On a regular lifted angular interval,

$$(T, r, \varphi, z)\mathrm{longmapsto}\,(c(T - T_*), r\cos(\alpha_\mu \varphi), r\sin(\alpha_\mu \varphi), z)$$

is a local Minkowski development. The geometry is an input, in the sense of I-B [4].

Proposition (The regular product is not globally hyperbolic). *For every $\mu \in I$, the regular spacetime M_μ is not globally hyperbolic.*

Proof. Fix $r_0 > 0$, one angle, and $z = 0$. Take two events at that spatial point with times $T_* \pm 2r_0/c$. The events at time T_* and radii $r_n \mathrm{downarrow}\, 0$, with the same angle and z, belong to their causal diamond: the required radial travel times are less than r_0/c. They have no convergent subsequence in M_μ. The diamond is noncompact.

No global conical Green or Cauchy theorem follows. IBG and IBGS, by their Scholar titles, are source records only: this package does not supply a conical Green or a spin-1/spin-2 inverse [5, 6].

Definition (Supported atlas and regular laboratory). A supported geometric presentation uses:

1. finitely many developed sectors, face charts, and overlap components for a bounded transverse patch and a bounded axial slab, with the singular stratum separately declared;

2. a regular operational tube whose spatial development is bounded and convex and whose closure is disjoint from the worldsheet;

3. a finite operating interval and all initial carrier, controller, programme, and ancillary data. There is no undeclared incoming boundary information. This is an operational support condition, not a field initial-boundary-value theorem.

Official VIII-Defect-A Version 2 supplies a documentary comparison, not a theorem of the present sheet [14]. In that sheet's official classes, the defect is a worldsheet (class (P) in def:class / doc:P), the Hawk07 pulse is bounded and is not class (C) (thm:pulse), and the power-law family shows finite angle coexisting with blow-up without

removing either (thm:samehost, prop:coexist). Those sentences do not relabel the typestate of this sheet. A worldsheet is not a worldline; the operational tube above is compact and disjoint from the worldsheet.

A meridian surrounding the defect needs an atlas or an angular cover. It is not contained in a single smooth chart through the apex.

Definition (Catalogue and host). The family $\{(M_\mu, g_\mu) : \mu \in I\}$ is a catalogue of prescribed backgrounds. An operational experiment additionally fixes one member $(M_{\mu_{\mathrm{H}}}, g_{\mu_{\mathrm{H}}})$, called its host.

A catalogue register may change its index μ. The host value μ_{H}, its metric, and its causal relation remain fixed. Whole-cone realization of a selected catalogue member in the host is asserted only when the corresponding identification has actually been supplied; in the benchmark below the direct identification is $\mu = \mu_{\mathrm{H}}$.

For $\mu \neq \nu$, the identity in (r, φ, z, T) coordinates does not identify their metrics, since their angular coefficients differ. Nor can a coherent frame change equate their different oriented peripheral rotations in the fixed interval. Local flat laboratory charts can be compared without identifying the full cones.

An explicit persistent transverse cellulation

The following construction gives a product lift of the particle family studied in VIII-A/B and VII-F [11, 12, 17]. All estimates and acceptance data used here are proved explicitly.

Sector coordinates and retuned profiles

For fixed $\mu \in I$, put

$$\theta = \frac{2\pi - \mu}{3}, \qquad \lambda = \frac{2\sqrt{2}}{3}, \qquad a = \lambda \cos(\theta/2), \qquad b = \frac{3}{5}\sin\theta.$$

The cut transverse wedge has rays

$$e_i = (\cos(i\theta), \sin(i\theta)), \qquad i = 0, 1, 2, 3.$$

In sector i, use

$$x = \xi e_{i} + \eta e_{i+1}, \qquad \xi, \eta \geq 0.$$

The upper boundary is identified with the lower by rotation through μ, since $3\theta = 2\pi - \mu$. Indices of identified cells are cyclic modulo three, but e_{3} and e_{0} remain different developed rays before gluing.

Write

$$\rho = \xi + \eta, \qquad h = a\rho, \qquad k = b\min\{\xi, \eta\}, \qquad F_{s} = s + \min\{2, \max\{h, s + k\}\}, \qquad -1 \leq s \leq 1.$$

Here ρ is a piecewise-linear sector radial coordinate, not the Euclidean norm $|x|$. The product marking is

$$\widehat{\Sigma}_{s}(\mu) = \{(\tau, x, \zeta) : \tau = F_{s}(x),\ \zeta \in \mathbb{R}\}.$$

Its transverse finite patch is $\rho \leq 4$.

Lemma (Uniform metric and localization estimates). *For every $\mu \in I$,*

$$\frac{129}{200} < a < \frac{137}{200}, \qquad 0 < b \leq \frac{3}{5} < a.$$

Define

$$d = a - \frac{b}{2}, \qquad r = \frac{2}{a}, \qquad \beta = \frac{1}{a}, \qquad \chi = \frac{1}{2a - b} = \frac{1}{2d}.$$

Then

$$d > \frac{69}{200}, \qquad \frac{1}{d} < r < \frac{7}{2} < 4, \qquad 0 < \chi < \beta.$$

The region $s + k \geq h$, for $0 < s \leq 1$, satisfies

$$\rho \leq \frac{s}{d} < r.$$

The graph is horizontal, $\tau = s + 2$, whenever $\rho \geq r$.

Proof. Write $\theta/2 = \pi/4 + t$, so $|t| \leq \pi/120 < 27/1000$, and

$$a = \frac{2}{3}(\cos t - \sin t).$$

The bounds $\cos t \ge 1 - t^2/2$, $\cos t \le 1$, and $|\sin t| \le |t|$ give . The bound on b follows from $0 < \theta < \pi$. Thus $d > a - 3/10 > 69/200$. Because $b < a$, $d > a/2$, which gives $1/d < 2/a = r$ and $\chi < \beta$. Also $r < 400/129 < 7/2$.

Since $\min\{\xi, \eta\} \le \rho/2$, $h - k \ge d\rho$. Dominance of $s + k$ therefore implies $\rho \le s/d$. For $\rho \ge r$, $h \ge 2$, so the cap in is active.

Lemma (Spacelikeness, embedding, and temporal ordering). *For each fixed μ, F_s descends across all sector rays and the seam and is globally λ-Lipschitz in the intrinsic transverse cone distance.*

The product graph is embedded. On each regular affine piece its induced metric satisfies

$$g_{\hat{\Sigma}_s} \ge \frac{\ell^2}{9}(\mathrm{d}s^2_{C_\mu} + \mathrm{d}\zeta^2)$$

when the spatial cone metric in the parentheses is expressed in normalized units. The regular graph is acausal.

For $s' < s''$,

$$s'' - s' \le F_{s''}(x) - F_{s'}(x) \le 2(s'' - s').$$

The transverse singular intersection has normalized time

$$\tau_P(s) = \begin{cases} s, & s \le 0, \\ 2s, & s \ge 0. \end{cases}$$

Proof. On a boundary ray, ρ is its ray coordinate and $k = 0$. Hence adjacent sectors and the seam agree.

The oblique spatial Gram matrix is

$$G_\theta = \begin{pmatrix} 1 & \cos\theta \\ \cos\theta & 1 \end{pmatrix}, \qquad G_\theta^{-1} = \frac{1}{\sin^2\theta}\begin{pmatrix} 1 & -\cos\theta \\ -\cos\theta & 1 \end{pmatrix}.$$

The squared physical norm of a covector p is $p^{\mathrm{T}} G_\theta^{-1} p$. Consequently,

$$|\nabla h|^2 = \frac{a^2}{\cos^2(\theta/2)} = \frac{8}{9}, \qquad |\nabla(b\xi)|^2 = |\nabla(b\eta)|^2 = \frac{b^2}{\sin^2\theta} = \frac{9}{25}.$$

Minima and maxima preserve a common Lipschitz constant. Integrate along sectorwise paths and pass to their length infimum. Continuity handles rays and the apex limit. The axial derivative is zero.

Graph projection is a homeomorphism with the continuous inverse $(x, \zeta) \mapsto (F_s(x), x, \zeta)$. For a regular physical gradient g, the graph metric is $\ell^2(I - gg^{\mathrm{T}})$, bounded below by $\ell^2(1 - \lambda^2)I = \ell^2 I/9$.

A future-causal regular curve has time increment at least its spatial path length, and thus at least intrinsic endpoint distance. Distinct points of the graph have a strictly smaller time difference, proving acausality. The same statement extends to the stipulated completion if its causal relation is defined by the corresponding ultrastatic length-space convention.

For fixed x, the capped term after the first s in is nondecreasing and 1-Lipschitz in s. This proves . Substitute $h = k = 0$ at the apex.

Cells and exact finite metric data

Let P_s be the transverse apex intersection. Persistent vertices have spatial coordinates

$$A_i = re_i, \qquad D_i = 4e_i, \qquad \tau(A_i) = \tau(D_i) = s + 2.$$

For $s > 0$, additional vertices are

$$B_i = \beta s e_i, \qquad C_i = \chi s(e_i + e_{i+1}), \qquad \tau(B_i) = 2s, \qquad \tau(C_i) = 2s + b\chi s.$$

Spatial symbols stand for their lifted graph points when used in faces.

For $s \le 0$, the core face in sector i is

$$V_i = [P, A_i, A_{i+1}], \qquad \tau = s + a(\xi + \eta).$$

For $s > 0$, use

$$U_i^- = [P, B_i, C_i], \qquad \tau = 2s + b\eta,$$

$$U_i^+ = [P, C_i, B_{i+1}], \qquad \tau = 2s + b\xi,$$

$$V_i = [B_i, A_i, A_{i+1}, B_{i+1}, C_i], \ \tau = s + a(\xi + \eta).$$

The V_i may be nonconvex. For all s, retain

$$Q_i = [A_i, D_i, D_{i+1}, A_{i+1}], \qquad \tau = s + 2,$$

and the resting exterior beyond $\rho = 4$.

Lemma (Exact face decomposition). *These faces cover the graph and have disjoint face interiors. For $s > 0$, the two inner triangles are contained strictly inside the cap boundary $\rho = r$.*

Proof. For $s \le 0$, $s + k \le h$, by $h - k \ge d\rho$. For $s > 0$, in $\xi \ge \eta$, the interface of the two nonconstant branches is

$$a\xi + (a - b)\eta = s.$$

Its endpoints are $(\beta s, 0)$ and $(\chi s, \chi s)$. The other half-sector has the reflected equation. The dominance region is exactly the union of the two inner triangles; its complement in the core triangle is the stated simple pentagon. Lemma excludes contact with the cap. Outside the cap the graph is horizontal.

Put

$$z_\theta = \cos\theta, \quad S_\theta = \sin\theta, \quad L_\theta = \sqrt{2(1 - z_\theta)},$$

and

$$W_\theta = \sqrt{(\chi - \beta)^2 + \chi^2 + 2z_\theta\chi(\chi - \beta) - b^2\chi^2}.$$

Normalized transverse edge lengths are:

llltoprule slot	$s \le 0$	$s > 0$
midrule r_i^{rad}	$r\sqrt{1 - a^2}$	$(r - \beta s)\sqrt{1 - a^2}$
$r_i^{\mathrm{crest}} = [A_i, A_{i+1}]$	rL_θ	rL_θ
$r_i^{\mathrm{conn}} = [A_i, D_i]$	$4 - r$	$4 - r$
$r_i^{\mathrm{outer}} = [D_i, D_{i+1}]$	$4L_\theta$	$4L_\theta$
$u_i = [P, B_i]$	inactive	βs
$v_i = [P, C_i]$	inactive	$\chi s\sqrt{2(1 + z_\theta) - b^2}$
$w_i^- = [B_i, C_i]$	inactive	$W_\theta s$
$w_i^+ = [C_i, B_{i+1}]$	inactive	$W_\theta s$
bottomrule		

The radial slot means $[P, A_i]$ before the event and $[B_i, A_i]$ afterwards. There are 24 finite slots.

Proposition (Lengths, areas, and nondegeneracy). *The table gives the exact induced lengths. Physical lengths are ℓ times the displayed values. Normalized transverse face areas are*

$$\operatorname{Area}(V_i) = \begin{cases} S_\theta r^2/6, & s \le 0, \\ (S_\theta/3)(r^2/2 - \beta\chi s^2), & s > 0, \end{cases}$$

$$\operatorname{Area}(U_i^{\pm}) = \frac{2}{5} S_\theta \beta\chi s^2, \qquad s > 0,$$

$$\operatorname{Area}(Q_i) = \frac{1}{2} S_\theta (16 - r^2).$$

Every active finite edge and compact face has positive size. Physical transverse areas are ℓ^2 times these values. Extrusion through a normalized axial interval of length L_z multiplies the area by ℓL_z.

Proof. For displacement $(\Delta\xi, \Delta\eta, \Delta\tau)$,

$$\ell^2_{\text{norm}} = (\Delta\xi)^2 + (\Delta\eta)^2 + 2z_\theta \Delta\xi\Delta\eta - (\Delta\tau)^2.$$

Substitution gives every table entry. Each nonzero edge is tangent to a spacelike face, so its radical is positive. The persistent radial factor satisfies $r - \beta s = \beta(2 - s) > 0$.

The spatial area element is $S_\theta \mathrm{d}\xi \mathrm{d}\eta$. The graph area multipliers are respectively 1/3, 4/5, and 1 for V, U, Q, by the gradient computation. Each projected inner triangle has area $S_\theta \beta\chi s^2/2$. Subtracting both from the projected core triangle proves .

Since $r = 2\beta$ and $\chi < \beta$,

$$r^2/2 - \beta\chi s^2 \ge 2\beta^2 - \beta\chi > \beta^2 > 0.$$

The collar is positive because $r < 4$. The axial extrusion is orthogonal to all transverse tangent vectors and has unchanged unit spatial metric.

Theorem (Unique transverse three-to-six incidence). *For every fixed $\mu \in I$, the declared transverse cellulation has exactly one incidence-event parameter, $s = 0$. Six outgoing vertex slots, twelve outgoing edge slots, and six inner face slots collapse there. The particle link changes from three incident faces to six.*

In the $3 + 1$ *product this is a transverse statement along* $\{\tau = 0, x = o\} \subset \mathscr{W}_{\mu}$*, not an isolated point event of the full spacetime.*

Proof. For each sign of s, Lemma fixes the cell pattern. The new vertices lie on distinct rays or strictly inside distinct sectors and are positive multiples of s. They coalesce only at zero. Proposition excludes other collapses, and the cap separation excludes an extra intersection.

The outgoing bisector edges are genuine creases because the gradients of $b\xi$ and $b\eta$ are distinct. Across a cone ray, unfolding the neighbouring sectors gives opposite nonzero transverse gradients. The incoming ray crease has transverse magnitude $a\tan(\theta/2) > 0$. Thus the link change is not an artificial subdivision of one flat face. Three V_i meet P before the event; six $U_i^{\pm}$ meet it afterwards.

At zero, the active limiting cells are the incoming core triangles and collar. Collapsed outgoing labels are one-sided germ metadata, not extra active zero-size cells. Taking the axial product proves the final statement.

The finite transverse counts are

$c\|ccc\|c$	V	E	F	$V - E + F$
hline $s < 0$	7	12	6	1
$s > 0$	13	24	12	1.

One-sided edge laws follow directly from the table. In particular,

$$\partial_s \ell(r_i^{\mathrm{rad}})(0^-) = 0, \qquad \partial_s \ell(r_i^{\mathrm{rad}})(0^+) = -\beta\sqrt{1 - a^2}.$$

Born slots have only right geometric derivatives.

Reference specialization and intrinsic defects

At $\mu = \mu_0$,

$$a = \frac{2}{3}, \quad b = \frac{3}{5}, \quad r = 3, \quad \beta = \frac{3}{2}, \quad \chi = \frac{15}{11}.$$

For example,

$$\ell(r_i^{\mathrm{rad}}) = \begin{cases} \sqrt{5}, & s \le 0, \\ \sqrt{5}(1 - s/2), & s > 0, \end{cases} \quad \ell(u_i) = \frac{3}{2}s, \quad \ell(v_i) = \frac{3\sqrt{41}}{11}s, \quad \ell(w_i^{\pm}) = \frac{3\sqrt{65}}{22}s.$$

The corresponding areas are

$$\operatorname{Area}(V_i) = \begin{cases} 3/2, & s \le 0, \\ 3/2 - 15s^2/22, & s > 0, \end{cases} \quad \operatorname{Area}(U_i^{\pm}) = 9s^2/11, \quad \operatorname{Area}(Q_i) = 7/2.$$

Proposition (Intrinsic particle defect is not the packet deficit). *The incoming and outgoing transverse particle angle defects are*

$$\kappa_P^{-} = 2\pi - 3\theta_h, \qquad \cos\theta_h = \frac{\cos\theta - a^2}{1 - a^2},$$

and

$$\kappa_P^{+} = 2\pi - 6\theta_k, \qquad \theta_k = \arctan\left(\frac{4}{5}\tan(\theta/2)\right).$$

They need not equal μ. Nevertheless the total intrinsic interior angle defect of the compact transverse patch $\rho \le 4$ equals μ.

Proof. On an incoming face the induced oblique metric is $G_\theta - (a,a)^{\mathrm{T}}(a,a)$. Its two ray tangents give the displayed cosine. On U_i^{-}, the ray and bisector tangents are $(1,0)$ and $(1,1)$. Their metric determinant and inner product give

$$\tan\theta_k = \frac{\sqrt{\sin^2\theta - b^2}}{1 + \cos\theta} = \frac{4}{5}\tan(\theta/2).$$

There are three incoming or six outgoing corners.

For the total, triangulate the simple faces without changing their intrinsic metrics. The triangle angle sum and Euler identity for a disk give

$$\sum_{\text{interior}} \kappa_v + \sum_{\text{boundary}} (\pi - \theta_v) = 2\pi.$$

At each outer vertex the two resting corners have total angle $\pi - \theta$, so boundary turning is 3θ. The interior sum is $2\pi - 3\theta = \mu$. At zero count only active limiting cells.

This intrinsic audit does not replace the affine peripheral certificate constructed next.

Lorentz-affine matching and complete certificates

Packet and chart conventions

Work first in dimensionless transverse spacetime coordinates $y = (\tau, X, Y)$ with $\eta_3 = \mathrm{diag}(-1, 1, 1)$. Let $t = (1, 0, 0)^{\mathrm{T}}$ and

$$J_\mu(y) = (\tau, \mathrm{Rot}(\mu)x).$$

Its product lift fixes ζ. We use the same notation for that lift.

Allowed reference-frame changes are proper time-oriented Lorentz-affine transformations in the transverse spacetime, extended by the identity on the axial factor. For $A = (L, a_0)$, define

$$\mathscr{W}_A = A(\mathbb{R}t) \times \mathbb{R}_\zeta, \qquad u_A = Lt, \qquad H_A(\mu) = AJ_\mu A^{-1}.$$

The packet records the defect identifier, deficit, frame, worldsheet, rest vector, and full affine map.

Lemma (Spinless fixed set). *For $0 < \mu < 2\pi$, J_μ fixes precisely the transverse time axis, hence its product lift fixes the worldsheet pointwise. The conjugate $H_A(\mu)$ fixes $\mathscr{W}_A$ pointwise and preserves the transported rest vector in its linear part.*

Proof. A nontrivial planar rotation has only the origin as fixed spatial point. Time and axial coordinates are unchanged. Conjugation transports the fixed set and rest vector.

For a Cartesian face gradient g, $|g| < 1$, let

$$B(g) = \begin{pmatrix} \gamma & -\gamma g^{\mathrm{T}} \\ -\gamma g & I_2 + (\gamma - 1)gg^{\mathrm{T}}/|g|^2 \end{pmatrix}, \qquad \gamma = (1 - |g|^2)^{-1/2},$$

with $B(0) = I$. For a face $\tau = q + g \cdot x$, choose the ambient affine chart

$$A_f(y) = B(g)y - \gamma q\, t,$$

and extend it by the identity on ζ. Resting faces may instead use the ambient identity chart.

Lemma (Adapted charts). *These are proper time-oriented Lorentz-affine charts on regular ambient neighbourhoods. The nonresting face has adapted time coordinate zero. The boost factors for V and U are respectively* 3 *and* 5/4*.*

Proof. In a spatial orthonormal basis along g and perpendicular to it, $B(g)$ is a 1 + 1 boost and an unchanged perpendicular coordinate. Direct multiplication gives $B(g)^{\mathrm{T}}\eta_3 B(g) = \eta_3$, determinant one, and positive 00-entry. Its time coordinate is $\gamma(\tau - g \cdot x)$, proving adaptation. The gradient norms in Lemma give the two boost factors.

These affine formulas extend algebraically to face closures. They do not make the apex a regular Minkowski point.

For an oriented overlap component $f \to g$, let $n_{gf} \in \{-1, 0, 1\}$ record its marked seam crossing. The canonical transition is

$$T_{g \leftarrow f} = A_g J_\mu^{n_{gf}} A_f^{-1}.$$

A longer path retains the ordered components and all exponents. Agreement on only the endpoints of an edge is weaker than : a nontrivial Lorentz transformation can fix a spacelike line pointwise.

Definition (Five-component acceptance). For an already realized polygonal product description g, write

$$\mathrm{Cert}(g) = (\mathrm{V}(g), \mathrm{P}(g), \mathrm{H}(g), \mathrm{K}(g), \mathrm{W}(g)).$$

Acceptance is the conjunction of:

1. endpoints, shared segments, polygon closure, specified overlap components, canonical ambient transitions, and regular vertex words match;

2. deficit, oriented rotation, and full spinless affine peripheral map match the packet;

3. ordered affine words retain overlap-component data and integer winding marks;

4. primitive core and collar words agree in the declared reference frame, and their shared boundary realization agrees;

5. the worldsheet, transported rest data, and slice intersection agree, and peripheral holonomy fixes the worldsheet pointwise. Embedding, spacelikeness, and active-cell nondegeneracy are separate prerequisites.

Theorem (Complete matching for the explicit family). *Every regular member and both one-sided incidence germs of Section have an accepted certificate.*

For a closed ordered chart word γ, based in f_0,

$$T_\gamma = A_{f_0} J_\mu^{N(\gamma)} A_{f_0}^{-1}, \qquad N(\gamma) = \sum n_{gf}.$$

Regular small vertex words have $N = 0$. *Primitive positive core, collar, and outgoing-star meridians have* $N = 1$, *and their reference-frame peripheral map is exactly* J_μ.

Proof. The graph and cell decomposition already establish geometric realization. Each polygon boundary closes by telescoping its vertex differences. Across ordinary overlaps the ambient map is the identity before face adaptation; across the marked seam it is J_μ. The descended graph values ensure that endpoints and shared segments match under these maps. Conjugating by the specified face charts gives , including inverse reverse maps.

Multiplication of successive transitions cancels all intermediate chart factors, proving . An angular lift of a regular small loop has zero net seam crossing. A loop crossing the three sectors once has angular increment $3\theta = 2\pi - \mu$ and winding one.

For a noncollapsing core loop choose constant

$$\rho_{\mathrm{core}} = \frac{1}{2}\left(\frac{1}{d} + r\right),$$

which lies between every inner dominance region and the cap. For the collar choose $\rho_{\mathrm{collar}} = 15/4$. Both wind once, and both lie in regions with the explicitly given charts. For $s > 0$, a sufficiently small loop around P meets the six inner faces once in cyclic order and also has one positive seam crossing. At zero the core loop remains noncollapsing and witnesses the common peripheral signature.

Transporting the products back by the base chart gives J_μ for each primitive meridian. The product lift preserves

the axial coordinate. Lemma , the declared rest data, and $\tau_P(s)$ prove (E5). The shared core–collar boundary is the same realized crest. These checks establish all five components.

A matrix equality $J_\mu^N = I$ at a rational rotation angle does not erase the integer N. At fixed deficit the persistent object is the framed particle and peripheral signature, not an unchanged list of cell equations.

Proposition (Fixed-presentation uniqueness and two rejection tests). *Once realization, charts, overlap components, frame, and seam are fixed, incompatible proposed values of one transition cannot both be accepted.*

For $\mu \neq \nu$ in I, keeping J_ν at a packet declaring μ fails packet/seam matching, although it still fixes the reference worldsheet pointwise. In spectral norm,

$$\|\mathrm{Rot}(\mu) - \mathrm{Rot}(\nu)\|_{\mathrm{op}} = 2\left|\sin\frac{\mu-\nu}{2}\right|.$$

For $\delta \neq 0$, the affine map

$$(\tau, x, \zeta)\mathrm{longmapsto}\,(\tau+\delta, \mathrm{Rot}(\mu)x, \zeta)$$

preserves the worldsheet as a set but fails pointwise fixation. The same distinctions survive coherent affine conjugation.

Proof. Acceptance requires equality with the single map . The rotation norm follows from

$$(I - \mathrm{Rot}(\theta))^{\mathrm{T}}(I - \mathrm{Rot}(\theta)) = 4\sin^2(\theta/2)I.$$

The interval is shorter than 2π, so different deficits give different oriented rotations. A time-shifted map sends $(\tau, 0, \zeta)$ to $(\tau+\delta, 0, \zeta)$, not the same point. Conjugation is injective and transports these equalities.

Proposition (Conditional affine gluing and composition). *Suppose realized patches have matching common boundary realizations, canonical overlap maps, inverse reverse maps, consistent triple-overlap products, and the required marked peripheral data. Their union has the concatenated certificate.*

A change of adapted charts $A_f \mapsto K_f A_f$ changes transitions by

$$T_{g \leftarrow f} \mapsto K_g T_{g \leftarrow f} K_f^{-1}$$

and conjugates based closed words. It preserves reference-frame acceptance.

The proposition does not glue different deficits into one spacetime evolution merely because their separate endpoint packets are certified.

Proof. Matching boundary maps identify the same realized points. The inverse and triple conditions make these identifications consistent on overlaps. Every closed word in the union is computed by concatenating its ordered overlap components. The asserted chart law follows by substitution and telescoping. Different-deficit endpoints have not supplied the common realization and overlap hypotheses, proving the stated limit.

Named access, residual instruments, and recovery boundaries

All Hilbert spaces in the operational layer are finite. A classical register is jointly block diagonal in its designated basis, including correlations with other factors. A diagonal marginal alone is insufficient.

Let Γ be the named surviving matter interface and

$$\mathscr{A}_{\mathrm{src}} \subseteq \mathscr{B}(\mathscr{H}_{\Gamma_{\mathrm{src}}})$$

an explicitly embedded unital *-subalgebra. Its accessible state input is

$$\omega_\rho|_{\mathscr{A}_{\mathrm{src}}} : B \mathrm{longmapsto} \operatorname{Tr}(\rho B).$$

Consumed clock factors, unnamed implementation history, and inaccessible spectators are not automatically source inputs.

Proposition (Accessible-observable criterion). *For channels Φ, Ψ with common interfaces and a fixed Hermitian output observable J,*

$$\operatorname{Tr}(J\Phi(\rho)) = \operatorname{Tr}(J\Psi(\rho)) \mathrm{for\ every} \rho \quad \Leftrightarrow \quad \Phi^*(J) = \Psi^*(J).$$

Moreover,

$$\sup_{\rho} |\mathrm{Tr}\,(J(\Phi - \Psi)(\rho))| = \|\Phi^{*}(J) - \Psi^{*}(J)\|_{\mathrm{op}}.$$

For a restricted input class, only annihilation of its real linear span follows. For the complete classical block-diagonal class, replace the operator difference by its block pinching.

Proof. The difference is Hermitian. Its largest absolute expectation is its spectral norm, attained in an extremal eigenspace. The restricted statements follow by testing only the declared span; block-diagonal states test exactly the pinched operator.

Definition (Spectator-blind control). A controller is spectator blind when its full specification factors through the declared geometry, exact command parameters, permissions, geometric resource reserve, frame, controller state, and named accessible inputs. Spectator location and history storage are separately reserved and are not read by geometric capacity guards.

Proposition (Deterministic blindness and spectator extension). *Equal complete accessible inputs select equal applicability, commands, certificates, abstract original-name transports, and successor controller states under a spectator-blind deterministic controller.*

In particular, extending a matter state by an arbitrary spectator with the same named source restriction does not change those selected classical outputs.

Proof. The first assertion is equality under the stated factorization. Partial trace preserves the named restricted functional, proving the second assertion. No equality of inaccessible global states is required.

This deterministic conclusion is not a no-signalling theorem for an unspecified nonlinear matter–geometry dynamics.

Record equality versus residual equality

Let P_z be input projectors, let q aggregate their fine outcomes, and put

$$\Delta_w(X) = \sum_{z\,:\,q(z)=w} P_z X P_z, \qquad R_w = \sum_{z\,:\,q(z)=w} P_z.$$

For a channel $\mathscr{T}$ and an output instrument $\{\mathscr{I}_w\}$, compare

$$\mathscr{F}(X) = \sum_w \operatorname{proj} w \otimes \mathscr{R}(\Delta_w(X)), \qquad \mathscr{G}(X) = \sum_w \operatorname{proj} w \otimes \mathscr{I}_w(\mathscr{R}(X)).$$

Proposition (Complete observation criterion). *The record laws agree on every input exactly when*

$$\mathscr{T}^*(\mathscr{I}_w^*(I)) = R_w.$$

Agreement on a declared recorded residual algebra $\mathscr{O}$ holds exactly when

$$\sum_{z\,:\,q(z)=w} P_z \mathscr{T}^*(B) P_z = \mathscr{T}^*(\mathscr{I}_w^*(B)), \qquad B \in \mathscr{O}.$$

These linear-map identities remain true with untouched references.

Proof. Pair each recorded block with I, or with B, and move the maps to the input by their adjoints. States separate Hermitian operators, and Hermitian elements span the matrix algebra. Reference extension tensors the resulting identities with the reference identity.

Proposition (What sharp coarse compatibility adds). *Suppose the coarse output instrument is Lüders:* $\mathscr{I}_w(Y) = Q_w Y Q_w$, *with orthogonal projections Q_w. If $\mathscr{T}^*(Q_w) = R_w$, then*

$$\mathscr{T}^*(Q_w B Q_w) = R_w \mathscr{T}^*(B) R_w.$$

Thus complete compatibility with the aggregated fine instrument additionally requires

$$P_z \mathscr{T}^*(B) P_{z'} = 0 \quad \text{whenever} z \neq z',\ q(z) = q(z') = w.$$

Sharp record compatibility alone does not remove coherences inside an aggregated block.

Proof. Choose Kraus operators for $\mathscr{T}$ and the corresponding isometry V, so $\mathscr{T}^*(B) = V^\dagger(B \otimes I)V$. For projections Q, R with $V^\dagger(Q \otimes I)V = R$,

$$\|(Q \otimes I)V - VR\|^2_{\text{on each vector}} = 0$$

by expansion, using $Q^2 = Q$ and $R^2 = R$. Hence $(Q \otimes I)V = VR$, proving the first identity. Insert it into Proposition .

Multiplication on the left and right by distinct $P_z, P_{z'}$ shows necessity of the displayed off-diagonal conditions; their vanishing is also sufficient.

Proposition (Residual-source separation with a robust gap). *Equal record channels need not determine residual source functionals. There are qubit instruments with identical records and residual trace distance* 1/2 *on one input. Implementation errors* $\varepsilon_1, \varepsilon_2$ *leave a gap at least* $1/2 - \varepsilon_1 - \varepsilon_2$.

Proof. Use one coarse outcome and compare the identity residual channel with computational dephasing Δ_Z. Both record channels are constant. On proj +, the residuals are proj + and $I/2$; their difference is $X/2$, with eigenvalues ±1/2. The residual observable X has expectations one and zero. The error statement is the triangle inequality.

These distinctions are the finite instrument comparisons of the VIII and VII observation-boundary records [11, 8, 9, 20, 21]. They concern complete instruments, not just outcome effects.

Quantum recovery safeguards

Proposition (Informative records exclude full-input exact recovery). *Let a complete recorded instrument have a CPTP left inverse on the full input matrix algebra. Every record effect is then a scalar multiple of the identity. Consequently an informative classical record cannot coexist with exact recovery of every unknown input from that complete recorded output.*

Proof. Let A_i be Kraus operators of the recorded channel and B_j those of a left inverse. The products $B_j A_i$ are Kraus operators for the identity channel. Its Choi matrix has rank one, so $B_j A_i = c_{ji} I$. Since $\sum_j B_j^\dagger B_j = I$,

$$A_i^\dagger A_k = \sum_j \overline{c_{ji}} c_{jk} I.$$

Sum the diagonal terms belonging to one record. Its effect is scalar.

The record-only bound used here is the deposited book [40]; the internal locator Hawk04-B thm:classical may be named in prose. It is a source record, not a black-hole endpoint.

Proposition (Sharp record-only recovery lower bound). *If a d-dimensional unknown input,* $d \geq 2$, *reaches a*

decoder only through a classical record, the decoded channel Λ obeys

$$d_{\diamond}(\Lambda, \mathrm{id}) \geq 1 - \frac{1}{d}.$$

Here $d_{\diamond}(\Phi, \Psi) = \frac{1}{2}\|\Phi - \Psi\|_{\diamond}$. The bound is attained by basis measurement and basis preparation.

Proof. The decoded channel is measure-and-prepare. On one half of a maximally entangled state its output is separable. Every product state has overlap at most $1/d$ with that maximally entangled state, by Cauchy–Schwarz; the same holds for mixtures. Testing its rank-one projector gives the lower bound.

Computational dephasing is $d^{-1}\sum_{k=0}^{d-1} \mathrm{Ad}_{Z_d^k}$. The triangle inequality bounds its half-diamond distance from identity by $1 - 1/d$, giving equality.

These are full-input statements. A surviving quantum memory, a restricted code, or a subsystem-recovery task changes the hypotheses [36, 34]. Reversible decoding of a geometry word below is not a quantum-return decoder.

Source selection, affinity, and finite promises

Fix a Hermitian matrix $J \in \mathscr{A}_{\mathrm{src}}$, a real coupling κ, and $0 \leq \theta \leq 1$. Define

$$\mathscr{D}_{\mathrm{src}} = \{\rho : \mu_0 + \kappa \mathrm{Tr}\,(\rho J) \in I\}, \qquad \mu_\theta(\rho) = \mu_0 + \theta\kappa \mathrm{Tr}\,(\rho J).$$

This is a semantic substitution into the already constructed catalogue.

Theorem (Sourced semantic packet). *On $\mathscr{D}_{\mathrm{src}}$, the selected packet and complete geometric family at $\mu_\theta(\rho)$ are well defined. The rule formally returns the same matter state. For fixed frame and named embedding, it is invariant under spectator extensions preserving the source restriction.*

Moreover,

$$|\mu_\theta(\rho) - \mu_\theta(\sigma)| \leq \theta|\kappa|\|J\|_{\mathrm{op}}\|\rho - \sigma\|_1.$$

Zero source, zero coupling, or $\theta = 0$ selects the reference family, not necessarily the previously stored catalogue entry.

Proof. The interval I is convex and contains μ_0. Thus the selected deficit belongs to I. Sections – were proved for every scalar member independently of the source, so substitution is legitimate. Trace duality proves ; partial trace proves spectator invariance. The source-off statements follow by direct substitution.

The assignment $\rho \mapsto (\mu_\theta(\rho), \rho)$ is not asserted to be an affine quantum channel.

Proposition (Affine deterministic-packet obstruction). *An affine map on a convex state set that assigns a probability distribution concentrated at one classical label to every state must have a constant label. The statement applies to any label space in which two distinct labels can be separated by a measurable event.*

Proof. For two different labels, the output on a nontrivial convex mixture is the same mixture of two different point masses. It is not concentrated at one label. A separating event has probability strictly between zero and one.

Thus nonconstant deterministic expectation-dependent packet selection is not implemented on the full convex state domain by calling it a hybrid channel. This is the source-versus-channel separation compared with VIII-B and VII-G [12, 8, 9, 20, 21].

An exact algebraic finite catalogue

For an integer $q \geq 6$, let

$$K_q = \left\lfloor \frac{2^q}{40} \right\rfloor, \qquad \mathcal{T}_q = \{-K_q, \ldots, K_q\}, \qquad t_m = m2^{-q}, \qquad \mu_m = \mu_0 + 6\arctan t_m.$$

Every entry lies in I, since

$$|\mu_m - \mu_0| \leq 6\arctan(1/40) < 3/20 < \pi/20.$$

Its sector angle is

$$\theta_m = \frac{\pi}{2} - 2\arctan t_m.$$

Consequently,

$$\cos\theta_m = \frac{2t_m}{1+t_m^2}, \qquad \sin\theta_m = \frac{1-t_m^2}{1+t_m^2},$$

$$a_m = \frac{2}{3}\frac{1+t_m}{\sqrt{1+t_m^2}}, \qquad b_m = \frac{3}{5}\frac{1-t_m^2}{1+t_m^2}.$$

Proposition (Exact finite evaluation). *The ray and seam matrices of this table have rational entries. At dyadic s, its vertex, adapted-chart, length, and area entries are real algebraic numbers. Their dyadic floor reports are exactly decidable by algebraic-number comparison, including equality cases. No floating-point angle is required.*

Proof. The half-angle identity gives

$$e^{2i\arctan t} = \frac{(1+it)^2}{1+t^2}.$$

Hence

$$e^{i\theta_m} = \frac{2t_m + i(1-t_m^2)}{1+t_m^2}, \qquad e^{i\mu_m} = i\left(\frac{(1+it_m)^2}{1+t_m^2}\right)^3.$$

These have rational components. All remaining formulas use finitely many arithmetic operations and positive square roots of positive algebraic numbers. Standard algebraic isolation and sign comparison determine each comparison with a dyadic threshold. The finite size bound in Section supplies a finite report range.

For a concrete source, take a surviving qubit M, $J = Z$, $\theta = \kappa = 1$. A supplied classical token m has the promise

$$\mathrm{Tr}\,(\rho_M Z) = z_m, \qquad z_m = 6\arctan t_m.$$

Each promise class is nonempty, for example

$$\rho_m = \frac{1}{2}(I + z_m Z), \qquad |z_m| < 3/20.$$

The token is supplied before the source command. No operational test of is included.

Proposition (Finite-promise acquisition obstruction). *For distinct m, n, no deterministic one-copy channel can produce their different exact token labels on both ρ_m, ρ_n. For a binary label-acquisition attempt with error probabilities e_m, e_n,*

$$\max\{e_m, e_n\} \geq \frac{1 - d_{\mathrm{tr}}(\rho_m, \rho_n)}{2} = \frac{1}{2} - \frac{|z_m - z_n|}{4}.$$

No finite number of copies makes exact deterministic discrimination of these full-rank states possible.

Proof. The input trace distance is $|z_m - z_n|/2 < 1$, whereas distinct deterministic output labels have distance one. Contractivity under a channel excludes exact acquisition.

Let the output event "label *m*" have probabilities $1 - e_m$ and e_n. Their difference is bounded by the input trace distance. Therefore $e_m + e_n \geq 1 - d_{\mathrm{tr}}(\rho_m, \rho_n)$, proving . Tensor powers remain full rank and have overlapping support, so their trace distance remains strictly below one.

This finite-promise statement is stronger than merely observing that a code-only circuit cannot read matter. It does not exclude statistical estimation, stochastic outcomes, additional promised orthogonality, or a separately analysed approximation.

Guarded flow and a complete five-command history

We use the particle profile, not an undeclared transition between different substrate profiles.

State of a description

A description configuration contains:

$$(m, s, \sigma, h, v_{\mathrm{G}}, v_{\mathrm{S}}, m_{\mathrm{src}}; \mathrm{realization}, \mathrm{Cert}, \mathrm{reports}, \mathscr{L}).$$

Here *m* is the catalogue index, *s* the exact slice parameter, *σ* distinguishes incoming and outgoing zero germs, *h* contains source and schedule stages, and $v_{\mathrm{G}}, v_{\mathrm{S}}$ are separate nonnegative permissions. The original-name location table $\mathscr{L}$ uses only explicitly permitted persistent slots.

For the concrete operational instance, original names occupy a resting collar slot Q_0, extruded along the axial direction. No name is assigned to a collapsed outgoing cell or to the defect. The location word is abstract catalogue metadata; actual laboratory positions are supplied independently.

The command clock *s*, an execution counter, geometric time *T*, and the finite destructive-clock label are different objects.

Definition (Admitted commands). Each admitted command returns the entire realized output packet, all five certificate components, exact parameter metadata, canonical finite reports when used, and the declared original-name transport.

1. $G_{s \to s'}$: nondecreasing slice advance within one incidence epoch at fixed m. It may end at 0^{-} or begin at 0^{+}, but does not cross zero internally.

2. S_{tab}: source stage zero, exact $s = -1/2$, incoming regular mode, $v_{S} \geq 1$, and a supplied compatible token. It replaces the complete catalogue realization by the entry m_{src}, decreases v_{S}, and sets source stage to one. It does not spend v_{G}.

3. $E_{3 \to 6}$: exact $s = 0$, incoming germ, and $v_{G} \geq 1$. It selects the outgoing germ at the same fixed catalogue deficit, decreases v_{G}, and recomputes its incidence and matching tables. All these description operations act as identity on internal matter in a promised-token history.

The source command is not a continuous interpolation between the old and new cones. The event command is not a mixed incidence–deficit germ.

Proposition (Derived fixed-packet flow). *Within the incoming epoch, all finite edge lengths are constant under slice advance. Within the outgoing epoch, the four outgoing-only edge types grow linearly in s, the persistent radial length decreases linearly, and the other finite lengths remain constant. Their rates are correlated by the single realized parameter s, not independently selectable velocities.*

Each such advance preserves the installed packet and framed peripheral signature.

Proof. Differentiate the exact length table. The graph realization and Theorem supply all intermediate certificates. The packet contains no s-dependent deficit or seam rotation.

Remark (Optional collar module). An independently installed collar refinement can split every resting Q_{i} by $\rho = u$, $7/2 < u < 4$, while holding a regular s and μ fixed. Its chord length is uL_{θ}; its two ray pieces have lengths $u - r$ and $4 - u$. Changing u changes those subdivision lengths but not the embedded horizontal slice. All new

overlaps have identity ambient transition, so the peripheral certificate is unchanged. This module is not inserted silently during a source or incidence command.

Theorem (Complete-output induction). *For every finite legal word of Definition , the output after each command has an accepted five-component certificate. Fixed-packet commands preserve the installed framed peripheral signature. A source command replaces the complete selected catalogue entry rather than changing only its deficit label.*

For the stated persistent original-name domain, location transport is identity and remains valid. The matter state is unchanged, including all spectator and reference correlations.

Proof. A flow command is realized by Section , and every intermediate member is certified by Theorem . A source command evaluates the entire construction at its new table entry, so Proposition and Theorem supply a complete new output. An incidence command uses the two germs of Theorem at the same μ, with their common noncollapsing peripheral witness.

The declared persistent collar slots exist in each output. No internal matter gate has occurred. Induction over the word proves every assertion. For a more general location domain or patch composition, the location and gluing hypotheses must be supplied explicitly, as in Proposition .

The five-command word

For $q = 6$, $\mathscr{T}_6 = \{-1, 0, 1\}$. Start at $m = 0, s = -1$, incoming mode, source stage zero, and $v_{\mathrm{G}} = v_{\mathrm{S}} = 1$. Supply $m_{\mathrm{src}} = 1$, for example with

$$z_{+} = 6\arctan(1/64), \qquad \rho_{+} = \frac{1}{2}(I + z_{+}Z).$$

The chronological word is

$$\mathrm{W} = \mathrm{G}_{-1 \to -1/2}\,;\mathrm{S}_{\mathrm{tab}}\,;\mathrm{G}_{-1/2 \to 0^{-}}\,;\mathrm{E}_{3 \to 6}\,;\mathrm{G}_{0^{+} \to 1/2}.$$

$c\|c\|c\|c\|c$toprule k	command	s	m	$(v_{\mathrm{G}}, v_{\mathrm{S}})$	$\tau_P$in the selected description
midrule 0	initial	-1	0	$(1, 1)$	-1
1	G	$-1/2$	0	$(1, 1)$	$-1/2$
2	$\mathrm{S}_{\mathrm{tab}}$	$-1/2$	1	$(1, 0)$	$-1/2$
3	G	0^{-}	1	$(1, 0)$	0
4	$\mathrm{E}_{3 \to 6}$	0^{+}	1	$(0, 0)$	0
5	G	$1/2$	1	$(0, 0)$	1
bottomrule					

Corollary (Nonempty promised history). *The word is legal on every compatible fixed-token input and returns accepted complete outputs. Its incidence occurs at the frozen selected deficit* $\mu_1 = \pi/2 + 6\arctan(1/64)$. *Its sole catalogue-deficit replacement occurs at the regular source command.*

Replacing the supplied token by zero, with zero source expectation, selects the reference family. It need not be identity on an arbitrary old catalogue packet.

Proof. The three flow intervals stay in their declared epochs. The source and incidence guards are exact, and each uses only its own available permission. Theorem applies. The zero-token statement follows from μ_0.

For auditing the nonzero entry,

$$e^{i\theta_1} = \frac{128 + 4095i}{4097}, \qquad a_1 = \frac{130}{3\sqrt{4097}}, \qquad b_1 = \frac{3\,4095}{5\,4097}.$$

At finer q, the same selected packet has index $m = 2^{q-6}$, not index one.

Proposition (What the history does on a fixed host). *On a fixed host with* $\mu_{\mathrm{H}} = \mu_0$, *the nonzero-token word is an implemented history of description registers. Its post-source certificates concern* M_{μ_1}, *not a changed host metric. The zero-token word may instead describe the host's own prescribed family throughout.*

Neither history supplies an Einstein evolution or a geometric interpolation between different deficits.

Proof. The host metric is fixed by Definition . Every source and event operation in the word is specified on finite description data; none acts on the metric. The distinct deficits have distinct peripheral rotations by Proposition . The zero-token specialization has $\mu = \mu_{\mathrm{H}}$. No common mixed realization has been supplied.

Finite encodings and reversible composition

Fix a clock precision $p_{\mathrm{c}} \geq 1$ and report precision $p_{\mathrm{r}} \geq 0$. Endpoint parameters are encoded exactly as

$$s = j2^{-p_{\mathrm{c}}}, \qquad -2^{p_{\mathrm{c}}} \leq j \leq 2^{p_{\mathrm{c}}}.$$

The two zero germs have separate mode codes. A report for one of the 24 finite slots is

$$Q_e = \lfloor 2^{p_{\mathrm{r}}} \ell_e \rfloor,$$

with zero for inactive slots.

All compact endpoints have spatial norm at most four. An induced spacelike edge length is at most the spatial endpoint distance, hence at most eight. Therefore $p_{\mathrm{r}} + 4$ bits per report are sufficient.

Definition (Canonical description block). Reserve one block of

$$B = 24(p_{\mathrm{r}} + 4) + (p_{\mathrm{c}} + 2) + 2(q + 2) + 16 + 6N_{\mathrm{loc}}$$

bits, containing:

• 24 reports;

• the exact signed parameter;

• installed and supplied-token indices;

• a 16-bit control reserve for schedule stage, source stage, mode, two one-bit permissions, validity, and padding;

• six location bits for each of N_{loc} original names. Fixed identifiers, frame, formulas, and code dictionaries belong to separately charged programme storage. The canonical decoder reconstructs the exact symbolic geometry from the index, parameter, mode, and formulas. Reports are consistency data, not the underlying geometry.

Six location bits suffice for the unrefined finite particle dictionary: the outgoing compact patch has $13 + 24 + 12 = 49$ cells. Only persistent permitted location slots are used operationally.

Proposition (Exact guard versus report). *A zero rounded length is not an exact incidence test. For a born edge*

of length cs, $c > 0$, its floor report is zero for every $0 < s < 2^{-p_r}/c$. The event guard must use exact $j = 0$, mode, and permission.

Proof. In that interval $0 < 2^{p_r} cs < 1$. Its floor is zero although the edge is active and positive.

Each command is a finite function on canonical blocks. Extend it to a total Boolean function $f_i : \{0,1\}^B \to \{0,1\}^B$ by preserving invalid code data and setting a declared rejection flag. A semantic matter promise is not operationally tested by this extension.

Theorem (Exact reversible implementation with retained inputs). *Every f_i has a NOT–CNOT–Toffoli realization of*

$$|x\rangle|0^B\rangle|0_w\rangle \text{longmapsto } |x\rangle|f_i(x)\rangle|0_w\rangle$$

with at most B clean work bits and the conservative gate bound

$$G_B \le (4B + 2)B2^B.$$

Five commands can be composed with six B-bit snapshot blocks, one B-bit work reserve, and at most $5G_B$ gates. The original input snapshots are retained; the work is returned to zero. The circuit acts as identity on internal matter and every untouched reference.

Proof. For each output bit, express its Boolean function as the XOR of its accepting input minterms. Each minterm is a NOT on the target conditioned on one complete B-bit pattern. Negative controls use at most $2B$ NOTs. A ladder of at most B clean work bits computes and uncomputes the conjunction with at most $2B$ further Toffoli-type steps, with CNOT or NOT handling the small cases. Thus $4B + 2$ gates per minterm is sufficient. There are at most $B2^B$ minterms. The resulting transformation is the total permutation $(x, y) \mapsto (x, y \oplus f_i(x))$.

Apply this construction from snapshot i into blank snapshot $i + 1$. The six snapshots retain all information needed for a reversal; no many-to-one erasure is asserted. Tensor every gate with identity on matter and reference.

This is an explicit finite truth-table construction. Its exponential bound is not a complexity improvement.

Retained-history reversibility is consistent with the general principle of reversible computation [37]. The recorded figshare comparison of readout, recovery, and the limits of geometric response [42] is a source record at this existing reversible-encoding discussion; it is not a new magic theorem of the present sheet.

Preparation and promise. The finite source table does not manufacture its own input token. A fixed independent code-only circuit has code output independent of an unencoded matter expectation. For each fixed token the circuit is a valid channel on all matter inputs; its geometric source interpretation is asserted only on the promised class.

Programme storage. Storing five full B-bit output tables uses at most $5B2^{B}$ bits, with an additional finite instruction and address reserve. These are classical resources, not free uncharged oracles. No executed table generation or physical compilation is reported.

One destructive clock and complete table instruments

Let the single designated quantum clock have dimension $D = 2^{m}$, with installed orthonormal calibration basis $\{|\tau_a\rangle\}_{a=0}^{D-1}$. Let S contain all surviving code, matter, and payload factors. Put

$$P_a = |\tau_a\rangle\langle\tau_a|, \qquad D_a = \langle\tau_a|_C \otimes I_S.$$

Theorem (Complete destructive-clock instrument). *A calibrated basis change followed by destructive Enter on all clock names has channel*

$$\mathscr{M}_C(X) = \sum_a \operatorname{proj} a_R \otimes D_a X D_a^{\dagger} = \sum_a \operatorname{proj} a_R \otimes \operatorname{Tr}_C[(P_a \otimes I)X(P_a \otimes I)].$$

It is CPTP on all operators and with every untouched reference. It returns the classical code and the unnormalized conditional surviving block, has no quantum clock output, and obeys

$$\operatorname{Tr}_R \mathscr{M}_C(X) = \operatorname{Tr}_C X.$$

Positive branches may be normalized; zero branches are not.

Proof. The Kraus operators are $|a\rangle_R \otimes D_a$, and their squared moduli sum to $\sum_a P_a \otimes I = I$. Expansion in the clock

basis shows that each formula in returns the same *aa*-block. Summing those blocks proves . The calculation is unchanged after adjoining a reference. Consumption is the declared destructive interface.

This is the finite interface compared with I-B, En09-A, VI-B, and the ST observation sheets [4, 10, 22, 8, 9, 20, 21]. Its proof is finite instrument theory, not geometric inference [35, 34].

The clock can be read once to select a finite declared programme. Subsequent exact command counters are classical control registers. They are not repeated uses of the consumed quantum clock.

Proposition (Calibration and clock limits). *For distinct labels t_a, exact event-time calibration at a single actual reading event e,*

$$p_a > 0 \Rightarrow t_a = T(e),$$

forces one deterministic outcome, or is impossible if no label equals $T(e)$.

A history/programme calibration may instead label different stored events or schedules and need not equal the reading-event time.

The clock instrument has no universal left inverse. No finite matrices satisfy $[T_C, H_C] = i\hbar I_C$, $\hbar \neq 0$. Consuming C does not consume the geometric time coordinate.

En09-A records the same discipline in Scholar-facing form [10]: the destructive clock consumes a finite encoding, not the geometric time axis. That comparison is documentary, not a new clock theorem of this sheet.

Proof. Distinctness permits at most one event-calibrated outcome. For noninvertibility, the two clock states $(|\tau_0\rangle \pm |\tau_1\rangle)/\sqrt{2}$, with the same payload, have identical destructive outputs. The commutator assertion follows by tracing the equation. The metric and T are external data, not output factors removed by $\mathscr{M}_C$.

No stationarity or clock-covariance hypothesis needed for a Page–Wootters dynamical interpretation is assumed here [38, 10]. The clock is a finite programme/history readout under external scheduling.

Branchwise promise correction

Proposition (Clock-conditioned source promises). *If a source command acts after clock readout, its token promise must hold for the conditional source reduction in every positive-probability branch that receives the source interpretation. A promise on the unconditional source marginal alone is insufficient.*

Proof. The actual branch input is $\sigma_a = D_a \rho D_a^\dagger / p_a$. Its source expectation is evaluated in σ_a, not in their average. For example, a clock classically correlated with source states $|0\rangle, |1\rangle$ can have unconditional source expectation zero but conditional expectations $1, -1$. The channel identity remains valid without any promise; only the source interpretation requires the branchwise condition.

This is not an operational promise test. Canonical fixed-code, fixed-clock preparations with the explicitly supplied ρ_m make the admissible domain nonempty.

Fixed-table complete-channel approximation

For a finite code set $\mathscr{X}$, let $L_{a,y}$ be known diagonal matrices,

$$L_{a,y} = \sum_{x \in \mathscr{X}} \ell_{a,y}(x) \operatorname{proj} x, \qquad \sum_y |\ell_{a,y}(x)|^2 = 1.$$

They encode already-defined certificate scores or readout choices, not an unknown continuum observable. The complete clock–table instrument is

$$\mathscr{I}(X) = \sum_{a,y} \operatorname{proj} a_R \otimes \operatorname{proj} y_Y \otimes L_{a,y} D_a X D_a^\dagger L_{a,y}^\dagger.$$

Proposition (Fixed-interface approximation). *The instrument is CPTP. Suppose normalized approximating coefficient vectors satisfy*

$$\max_{a,x} \left(\sum_y |\hat{\ell}_{a,y}(x) - \ell_{a,y}(x)|^2 \right)^{1/2} \le \delta.$$

On the same finite interfaces, the approximating complete instrument obeys

$$d_\diamond(\widetilde{\mathscr{I}}, \mathscr{I}) \le \min\{1, \delta\}.$$

Exact discrete outputs such as acceptance and incidence guards must be retained exactly, not inferred from approximate scores.

Proof. Completeness of the displayed Kraus family proves the channel assertion. Define

$$V_a|x\rangle = |x\rangle\sum_y \ell_{a,y}(x)|y\rangle.$$

These are isometries and $\left\|\widehat{V}_a - V_a\right\|_{\mathrm{op}} \le \delta$, because distinct x-columns have orthogonal code factors. Use one joint controlled isometry for all clock blocks, then the common record dephasing/readout. For isometries V, W, expansion into two terms gives $\frac{1}{2}\|\mathrm{Ad}_V - \mathrm{Ad}_W\|_\diamond \le \|V - W\|_{\mathrm{op}}$, also with references. Channel postprocessing contracts the norm. The last assertion is the guard distinction of Proposition .

For deterministic exact table outputs, it is usually preferable to retain the symbolic output label and decoder. Approximating a real label by a different orthogonal output label does not itself converge in diamond norm.

Computational support and independent causal containment

Every preparation, encoder, decoder, measurement outcome, controller variable, route-selection bit, reset, and retained record read by an operation belongs to its declared interface. All network maps are unconditional CPTP maps. Classical feed-forward is represented by controlled channels, not by a hidden state-functional scheduler.

For finite site set X, let

$$\mathscr{H}_X = \mathrm{bigotimes}_{x\in X}\mathscr{H}_x, \qquad \mathscr{A}(Y) = \mathscr{B}(\mathscr{H}_Y)\otimes I_{X\setminus Y}.$$

Theorem (Computational backwards support: the C5 interface). *Let prescribed partitions $\mathscr{B}_r$ define layers*

$$\Phi_r = \mathrm{bigotimes}_{B\in\mathscr{B}_r}\Phi_{r,B}, \qquad \mathrm{diam}_{d_X}(B) \le \Delta,$$

with all block maps CPTP. Set

$$N_{t,t}(Y) = Y, \qquad N_{u,t}(Y) = \bigcup_{\text{substack } B\in\mathscr{B}_{u+1}}$$

Then

$$(\Phi^{*}_{u+1}\cdots\Phi^{*}_{t})(\mathscr{A}(Y)) \subseteq \mathscr{A}(N_{u,t}(Y)), \qquad N_{u,t}(Y) \subseteq \{x : d_X(x,Y) \le (t-u)\Delta\}.$$

Equal input reductions on $N_{u,t}(Y)$ give equal outputs on Y. For joint output with untouched reference E, equality is required on the joint input $N_{u,t}(Y)E$, not only on its site marginal.

This set is a computational upper bound, not an identified spacetime causal past.

Proof. A block disjoint from the current observable support acts on identity. Its adjoint is unital and preserves that identity. Every other block can enlarge support only within its own input block. Backward induction proves the first inclusion. Each layer adds at most one block diameter, giving the second.

Output expectations then depend only on the named input reduction. With a reference, the pullback belongs to $\mathscr{A}(N_{u,t}(Y)) \otimes \mathscr{B}(\mathscr{H}_E)$, proving the referenced statement.

This is the computational content of VIII-C's C5 and the partitioned-locality comparisons [13, 23, 24]. Operational consistency does not, by itself, select the Lorentzian host geometry [43]. An identity block can overestimate influence, and two independent SWAPs can cancel. Scheduled ancestry need not be minimal influence.

For a general finite directed acyclic circuit, conservative dependency edges connect every input of a gate to every output. The same reverse induction bounds every joint terminal observable by its complete scheduled ancestor set. A reduced dependency graph needs a joint-output support proof; single-output marginal tests are insufficient.

Proposition (Exact no-signalling criterion). *For input region A, output B, and channel Φ_B, the following are equivalent:*

1. *all deterministic local interventions on A give the same BE output for every initial state and untouched reference;*

2. $\Phi_B = \Xi \mathrm{Tr}_A$ *for a CPTP map* Ξ*;*

3. $\Phi^{*}_{B}(\mathscr{B}(\mathscr{H}_B)) \subseteq I_A \otimes \mathscr{B}(\mathscr{H}_{A^c})$.

Proof. Factorization proves (i), because a local trace-preserving intervention leaves the A^cE reduction unchanged.

For the converse, compare identity on A with replacement by $I_A/\dim \mathscr{H}_A$. Equality on all states and linearity give

$$\Xi(Z) = \Phi_B(I_A/\dim \mathscr{H}_A \otimes Z), \qquad \Phi_B = \Xi \mathrm{Tr}_A.$$

Taking adjoints gives (iii). Conversely (iii) makes all output expectations depend only on the A^c reduction and gives the same factorization.

Postselection and normalized branch conditioning are not deterministic interventions in this criterion.

Theorem (Independent physical-containment certificate). *Assign every port of the complete encoded–computed–decoded network an event in the fixed regular host. Suppose every dependency edge has an actual future-causal route inside its supported operational presentation. Then*

$$\mathrm{Inf}^{-}(B) \subseteq \mathrm{Sch}^{-}(B) \subseteq \mathrm{Phys}^{-}(B).$$

Interventions outside the prescribed physical past of the declared joint output have zero signalling, including with untouched references.

Proof. The support theorem gives the first inclusion. Concatenate the supplied causal curves along each scheduled path. Transitivity gives the second inclusion. Apply Proposition .

This is an embedding into an input causal relation, not a reconstruction of that relation [18, 19]. No numerical shortest-distance infimum is substituted for a regular route that might pass through the removed apex.

Lemma (A sufficient speed in the slicing parameter). *An actual regular spatial path $x(s), \zeta(s)$ with speed at most*

$$v_* = \frac{1}{1+\lambda}$$

lifts by $(F_s(x(s)), x(s), \zeta(s))$ to a future-causal curve. The bound holds across $s = 0$.

Proof. The lower temporal-order estimate and spatial Lipschitz bound give, almost everywhere,

$$\frac{\mathrm{d}}{\mathrm{d}s} F_s(x(s)) \geq 1 - \lambda |\dot{x}(s)| \geq |(\dot{x}(s), \dot{\zeta}(s))|$$

when the full spatial speed is at most v_*. The lift is Lipschitz and has future-causal tangent almost everywhere. The estimate does not require differentiability of the cellulation at zero.

A regular buffered clock–certificate transport realization

Finite routing permissions

Assumption (Operational primitives). The fixed host permits:

• independent local finite preparations;

• positive-duration local finite gates and complete instruments;

• storage on static regular station worldlines;

• exact carriage of a finite register along a specified future-causal regular curve;

• classical copying and communication with all records, controllers, and buffers charged. These are ideal finite-model permissions. They are not a continuum-field construction of the communication mechanism.

Lemma (Reference-preserving chain identity). *Install $n + 1$ equal payload registers on a supplied regular chain. Initialize all except the source in one fixed blank. Successive adjacent SWAPs transport the source factor exactly to the final site and return the previous sites to blank. The identity holds on all payload-reference operators.*

Proof. Each SWAP exchanges tensor factors, not merely their marginal states. Inductively the complete unknown factor and all its correlations move one step. Every factor left behind equals the original blank. Matrix-unit linearity proves the referenced identity.

A two-site SWAP at separated static endpoints is realized here by opposite causal carriage of their contents. It is not an instantaneous nonlocal gate. For a prescribed local null displacement a target-adapted chain can realize exact logical transport under the same permissions; local computation, copying, and decoding time must then be accounted separately [4, 25, 26, 41].

Explicit stations, buffer, and schedule

Choose the host deficit $\mu_{\mathrm{H}} = \mu_{0}$. In its first developed right-angle sector set

$$x_{*} = (15/8, 15/8), \qquad \rho(x_{*}) = 15/4.$$

This is a regular resting-collar point. Choose axial separation

$$L = 1/64, \qquad A = (x_{*}, 0), \qquad B = (x_{*}, L),$$

and $n \geq 1$ equally spaced axial chain sites. Take a bounded convex spatial tube around this segment and normalized operating interval $[-1, 3]$. Its closure is disjoint from the worldsheet. All initial data and controllers are installed before use.

Let M be the surviving source register and P an arbitrary p-qubit payload, both initially at A. They may be correlated with each other and with an untouched reference. Install n blank p-qubit payload registers along the chain.

Use one three-qubit clock. Its codes $a = 0, 1, 2$ select the declared five-command history with supplied token $m_{a} = -1, 0, 1$, respectively. Other codes select a complete rejected/no-op branch. A code is geometrically interpreted only when its stored token and branchwise source promise are compatible. No record is asserted to acquire that promise.

Destroy the three clock qubits in three positive slots of length 1/48, during

$$[-1/2, -7/16].$$

The record is then available before all programme-controlled operations.

Run the five reversible command computations in the intervals

$$\begin{aligned} c|c\mathrm{G}_{1} &\quad [1, 17/16] \\ \mathrm{S}_{\mathrm{tab}} &\quad [5/4, 21/16] \\ \mathrm{G}_{2} &\quad [3/2, 25/16] \\ \mathrm{E}_{3 \to 6} &\quad [17/8, 35/16] \\ \mathrm{G}_{3} &\quad [35/16, 9/4]. \end{aligned}$$

Each finite gate list fits by giving its elementary gates equal positive subintervals within its macro-slot. The finite permission assumption supplies those local gates; no gate-rate law is inferred.

The payload remains stored at A through $\tau = 9/4$. Thus it is buffered across the singular transverse incidence time $\tau = 0$ and across the host marking $s = 0$ at the regular collar station, where $F_{0}(x_{*}) = 2$. No operation touches the defect. The event-code computation describes the prescribed zero germ and finishes later; it is not an instantaneous geometric update.

Let

$$K = 6B + 3$$

be the classical packet consisting of all six snapshots and the three-bit clock record. After $\tau = 9/4$, use n stages of duration $1/(4n)$. In each stage:

1. during its first half, copy the K classical bits at the current station into a local blank outgoing buffer, using K positive slots of duration $1/(8nK)$;

2. during its second half, carry that copied classical packet and exchange the adjacent payload contents over the axial segment of length L/n. The communication speed is

$$\frac{L/n}{1/(8n)} = 8L = \frac{1}{8} < 1$$

in normalized developed units. The payload and all records arrive by $\tau = 5/2$, then wait until output time $\tau = 3$. All station copies of the classical history are retained.

Theorem (Complete buffered recorded channel). *The preceding construction is a nonempty regular-part realization of the clock, five-command computation, and certificate-history transport.*

For an input classical code word x, let $r(a, x)$ be its complete six-snapshot history together with the clock record, including rejection data on invalid branches. For an arbitrary operator X on clock, code, source, and payload, define the canonical classical-interface blocks

$$X_{a,x} = (\langle\tau_a|_C\langle x|_G \otimes I_{MP})X(|\tau_a\rangle_C|x\rangle_G \otimes I_{MP}).$$

The complete channel, with the canonical pinching of the classical input interface understood, is

$$\mathcal{J}(X) = \sum_{a,x} (|r(a,x)\rangle\langle r(a,x)|)^{\otimes(n+1)} \otimes \mathcal{U}_{\mathrm{tr}}(X_{a,x}) \otimes \omega_{\mathrm{clean}}.$$

Here $\mathcal{U}_{\mathrm{tr}}$ is identity on the named source factor and exact transport of the payload factor from A to B; ω_{clean} contains the final blank payload registers and zero work.

Equation holds with every untouched reference. Its geometric certificate interpretation holds branchwise on the stated promised canonical domains. Its causal dependencies are contained in the fixed host causal relation.

Proof. Theorem gives the clock blocks. On a classical code word, Theorem produces its six retained snapshots and clean work while acting as identity on *MP*. Copying an already classical word creates the displayed perfectly correlated record copies; it does not copy an unknown quantum state.

Lemma proves exact payload transport, including its correlations with source and reference. All elementary operations are trace preserving on the complete interface; invalid branches are retained rather than postselected away. This proves the channel formula.

The semantic promise is used only to interpret the source-table entry. Proposition identifies the required branchwise class. For arbitrary off-diagonal code operators, the stated canonical classical-interface extension first pinches them. The coherent reversible circuit, before that classical extension, has its own isometric action and is not confused with the pinched map.

Every local operation has a positive duration on a regular station worldline. Every communication uses an explicit timelike axial segment in the convex tube, and each record is delivered before its next use. Theorem applies.

The source register remains at *A*. The payload's reference entanglement is preserved, not generated by the cone.

On any canonical accepted branch, replacing the source payload *P* by $|0^p\rangle$ or $|1^p\rangle$ produces orthogonal outputs at *B*, a unit signalling witness along the allowed route.

For $m_{a} \neq 0$, the delivered certificate describes another catalogue cone. The causal routes in still use $g_{\mu_{0}}$.

Resource ledger

For q_{M} source qubits and a p-qubit payload, sufficient reserves are:

$l\|l$toprule resource	reserve or count
midrule source register	q_{M}qubits
payload registers	$(n+1)p$qubits
single destructive clock	3qubits
description snapshots	$6B$bits
clean command work	Bbits
sender clock record	3bits
receiver-side history buffers	nKbits
command gates	$\leq 5G_{B}$
classical copying gates	nKCNOTs
payload exchanges	$n$block SWAPs
classical packet transmissions	n
clock destructive readouts	3
resets during the run	0
retained complete classical histories	$n+1$
bottomrule	

If all classical storage is represented by basis-state qubit carriers, a conservative peak is

$$Q_{\text{peak}} \leq q_{M} + (n+1)p + 7B + 6 + nK.$$

The extra six reserves both clock inputs and its record at the peak without optimizing their overlap. A block SWAP consists of p qubit exchanges if that is the primitive interface.

For completeness, set

$$b_{\text{ctl}} = \lceil \log_{2}(5G_{B} + K + n + 16) \rceil.$$

One b_{ctl}-bit local counter per station suffices to index its finite gate/copy/communication programme. A finite explicit ROM reserve can be chosen as

$$5B2^{B} + (n+1)(5G_{B} + K + n + 16)(4 + 3b_{\text{ctl}})$$

bits. These instructions and counters are classical inputs and must be present before use. No remote instantaneous global counter is required.

All blanks, copied records, histories, and work are charged. Reference storage is external and is not charged as laboratory storage. No thermal reset cost, energy budget, or Landauer cost is deduced from this channel ledger.

Error budgets and finite certificates

Proposition (Complete-channel telescoping). *For compatible ideal and implemented channel factors,*

$$d_{\diamond}(\widetilde{\Phi}_N \cdots \widetilde{\Phi}_1, \Phi_N \cdots \Phi_1) \leq \min\left\{1, \sum_{j=1}^{N} d_{\diamond}(\widetilde{\Phi}_j, \Phi_j)\right\}.$$

All encoders, clock operations, classical controls, communication, failure outputs, and decoders belong to the comparison.

Proof. Subtract the compositions and replace one factor at a time. Each term has one channel difference, surrounded by channels. Their diamond norms are contractive under those compositions. Apply the triangle inequality and divide by two.

Define reference-assisted signalling as the supremum of output trace distance produced by two deterministic local interventions on a fixed input region, with arbitrary initial state and untouched reference.

Proposition (Accuracy is not exact causal safety). *For channels on the same comparison interfaces,*

$$|\mathrm{Sig}_{\Phi}(A \to B) - \mathrm{Sig}_{\Psi}(A \to B)| \leq 2 d_{\diamond}(\Phi_B, \Psi_B).$$

Thus a total half-diamond error ε changes a signalling value by at most 2ε. An implemented causally embedded network has exact forbidden-pair no-signalling independently of its simulation accuracy. Accuracy alone supplies only the stated leakage bound.

Proof. For fixed initial state, reference, and interventions, compare the two output pairs by the triangle inequality. Each of the two state-comparison errors has trace distance at most the channel half-diamond distance. Take suprema and exchange Φ, Ψ. Exact containment follows separately from Theorem .

These conventions agree with the finite VII-J comparisons [18, 19]. No normalized rare-branch error is substituted for a complete instrument error.

Certificate table

The principal finite checks can be organized without an executed numerical run:

$p.\,34\mathrm{linewidth} p.\,57\mathrm{linewidth}\mathrm{toprule}$ obligation	exact witness
midrule uniform regular spacelikeness	$(1-\lambda^2 = 1/9)$
cap separation	$(h-k \geq d\rho, \quad 1/d < r)$
active nondegeneracy	$lengthtableandpositiveareas$
unique transverse incidence	$newcoordinatesproportionalto(s>0), withnocapcontact$
ambient matching	$(T_{g \leftarrow f} = A_g J_\mu^{n_{gf}} A_f^{-1})$
primitive topology	$angularliftincrement(2\pi-\mu), retainedwindingone$
worldsheet fixation	$(J_\mu(\tau,0,\zeta) = (\tau,0,\zeta))$
source-off control	$(\mu_\theta = \mu_0) when (\theta\kappa \mathrm{Tr}\,(\rho J) = 0)$
table algebraicity	$rationalhalf-angleidentities$
exact event guard	$(j=0), incomingmode, (v_{\mathrm{G}} \geq 1)$
clock completeness	$(\sum_a D_a^\dagger D_a = I)$
reversible composition	$sixretainedsnapshotsandzerofinalwork$
transport	$axialcommunicationspeed(1/8<1)$
output arrival	$(9/4+1/4=5/2<3)$
physical support	$allcontrollerandpayloadcurvesinsidetheregulartube$
bottomrule	

Finite matrices may store these already-defined evaluations. For example,

$$A_{\text{permission}} = \sum_x 1_{\{\text{exact guard accepts} x\}} \text{proj}\, x$$

is an exact Boolean table, not a detector for an unknown continuum geometry.

Release theorem, significance, and non-claims

Proposition (Stress identities do not imply Einstein dynamics). *Symmetry, conservation, and zero trace of a tensor on a prescribed metric do not imply*

$$G_{\mu\nu}(g) = 8\pi G_{\mathrm{N}} t_{\mu\nu}.$$

Proof. In any regular Minkowski chart of the host, choose a nonzero constant null covector k and set $t_{\mu\nu} = k_\mu k_\nu$. It is symmetric, constant and conserved, nonzero and traceless. The local Einstein tensor is zero. The displayed equation fails for $G_{\mathrm{N}} \neq 0$. This local counterexample does not require an assertion about a distributional stress tensor on the singular worldsheet.

This is the finite logical separation emphasized in the VIII source records [11, 12]. Classical conical gravity supplies useful context, but no mass–deficit law or Hamiltonian is imported from it [39].

Theorem (VIII-ST local Grade S release). *For the prescribed catalogue and fixed-host operational permissions, this manuscript establishes:*

1. *an explicit uniformly spacelike, embedded, acausal, strictly ordered product marking, with a unique transverse three-to-six incidence for every fixed $\mu \in I$;*

2. *exact vertices, finite lengths, areas, one-sided laws, adapted Lorentz-affine charts, winding-marked words, and complete five-component matching certificates;*

3. *fixed-presentation uniqueness, stale-rotation rejection, time-shift rejection, and spectator-blind deterministic control;*

4. *residual-source separation, sharp coarse-instrument compatibility conditions, and the stated full-input recovery safeguards;*

5. *a semantic expectation-selected catalogue packet, source-off specialization, affine-label obstruction, and finite-promise acquisition obstruction;*

6. *an exact algebraic table, guarded five-command history, complete-output induction, and finite reversible implementation on canonical forward domains with retained histories;*

7. *one complete destructive-clock instrument, explicit calibration limits, branchwise promise conditions, and a fixed-table complete-channel approximation theorem;*

8. *computational backwards support, exact intervention no-signalling, and physical containment under a separately certified causal embedding;*

9. *a nonempty regular buffered protocol transporting an unknown quantum payload and its classical certificate history with arbitrary untouched references and the displayed resource ledger. The variable-deficit source command is catalogue replacement, not host metric evolution. These results constitute local Grade S, not Grade*

E.

No inherited quantum response coefficient is admitted. The quantum certificate remains RG-open. The standing analytical boundaries recorded below are not discharged by this release.

Proof. Lemmas –, Proposition , and Theorem prove (i)–(ii), completed by Theorem . Propositions and prove (iii). Section proves (iv). Theorem and Propositions , prove (v). Sections – prove (vi). Section proves (vii). Section proves (viii). Theorem and its ledger prove (ix). Proposition supplies the principal interpretive correction.

None of these constructions defines a characteristic quantum product, a renormalized relational field observable, or the missing analytic admission map. The final scope statements therefore are not altered.

Potential usefulness and precise novelty

The positive outcome is a same-document chain from classical geometric realization to finite accepted descriptions, guarded code flow, complete recorded channels, and actual regular causal routes.

It is potentially useful as a benchmark for a later proposal that claims more. Such a proposal can be asked to supply, on the same interfaces:

• a source-acquisition instrument rather than a promised token;

• a consistent dynamical host change rather than catalogue replacement;

• a field representation rather than a finite table;

• a physical embedding of every controller dependency rather than a computational support diagram. Passing one item does not pass the others.

The geometry, matching philosophy, and guarded history have explicit predecessors in series VIII. The general instrument, channel-distance, recovery, and reversible-computation principles are also established subjects [35, 34, 36, 37]. No priority claim for those general principles is made.

Documentary relationships and analytical stops

I-B, VII-F, VII-J, the ST counterparts, the observation sheets, VI-B, En09-A, En03-A, En05-A, and En08-A/B are comparison records for the interfaces identified in the text [4, 17, 18, 19, 8, 9, 20, 21, 22, 10, 23, 24, 25, 26]. Their citation does not transfer an unprinted theorem premise. Official Series-VIII-Enter-A Version 3 is the successor synthesis of this package, not a parent and not a theorem premise [15]. It is not cited here as Version 4. Official I-D-v5 [7] is a dynamical-host comparison; the host of this sheet stays prescribed. A Scholar display reading "ID-v6 Dynamical Spacetime Enter over Two Prescribed Hosts" is a display only; it does not retitle the official work. Until this sheet is deposited, citing it from another sheet does not by itself create a Scholar-counting DOI. In particular, scheduler consistency does not select the host cone; a supplied null-transport contract does not derive its metric.

The OpenAI catalogue is a separate collection attributed to OpenAI [44]. Families concerning finite computation, recovery, matching, or scheduling supply no premise or verification here. A documentary separation is not a proof transfer.

Historical H2 in XIV-H, the internal amplitude construction in XIV-I, and the still missing full characteristic map at I3/J2 are different version-qualified records [27, 28, 29, 30]. This manuscript does not discharge historical H2 or the full I3/J2 requirements. It does not open the downstream quantum-admission exit called XV-B. This is not a claim that no technical manuscript bearing that identifier exists.

XVI-N's universal obligations and Route B are not discharged. Within the stated XVI-O prescription, O.1 remains NOT_(C)LOSED; separately scoped enlarged-prescription subsector statements do not update that particular record [31, 32, 33].

par **Explicit non-claims** par No intrinsic global conical Green/Cauchy theorem, continuum-field acquisition, quantum-field discretization, sourced Einstein solution, renormalized relational product, quantum Ward/BRST/BV identity, radiative coefficient, or quantum renormalization separator is constructed.

No causal cone or metric is reconstructed from records. No Einstein dynamics, Grade E, spacetime emergence,

holographic identification, Page curve, island, interior, gravity-generated entanglement test, ultraviolet completion, cosmological bounce, or vacuum-energy stability theorem is supplied.

No quantized relational time without external scheduling is constructed. Destructive Enter consumes a finite clock encoding, not the geometric time axis.

O.1 stays NOT_(C)LOSED in the stated prescription. XV-B is not opened. XVI-N is not discharged. The historical H2 and full I3/J2 boundaries are not discharged. No quantum coefficient is admitted. No compilation is asserted. par

appendix

Routing note and registry-facing scope record

The following is suggested documentary metadata. It is not an assertion that an external registry or user interface has been changed.

Routing note. VIII-ST specifies a local Grade S unification of affine matching, persistent transverse three-to-six cellulation, and guarded description flow on a prescribed conical product. Proposition records non-global hyperbolicity; Definition separates the sector atlas from a compact regular laboratory disjoint from the worldsheet. The variable-deficit family is a catalogue, and a source-table command updates a description rather than the host metric. Residual and affine obstructions separate record agreement, source selection, expectation acquisition, and quantum recovery. The C5 theorem is computational support; physical containment requires the independently supplied causal embedding. One destructive clock and an exact buffered transport protocol return complete records and surviving payloads. The quantum certificate remains RG-open. No intrinsic global cone theory, Einstein dynamics, Grade E, spacetime emergence, Page curve, island, interior, gravity-generated entanglement, ultraviolet completion, or externally unscheduled quantum time is constructed. O.1 remains NOT_(C)LOSED; XV-B is not opened; XVI-N and the historical H2/full I3/J2 boundaries are not discharged. No quantum coefficient or compilation is asserted. The author field is set to Ngo Cheung. Citing Cheung or OpenAI does not

by itself assign authorship.

identifier: VIII-ST?version: 2?grade: local Grade S??primarySourceRecords:? I-B? VIII-A@3? VIII-B@3? VIII-C@3??supportingComparisonRecords:? VII-F? VII-F-ST? VII-J? VII-J-ST? VII-E? VII-G? VII-E-ST? VI-B? En09-A? En03-A? En05-A? En08-A? En08-B??relationshipRole: separation?relationshipDistinction:? A documentary separation is not a proof transfer.??primaryProblemConnections:? relational: classical matching is not a quantized gravity observable? time: finite destructive clock and externally scheduled description flow? singularities: prescribed transverse incidence; defect not resolved??boundaryProblemConnections:? products: no renormalized relational product? vacuum: no vacuum-energy stability theorem? entanglement: no gravity-generated entanglement claim? beyond-EFT: no ultraviolet completion? Page-curve: not constructed??timeLandmarks: 1?includeInEmergenceSources: false?emergenceStatus: not constructed?quantumCertificate: RG-open??fixedHostCorrection:? A selected catalogue deficit does not change the apparatus metric.??standingBoundaries:? O.1 remains NOT_CLOSED in the stated prescription.? The downstream XV-B quantum-admission exit is not opened.? XVI-N and Route B are not discharged.? Historical H2 and full I3/J2 boundaries are not discharged.? No quantum coefficient is admitted.? No compilation is asserted.

Emergence card and walk sentence. VIII-ST certifies finite affine matching, persistent transverse three-to-six cellulation, and scheduled description flow on a prescribed conical product, with a destructive clock and reference-preserving transport. It does not extract the causal cone from records, evolve the host metric by a source token, or establish spacetime emergence.

Declarations

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