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VIII-B: A sourced spinless conical packet with a persistent three-to-six polyhedral slicing event

Landmark VIII-B

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Abstract

We construct an explicit spinless conical family on a compact deficit interval about $\pi/2$ and prove persistence of one declared three-to-six polyhedral slicing event. Three sectors of angle $(2\pi - \mu)/3$ are used, with coefficients retuned in the physical oblique metric. The two nonconstant gradient norms are exactly $2\sqrt{2}/3$ and $3/5$. The slices are embedded, uniformly spacelike on regular faces, globally acausal, and strictly ordered. At every admitted fixed deficit, the declared cellulation has exactly one incidence-event parameter. Vertices, lengths, one-sided laws, areas, adapted affine charts, winding-marked words, and primitive core and collar holonomies are explicit.

A fixed Hermitian observable on a named surviving matter interface selects a member of this preconstructed family through its expectation. The resulting deterministic semantic constructor leaves matter unchanged and is invariant under spectator extensions that preserve the named source reduction. Fixed-presentation matching uniqueness, stale-rotation rejection, and time-shift rejection are proved for the whole deficit interval.

A separate finite restriction uses an algebraic packet table and a supplied classical source token. On canonical promised inputs, it has an exact NOT–CNOT–Toffoli realization with retained history, clean work returned to zero, and identity action on internal matter. The token's agreement with the expectation is a representation promise, not an implemented measurement. Affine packet selection, expectation acquisition, classical records, and quantum recovery are distinguished by local proofs.

No mixed incidence–deficit germ, hybrid evolution theorem, field-theoretic source admission, mass law, or derivation of Einstein dynamics is asserted.

Bibliographic record

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Introduction and logical scope

Changing a conical deficit requires more than changing a label. The sector opening, seam identification, realized slices, adapted charts, and matching witnesses must change coherently. This paper supplies such a constructor on an explicit compact interval and proves that a specified particle-link event persists throughout it.

The argument has three independent stages:

1. construct and certify the geometry for every scalar deficit in the interval;

2. substitute the expectation of a fixed named Hermitian matrix into that scalar construction;

3. implement a finite algebraic restriction on classical codes carrying a compatible, externally supplied source token. The geometric theorem does not depend on the source law. The finite implementation does not acquire the

expectation and does not turn the continuum semantic rule into a quantum channel.

The affine matching interface of Landmark VIII-A [18] is restated here. Its fixed-presentation uniqueness and two rejected updates are proved locally for variable deficit. The accessible-current and residual distinctions reported in VII-E [15], and the affinity distinction reported in VII-G [16], are also proved in the present notation. None of these companion results is a formal premise. Destructive readout and the refusal of identification are the Scholar-facing Enter records [9, 10].

The physical setting is motivated by classical 2 + 1-dimensional gravity with zero cosmological constant: source-free regions are locally flat [1], and polygon descriptions can be reconstructed from first-order gravity [2]. These references provide context. We import neither a mass normalization nor a Hamiltonian or constraint-algebra theorem.

Faces in the present construction may be nonconvex, and regular vertices need not be trivalent. The results concern the explicit matching contract below, not every more restrictive polygon gauge.

toprule Object Result established here

midrule Variable-deficit cone Explicit spinless dictionary on a compact interval

Retuned slicing family Embedded, acausal, ordered, and uniformly spacelike

Three-to-six event Unique event of the declared cellulation

Matching certificate Realized witnesses for all five checks

Rejected incomplete updates Stale rotation and time shift rejected locally

Continuous source law Expectation-dependent semantic constructor

Spectator extension Invariance under unchanged named source reduction

Finite table Exact promised-domain reversible realization

Expectation acquisition Not implemented; an obstruction is proved

Quantum recovery Separate comparison criteria, not a table-decoding claim

bottomrule

Notation and conventions. Matter states are ρ; the sector radial coordinate is ρ. Developed spatial rays are $e_i \in \mathbb{R}^2$, whereas $\mathbf{t} = (1, 0, 0)^{\mathrm{T}}$ is timelike. The second oblique coordinate is ζ, distinct from the Minkowski metric η. All matrix operator norms are Euclidean spectral norms, including norms of homogeneous affine matrices; $\|\cdot\|_1$ is the trace norm. Report precision, clock precision, and permission width are p_{rep}, p_{clk}, and w_{src}. Lengths and the slicing parameter are expressed in fixed normalized units.

Named sources and observable agreement

The surviving source algebra

Let Γ be a finite named matter interface and $\rho \in \mathscr{D}(\mathscr{H}_\Gamma)$. Registers declared classical are jointly block diagonal in their distinguished bases, including their correlations with other factors.

For destructive basis readout of a factor S, with complement B, the output channel is

$$\mathscr{M}_S(\rho) = \sum_z |z\rangle\langle z|_R \otimes (\langle z|_S \otimes I_B)\rho(|z\rangle_S \otimes I_B).$$

The name S is absent from the output interface. Forgetting R gives $\mathrm{Tr}_S \rho$, by summing the diagonal blocks.

Choose a unital *-subalgebra

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

on declared surviving names, with a fixed embedding into the complete current interface. Fix

$$j[f] = j[f]^\dagger \in \mathscr{A}_{\mathrm{src}}, \qquad I_f(\rho) = \mathrm{Tr}\,(\rho j[f]).$$

The embedding is suppressed in formulas. Equivalently, the source input is the restricted state functional

$$\omega_\rho|_{\mathscr{A}_{\mathrm{src}}}, \qquad \omega_\rho(a) = \mathrm{Tr}\,(\rho a).$$

The notation $j[f]$ permits a declared real linear combination of smearings, but only the resulting fixed finite matrix

is used. Calling it a current is a declared interpretation, not a hypothesis needed to evaluate the trace.

A consumed factor, an inaccessible coherent carrier, spectator cardinality, and implementation history are not source variables. A produced record is eligible as a source only when its surviving register is explicitly named.

Agreement on one current and on an algebra

For a channel Φ, its adjoint is defined by

$$\mathrm{Tr}\,(\Phi(X)a) = \mathrm{Tr}\,(X\Phi^{*}(a)).$$

The following finite-dimensional observation criterion makes the meaning of source agreement explicit.

Proposition (Accessible-current criterion). *Let Φ, Ψ be channels with the same input and output interfaces, and let $j = j^{\dagger}$ be a fixed output observable. On the full input state space,*

$$\mathrm{Tr}\,(\Phi(\rho)j) = \mathrm{Tr}\,(\Psi(\rho)j) \quad \text{for every} \rho \quad \Leftrightarrow \quad \Phi^{*}(j) = \Psi^{*}(j).$$

Moreover,

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

*Agreement on every observable in a unital *-algebra $\mathscr{A}_{\mathrm{src}}$ is equivalent to equality of the adjoints on that algebra.*

If inputs are restricted to the complete classical block-diagonal state space, replace adjoint equality by

$$\mathscr{P}_{\mathrm{cl}}(\Phi^{*}(j) - \Psi^{*}(j)) = 0,$$

and replace the norm in by the norm of this pinched operator. Here $\mathscr{P}_{\mathrm{cl}}$ is the input block pinching.

Proof. Put $\Delta = \Phi^{*}(j) - \Psi^{*}(j)$, which is Hermitian. The expectation difference is $\mathrm{Tr}\,(\rho\Delta)$. Pure states in the eigenspaces of Δ show that all these expectations vanish precisely when $\Delta = 0$, and that the largest absolute expectation is $\|\Delta\|_{\mathrm{op}}$. Every algebra element is a complex linear combination of Hermitian elements, proving the algebra statement.

For block-diagonal ρ,

$$\mathrm{Tr}\,(\rho\Delta) = \mathrm{Tr}\,(\rho\mathscr{P}_{\mathrm{cl}}(\Delta)).$$

All density operators within every classical block are admitted. Spectral testing within those blocks proves both restricted statements.

This is the local current version of the observation-boundary criterion documented in VII-E [15]. Equality on one current does not imply equality on the whole source algebra, equality of channels, or equality of residual instruments.

Proposition (Record agreement does not determine residuals). *Two channels can have identical classical records for every input and different surviving residual states.*

Proof. For a qubit, let

$$\Delta_Z(X) = P_0XP_0 + P_1XP_1, \qquad P_z = |z\rangle\langle z|,$$

and define channels to a one-label record and a surviving qubit by

$$\mathscr{G}(X) = |*\rangle\langle *|_R \otimes X, \qquad \mathscr{F}(X) = |*\rangle\langle *|_R \otimes \Delta_Z(X).$$

Both records are always *. For $|+\rangle = (|0\rangle + |1\rangle)/\sqrt{2}$, the residual states are $|+\rangle\langle +|$ and $I/2$. Their difference is the Pauli matrix $X_{\mathrm{p}}/2$, with eigenvalues $\pm 1/2$. Thus their trace distance is 1/2. The residual observable X_{p} distinguishes them.

The example restates the residual distinction in VII-E [15]. In particular, agreement of classical token values does not certify agreement of an unobserved residual algebra or verify a token's agreement with an expectation.

Spinless packets and the matching contract

Affine conventions and packets

Use coordinates $z = (T, X, Y)$ and

$$\eta = \mathrm{diag}\,(-1, 1, 1), \qquad \mathbf{t} = (1, 0, 0)^{\mathrm{T}}.$$

Affine maps and their composition are

$$(L, b)z = Lz + b, \qquad (L, b)(L', b') = (LL', Lb' + b).$$

Define

$$R(\mu) = \begin{pmatrix} 1 & 0 & 0 \\ 0 & \cos\mu & -\sin\mu \\ 0 & \sin\mu & \cos\mu \end{pmatrix}, \qquad J(\mu) = (R(\mu), 0).$$

The reference worldline and rest vector are

$$\mathscr{W}_0 = \mathbb{R}\mathbf{t}, \qquad u_0 = \mathbf{t}.$$

The declared frame is restricted to

$$A = (C, a_0) \in \mathrm{ISO}^+(2,1), \qquad C \in \mathrm{SO}^+(2,1).$$

It preserves the metric, orientation, and time orientation. For a fixed particle identifier p, put

$$\Pi_A(\mu) = (\mathrm{p}, \mu, A\mathscr{W}_0, C\mathbf{t}, A, H_A(\mu)), \qquad H_A(\mu) = AJ(\mu)A^{-1}.$$

Explicitly,

$$H_A(\mu) = (CR(\mu)C^{-1}, a_0 - CR(\mu)C^{-1}a_0).$$

Lemma (Spinless matching). *For $0 < \mu < 2\pi$, the fixed-point set of $J(\mu)$ is $\mathscr{W}_0$, its Lorentz part fixes $\mathbf{t}$, and its oriented rest-frame spatial rotation is μ. Consequently $H_A(\mu)$ fixes $A\mathscr{W}_0$ pointwise and its Lorentz part fixes $C\mathbf{t}$.*

For $\delta \neq 0$, the map $(R(\mu), \delta\mathbf{t})$ has no fixed point and is not an admitted spinless peripheral map.

Proof. The spatial rotation has no nonzero fixed spatial vector for $0 < \mu < 2\pi$, while its time component is unchanged. Affine conjugation transports the fixed set. A fixed point of $(R(\mu), \delta\mathbf{t})$ would require $T = T + \delta$, which is impossible.

Fixed presentations and complete acceptance

Definition (Fixed developed presentation). A developed presentation fixes:

1. the developed realization and all face, edge, and vertex labels;

2. every oriented overlap component;

3. the affine extension $\mathcal{A}_f$ of each face-coordinate map;

4. its prescribed developed ambient identification S_{gf}, including the seam identification;

5. a frame and topological winding convention. An accepted transition on that component must satisfy the *ambient affine-map equality*

$$t_{g \leftarrow f}\mathcal{A}_f = \mathcal{A}_g S_{gf}.$$

Its restriction must also match the realized shared segment.

The ambient equality is important. Agreement on the endpoints of one segment does not generally determine a Lorentz-affine map: a nontrivial boost can fix a spacelike line pointwise.

Write the certificate as

$$\mathrm{Ein}_0(g) = (\mathscr{V}(g), \mathscr{R}(g), \mathscr{H}(g), \mathscr{K}(g), \mathscr{W}(g)).$$

Its components contain the following five checks:

1. *Realized local matching:* endpoints, shared segments, polygon closure, overlap components, canonical ambient transitions , and regular local vertex words.

2. *Packet matching:* deficit, oriented rotation, and spinless peripheral affine map.

3. *Marked ordered words:* affine products with their overlap data and integer winding marks.

4. *Peripheral agreement:* core and collar primitive maps in the declared transported frame.

5. *Particle data:* worldline, rest vectors, slice intersection, and pointwise fixation of the worldline. Embedding, spacelikeness, and active-cell nondegeneracy are separate geometric preconditions. Matrix matching alone proves none of them.

Proposition (Fixed-presentation transition uniqueness). *In a fixed presentation, two distinct proposed values for the same required transition cannot both be accepted. This is not uniqueness of transitions from peripheral holonomy alone.*

Proof. Since $\mathcal{A}_f$ is invertible, requires

$$t_{g \leftarrow f} = \mathcal{A}_g S_{gf} \mathcal{A}_f^{-1}.$$

Both accepted proposals must equal this map.

For the qualification, changing face coordinates by invertible maps B_f changes transitions to $B_g t_{g \leftarrow f} B_f^{-1}$ and changes a based peripheral word by conjugation at its base. If that base map is the identity, the peripheral word is unchanged despite changes in individual transitions. Such a change is excluded only after the presentation has been fixed.

This is the precise local completeness statement used here, in the sense of VIII-A [18]; it is not a classification of Einstein initial data.

At an incidence change, the raw cell tables change. For a fixed deficit, the preserved data are the particle and peripheral signature, not an unchanged list of vertex equations.

Control and the sourced-step signature

Assumption (Spectator-blind deterministic control). For a fixed named source embedding, equal incoming geometry, controller state, source permission, geometric resource reservation, declared frame, interpolation flag, and accessible source functional select equal applicability results, sourced rules, realizations, certificates, abstract original-name transports, and successor controller states.

Spectator locations and history storage are reserved separately. Their number and state do not change the geometric or sourced update budget.

The sourced step is performed at

$$s_c = -\frac{1}{2}.$$

Its formal input is

$$(g_{\mathrm{in}}, \text{source embedding}, \omega_\rho|_{\mathcal{A}_{\mathrm{src}}}, \text{controller}, \nu_{\mathrm{src}} \geq 1, A, \text{geometric reservation}, \theta).$$

On the admitted domain, it returns:

1. a new packet and ambient cone, with seam, rest data, complete slicing family, charts, collar, and certificate;

2. the new slice at $s = s_c$;

3. permission $\nu_{\mathrm{src}} - 1$ and the selected successor controller;

4. unchanged internal matter and identity transport of valid incoming abstract cell labels. Identity label transport is not a pointwise identification of old and new cones.

This step consumes no incidence permission and fires no incidence rule. Future incidence germs are returned as family data; their installed deficit stays fixed when traversed.

The variable-deficit cone

The variable-deficit family constructed in this section is a catalogue of prescribed backgrounds, not a changing host metric. Changing μ changes a description, not $g_{\mu_{\mathrm{H}}}$. That interpretive sentence is sourced from the fixed-host discipline of attached typographic parent VIII-ST Version 1 [20]; it is not an imported theorem.

Set

$$\mu_0 = \frac{\pi}{2}, \qquad I = \left[\frac{\pi}{2} - \frac{\pi}{20}, \frac{\pi}{2} + \frac{\pi}{20}\right], \qquad \alpha(\mu) = \frac{2\pi - \mu}{3}.$$

Then

$$\frac{\pi}{2} - \frac{\pi}{60} \leq \alpha \leq \frac{\pi}{2} + \frac{\pi}{60}.$$

Write

$$z_{\alpha} = \cos\alpha, \qquad S_{\alpha} = \sin\alpha, \qquad \lambda_{*} = \frac{2\sqrt{2}}{3},$$

and retune the coefficients by

$$\text{boxed}\, a(\mu) = \lambda_{*}\cos\frac{\alpha(\mu)}{2}, \qquad b(\mu) = \frac{3}{5}\sin\alpha(\mu).$$

The developed rays are

$$e_{i}(\mu) = \begin{pmatrix} \cos(i\alpha(\mu)) \\ \sin(i\alpha(\mu)) \end{pmatrix}, \qquad i = 0, 1, 2, 3.$$

Sector i, for $i = 0, 1, 2$, has coordinates

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

Physical cone labels are cyclic modulo three. The fourth developed ray is an upper seam copy, not a fourth sector.

Theorem (Cone dictionary). *For every $\mu \in I$, the three sectors have total opening $2\pi - \mu$. Identifying the upper boundary with the lower boundary using $J(\mu)$ produces a spinless spatial cone C_{μ}. The ray data, metric coefficients, seam, and packet vary continuously with μ. The particle axis is fixed pointwise and the oriented rest-frame rotation is μ.*

Proof. Since $0 < \alpha < \pi$, each sector is a convex wedge with independent boundary rays. Its opening is α, so the total is $3\alpha = 2\pi - \mu$. The upper ray has angle 3α; rotation by μ sends it to angle 2π, the lower ray. All formulas are continuous, and $I \subset (0, 2\pi)$, so Lemma applies.

Continuity across different cones can be understood on one common topological template: glue three copies of the nonnegative (ξ, ζ) quadrant by their corresponding boundary parameters. Only their physical Gram matrices and developments vary.

The ambient spacetime is

$$\mathbb{R} \times C_{\mu}, \qquad -dT^{2} + ds^{2}_{C_{\mu}}$$

on its regular part. The singular time axis is the particle.

Proposition (Two rejected updates on the whole interval). *Let $\mu, \nu \in I$ with $\mu \neq \nu$. Using the stale rotation $J(\nu)$ for the μ-cone fails seam and packet matching, although it still fixes $\mathscr{W}_0$ pointwise.*

For every $\mu \in I$ and $\delta \neq 0$, replacing $J(\mu)$ by $(R(\mu), \delta\mathbf{t})$ fails pointwise worldline fixation. Both statements persist under a common declared frame A.

Proof. The stale rotation sends the upper ray $e_3(\mu)$ to angle

$$3\alpha(\mu) + \nu = 2\pi + \nu - \mu.$$

For this to be the lower ray, $\nu - \mu$ must be a multiple of 2π. But $|\nu - \mu| \leq \pi/10$, so it must be zero, contrary to the hypothesis. Also $R(\nu) \neq R(\mu)$. Hence (E1) and (E2) fail. The stale rotation nevertheless fixes the time axis.

The time-shifted map sends $T\mathbf{t}$ to $(T + \delta)\mathbf{t}$. It fixes the rest vector in its linear part but not a single point of the worldline. Thus (E5) fails; unchanged seam heights also cannot match the shifted map. Conjugation by A preserves these failures.

The two omissions are independent, as emphasized in VIII-A [18]. Worldline fixation alone does not detect a stale spatial angle, and a correct spatial angle alone does not exclude a time shift.

The retuned polyhedral slicing family

Fix $\mu \in I$ throughout this section and let $s \in [-1, 1]$. Abbreviate $a = a(\mu)$, $b = b(\mu)$, and $\alpha = \alpha(\mu)$. Define sectorwise

$$\rho = \xi + \zeta, \qquad h_\mu = a\rho, \qquad k_\mu = b\min\{\xi, \zeta\}, \qquad F_s^{(\mu)} = s + \min\{2, \max\{h_\mu, s + k_\mu\}\}.$$

The slice is the graph

$$\Sigma_s^{(\mu)} = \{(F_s^{(\mu)}(x), x) : x \in C_\mu\}.$$

The function ρ is a continuous piecewise-linear radial coordinate; it is not the Euclidean radius $|x|$.

Descent and the physical gradient identities

Lemma (Descent and constant physical norms). *The functions in agree across sector rays and the seam. The*

oblique spatial metric is

$$G_{\alpha} = \begin{pmatrix} 1 & z_{\alpha} \\ z_{\alpha} & 1 \end{pmatrix}, \qquad G_{\alpha}^{-1} = \frac{1}{S_{\alpha}^{2}} \begin{pmatrix} 1 & -z_{\alpha} \\ -z_{\alpha} & 1 \end{pmatrix}.$$

For a covector p, its physical squared norm is $p^{\mathrm{T}} G_{\alpha}^{-1} p$. In particular,

$$\begin{aligned} \|\nabla h_{\mu}\|^{2} &= \frac{2a^{2}}{1+z_{\alpha}} = \frac{a^{2}}{\cos^{2}(\alpha/2)} = \frac{8}{9}, \\ \|\nabla(b\xi)\|^{2} &= \|\nabla(b\zeta)\|^{2} = \frac{b^{2}}{S_{\alpha}^{2}} = \frac{9}{25}. \end{aligned}$$

Proof. On a sector ray, ρ is its ray parameter, $h_{\mu} = a\rho$, and $k_{\mu} = 0$. Adjacent sectors and the seam-identified boundaries therefore agree.

The Gram matrix of the unit boundary rays is G_{α}. Substitute $(a, a)^{\mathrm{T}}$, $(b, 0)^{\mathrm{T}}$, and $(0, b)^{\mathrm{T}}$ into its inverse. Equation gives the constant values.

Keeping the coefficients fixed while varying α would not preserve these physical norms.

Exact localization bounds

Put

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

Lemma (Bounds and resting collar). *Uniformly for $\mu \in I$,*

$$\frac{129}{200} < a < \frac{137}{200}, \qquad 0 < b \le \frac{3}{5} < a, \qquad c > \frac{69}{200}.$$

Consequently,

$$R_{*} < \frac{200}{69} < \frac{29}{10} < \frac{400}{137} < r < \frac{400}{129} < \frac{7}{2} < \frac{15}{4} < 4.$$

For $s > 0$, the region $s + k_{\mu} \ge h_{\mu}$ has largest ρ-coordinate $s/c < r$ and is not cut by the cap. For $\rho \ge r$, the graph is resting:

$$T = s + 2.$$

In particular, $7/2 \le \rho \le 4$ *is a fixed resting collar.*

Proof. Write $\alpha/2 = \pi/4 + t$, with $|t| \le \pi/120 < 27/1000$. Then

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

The inequalities $\cos t \ge 1 - t^2/2$, $|\sin t| \le |t|$, and $\cos t \le 1$ give the stated strict bounds on a. Since $0 < \alpha < \pi$, $b = (3/5)\sin\alpha \in (0, 3/5]$, whence $c > a - 3/10 > 69/200$.

The comparisons in follow from $r = 2/a$ and $R_* = 1/c$, together with direct rational comparisons. In particular, $200/69 < 29/10$ is equivalent to $2000 < 2001$.

Since $\min\{\xi, \zeta\} \le \rho/2$,

$$h_\mu - k_\mu \ge c\rho.$$

Thus $s + k_\mu \ge h_\mu$ implies $\rho \le s/c$. Equality occurs on the bisector. The inequality $b < a$ gives $a < 2a - b = 2c$, hence $1/c < 2/a = r$. Finally, $h_\mu \ge 2$ when $\rho \ge r$, so the outer minimum in equals 2.

Embedding, acausality, and ordering

Causality at the singular axis is understood in the ultrastatic length-space sense: a future causal curve has nondecreasing time and spatial speed at most its time speed. This agrees with ordinary Lorentzian causality on the regular part.

Lemma (Global graph properties). *For every* $\mu \in I$ *and* $s \in [-1, 1]$*:*

1. $F_s^{(\mu)}$ *is globally* λ_**-Lipschitz in the intrinsic cone distance;*

2. *graph projection* $\Sigma_s^{(\mu)} \to C_\mu$ *is a homeomorphism;*

3. *on each regular face, the induced metric is at least* $1/9$ *times the spatial metric;*

4. *the graph is acausal. For* $s_1 < s_2$*,*

$$s_2 - s_1 \le F_{s_2}^{(\mu)}(x) - F_{s_1}^{(\mu)}(x) \le 2(s_2 - s_1).$$

The particle intersection is

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

No regular Minkowski tangent plane is asserted at the particle.

Proof. The affine spatial branches have gradient norm at most $\lambda_* < 1$, by Lemma ; the constant branch has norm zero. Minimum and maximum preserve a common Lipschitz bound. Integrating along paths, using continuity at sector rays, the seam, and the apex, proves the intrinsic global bound.

The inverse projection is $x \mapsto (F_s^{(\mu)}(x), x)$, so projection is a homeomorphism. For a graph plane with Cartesian gradient g, its induced metric is

$$I_2 - gg^{\mathrm{T}} \ge (1 - \lambda_*^2) I_2 = \frac{1}{9} I_2.$$

This is a coordinate-independent lower bound relative to the spatial metric.

A causal curve between distinct spatial points has time difference at least their intrinsic spatial distance. The graph's time difference is strictly smaller, since $\lambda_* < 1$. Distinct graph points therefore cannot be causally related.

For fixed x, the function $\min\{2, \max\{h_\mu(x), s + k_\mu(x)\}\}$ is nondecreasing and 1-Lipschitz in s. Adding s proves . At the apex $h_\mu = k_\mu = 0$, giving .

Remark (Parameter and kinematical lapse). The source clock $s_c = -1/2$ is a parameter value, not a lapse. On a regular branch, the future unit normal is

$$n = \frac{(1, g)}{\sqrt{1 - |g|^2}},$$

so the normal component of the deformation $(\partial_s F, 0)$ is

$$N_s = \frac{\partial_s F}{\sqrt{1 - |g|^2}}.$$

It equals 3 on a core branch, 5/2 on an inner branch, and 1 on a resting branch. These are local kinematical quantities of this prescribed family. No matter-defined relational clock or relational lapse is constructed. The

relational expansion reported in Em02-E [24] is a different object.

The declared cellulation

The compact patch is $\rho \le 4$. Define

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

For $s > 0$, define

$$\begin{aligned} B_i &= \beta s\, e_i, & T(B_i) &= 2s, \\ C_i &= \chi s(e_i + e_{i+1}), & T(C_i) &= 2s + b\chi s. \end{aligned}$$

Vertex symbols mean their lifted graph points when used in cells.

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

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

For $s > 0$, the sector faces are

$$\begin{aligned} U_i^- &= [P, B_i, C_i], & T &= 2s + b\zeta, \\ U_i^+ &= [P, C_i, B_{i+1}], & T &= 2s + b\xi, \\ V_i &= [B_i, A_i, A_{i+1}, B_{i+1}, C_i], & T &= s + a(\xi + \zeta). \end{aligned}$$

For all s, retain

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

and the three resting unbounded sector faces beyond $\rho = 4$, with the exterior ray subdivisions.

Lemma (Exact decomposition). *The displayed active cells cover the graph, with disjoint face interiors. The incoming core faces are triangles; the outgoing V_i are simple pentagons and may be nonconvex.*

Proof. For $s \le 0$, $s + k_\mu \le h_\mu$, because $h_\mu - k_\mu \ge c\rho \ge 0$. Thus the uncapped core is $T = s + h_\mu$.

For $s > 0$, in the half-sector $\xi \ge \zeta$, equality of the nonconstant branches is

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

Its endpoints are $(\beta s, 0)$ and $(\chi s, \chi s)$. The other half-sector has boundary

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

The dominance region is the union of the two stated inner triangles. Its complement within $\rho \le r$ is the stated pentagon. The inequalities $a - b > 0$ and $\rho(C_i) = s/c < r$ establish the placement and prevent a cap intersection. Outside $\rho = r$, the graph is resting.

Lengths, areas, and nondegeneracy

Set

$$\begin{aligned} L_\alpha &= \sqrt{2(1 - z_\alpha)}, \\ W_\alpha &= \sqrt{(\chi - \beta)^2 + \chi^2 + 2z_\alpha \chi(\chi - \beta) - b^2\chi^2}. \end{aligned}$$

The persistent radial slot has epoch-dependent interpretation

$$r_i^{\mathrm{rad}} = \begin{cases} [P, A_i], & s \le 0, \\ [B_i, A_i], & s > 0. \end{cases}$$

Lemma (Metric data and positivity). *The finite lengths are those of Table . Every active finite edge has positive length. The compact face areas are*

$$\begin{aligned} \operatorname{Area}(V_i) &= \begin{cases} S_\alpha r^2/6, & s \le 0, \\ \frac{S_\alpha}{3}\left(\frac{r^2}{2} - \beta\chi s^2\right), & s > 0, \end{cases} \\ \operatorname{Area}(U_i^{\pm}) &= \tfrac{2}{5} S_\alpha \beta\chi s^2, \qquad s > 0, \\ \operatorname{Area}(Q_i) &= \tfrac{S_\alpha}{2}(16 - r^2). \end{aligned}$$

Every active compact face has positive area.

Proof. For oblique spatial displacement $(\Delta\xi, \Delta\zeta)$ and time displacement ΔT,

$$\ell^2 = (\Delta\xi)^2 + (\Delta\zeta)^2 + 2z_\alpha \Delta\xi\Delta\zeta - (\Delta T)^2.$$

Substitution gives the first four rows and PB_i. For PC_i, the spatial displacement is $(\chi s, \chi s)$ and the time displacement is $b\chi s$. For B_iC_i, these are $((\chi - \beta)s, \chi s)$ and $b\chi s$; the reflected edge has the same length.

Every active spatial edge is nonzero and tangent to a spacelike face, so its induced length is positive. In particular

the displayed radicals are positive. Also

$$r - \beta s = \beta(2 - s) > 0.$$

The spatial area element is $S_{\alpha}\, d\xi\, d\zeta$. Its graph multiplier is $\sqrt{1 - |g|^2}$: 1/3 on V_i, 4/5 on $U_i^{\pm}$, and 1 on Q_i. The incoming projected triangle has area $S_{\alpha} r^2/2$. Each projected inner triangle has area $S_{\alpha}\beta\chi s^2/2$. Subtracting both inner triangles gives the outgoing core area. The collar is the difference of projected triangles of radial sizes 4 and r.

Since $b < a$,

$$0 < \chi = \frac{1}{2a - b} < \frac{1}{a} = \beta, \qquad r = 2\beta.$$

Therefore, for $0 < s \le 1$,

$$\frac{r^2}{2} - \beta\chi s^2 \ge 2\beta^2 - \beta\chi > \beta^2 > 0.$$

Finally $S_{\alpha} > 0$ and $r < 4$, proving all area assertions.

The persistent radial slot has one-sided laws

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

The crest, connector, and outer lengths have zero derivative. The born slots have right derivatives

$$\begin{aligned} \partial_s \ell(u_i)(0^+) &= \beta, \\ \partial_s \ell(v_i)(0^+) &= \chi\sqrt{2(1 + z_{\alpha}) - b^2}, \\ \partial_s \ell(w_i^{\pm})(0^+) &= W_{\alpha}. \end{aligned}$$

Born slots have no incoming geometric edge derivative, since they are inactive rather than zero-length incoming edges.

The physical normal speed of the moving half-sector boundary is

$$\left((a, a - b) G_{\alpha}^{-1} (a, a - b)^{\mathrm{T}}\right)^{-1/2};$$

the other half-sector has the reflected expression. These are slicing-parameter laws, not matter-velocity laws.

The unique event and its germs

Definition (Incidence epochs and germs). An incidence epoch is an open parameter interval on which the declared active-cell pattern is constant. The germs at $s = 0$ consist of the one-sided labelled cell data, their limits, and their one-sided laws. Outgoing cells whose size tends to zero are germ metadata, not additional active zero-size cells of the limiting slice.

Lemma (Unique incidence-event parameter). *For the declared cellulation, the only incidence-event parameter in* $[-1, 1]$ *is* $s = 0$*. At that parameter, six outgoing vertex slots, six particle-star radial edge slots, six perimeter edge slots, and six inner face slots collapse at P. The particle link changes from three to six faces.*

Proof. Lemma gives a constant pattern for each sign of s. For $s > 0$, the three B_i lie on distinct cone rays and the three C_i lie strictly in their sectors. Their coordinates are positive multiples of s, so they coalesce only at $s = 0$.

All particle-star edges are genuine creases. Across PC_i, the gradients are those of $b\xi$ and $b\zeta$, which are distinct. Across a cone ray, unfolding the adjacent sectors gives inner transverse gradients of opposite nonzero signs. Incoming core gradients also have opposite nonzero transverse components after unfolding: their magnitude is $a\tan(\alpha/2) > 0$.

No inner region meets the cap, by Lemma . Persistent radial lengths remain positive, all born edges and inner areas are positive for $s > 0$, the outgoing core area is bounded below by a positive coefficient, and the collar never degenerates, by Lemma . The exterior is resting with fixed incidence. Thus no other collision, edge collapse, face collapse, or crease loss occurs in the window.

For $s < 0$ the three V_i meet P. For $s > 0$ the six $U_i^{\pm}$ meet P, proving the link change.

toprule Possible extra event Exclusion

midrule Inner cells reach the cap $\rho \le s/c < r$

Persistent radial edge collapses $r - \beta s = \beta(2 - s) > 0$

Inner triangle degenerates off $s = 0$ Positive coefficient times s^2

Outgoing pentagon degenerates $\mathrm{Area}\,(V_{i}) > S_{\alpha}\beta^{2}/3$

Collar degenerates $r < 7/2 < 4$

New vertices coincide off P Distinct ray/interior placement for $s > 0$

Particle-star edge loses its crease Distinct unfolded gradients

bottomrule

The common limiting slice consists of the regular core triangles, collar, and resting exterior. The labels P, A_{i}, D_{i}, the persistent slots, and the core/collar/exterior face labels persist. The outgoing-only B_{i}, C_{i}, PB_{i}, PC_{i}, $B_{i}C_{i}, C_{i}B_{i+1}$, and $U_{i}^{\pm}$ belong to outgoing germ metadata. A zero report in an inactive slot is a coding convention, not an additional geometric cell.

Adapted charts and winding-marked affine matching

Physical gradients and boosts

In the first developed sector,

$$e_{0} = (1, 0)^{\mathrm{T}}, \qquad e_{1} = (z_{\alpha}, S_{\alpha})^{\mathrm{T}}.$$

They are orthonormal only at $\alpha = \pi/2$. The Cartesian gradients are

$$g_{h} = \begin{pmatrix} a \\ a\tan(\alpha/2) \end{pmatrix}, \qquad g_{-} = \begin{pmatrix} 0 \\ b/S_{\alpha} \end{pmatrix} = \begin{pmatrix} 0 \\ 3/5 \end{pmatrix}, \qquad g_{+} = \begin{pmatrix} b \\ -bz_{\alpha}/S_{\alpha} \end{pmatrix}.$$

For $0 < |g| < 1$, define

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

In an orthonormal spatial basis along and perpendicular to g, this is a standard two-dimensional boost plus an unchanged perpendicular coordinate. Consequently,

$$\mathscr{B}(g)^{\mathrm{T}}\eta\mathscr{B}(g) = \eta, \qquad \det\mathscr{B}(g) = 1, \qquad \mathscr{B}(g)^{0}{}_{0} = \gamma > 0.$$

Thus $\mathscr{B}(g) \in \mathrm{SO}^{+}(2,1)$. Here $\gamma_h = 3$ and $\gamma_{\pm} = 5/4$.

Put $O_i = \mathrm{diag}(1, \mathrm{Rot}(i\alpha))$. The affine extensions of the adapted face-coordinate maps are

$c\|l$Face	$\mathcal{A}_f(z)$
hline V_i	$O_i \mathscr{B}(g_h) O_i^{-1} z - 3\mathbf{st}$
U_i^-	$O_i \mathscr{B}(g_-) O_i^{-1} z - \frac{5}{2}\mathbf{st}$
U_i^+	$O_i \mathscr{B}(g_+) O_i^{-1} z - \frac{5}{2}\mathbf{st}$
$Q_i$and resting exterior	z.

If a face is $T = q + g \cdot x$, its first boost coordinate is $\gamma(T - g \cdot x) = \gamma q$. Therefore nonresting faces have adapted time $T' = 0$, whereas resting faces have $T' = 2 + s$.

These are regular ambient affine coordinates away from the singular axis and algebraic extensions to face closures. They do not supply a regular Minkowski neighbourhood of the apex.

Transitions and winding convention

Positive traversal means increasing developed angle. For each oriented overlap component, let $n_{gf} = 1$ for an upper-to-lower marked seam crossing, $n_{gf} = -1$ for its reverse, and $n_{gf} = 0$ for an ordinary crossing. The fixed presentation prescribes $S_{gf} = J(\mu)^{n_{gf}}$. Hence

$$t_{g \leftarrow f} = \mathcal{A}_g J(\mu)^{n_{gf}} \mathcal{A}_f^{-1}.$$

The last chronological transition acts on the left.

For a closed ordered chart word based in f_0,

$$\mathrm{Hol}(\gamma) = \mathcal{A}_{f_0} J(\mu)^{N(\gamma)} \mathcal{A}_{f_0}^{-1}, \qquad N(\gamma) = \sum n_{gf}.$$

The integer N is retained as a topological mark, not reconstructed from the matrix. In the angular covering of the punctured cone, a loop of winding N has angular lift increment $N(2\pi - \mu)$.

Transport from the base-face coordinates to the developed rest reference frame is conjugation by $\mathcal{A}_{f_0}^{-1}$. Transport onward to the declared frame is conjugation by A.

Lemma (Complete local matching and primitive words). *The transitions match every shared developed segment, satisfy , and have inverse reverse transitions. Face polygons close and regular local vertex words are affine identities.*

The loops $\rho = 29/10$ *and* $\rho = 15/4$ *are primitive positive meridians, lying respectively in the core and resting collar. Their products, transported to the reference frame, are both* $J(\mu)$*. For* $s > 0$*, the six-face particle star has the same primitive peripheral product.*

Proof. An ordinary overlap shares one developed segment. On a seam overlap, $J(\mu)$ identifies the upper segment with the lower segment, including its height by descent. Applying the two face maps gives and . Reversing the overlap gives the inverse map.

Every polygon is realized by the displayed endpoint coordinates. Its oriented endpoint displacements telescope to zero. Shared endpoints coincide, including seam copies. In an ordered word, consecutive chart factors cancel, leaving . A sufficiently small loop about a regular vertex has winding zero, so its word is the identity.

The bounds

$$R_* < \frac{29}{10} < r < \frac{15}{4} < 4$$

place the core loop outside all inner regions and inside the cap, and place the collar loop in the resting region. Write $\mathcal{A}_i = \mathcal{A}_{V_i}$. The core's chronological crossings give

$$(\mathcal{A}_0 J \mathcal{A}_2^{-1})(\mathcal{A}_2 \mathcal{A}_1^{-1})(\mathcal{A}_1 \mathcal{A}_0^{-1}) = \mathcal{A}_0 J \mathcal{A}_0^{-1}.$$

Transport gives J. The collar charts are identities, so its chronological crossings are I, I, J, with product J. Both loops traverse all three sectors once and have angular lift increment $3\alpha = 2\pi - \mu$, proving primitivity independently of matrix values.

For the outgoing star use $\rho = s$, where $s > 0$. Since $a < 1$,

$$h_\mu - k_\mu \le h_\mu = as < s,$$

so this loop lies strictly in the inner region. In angular order set

$$F_0 = U_0^-,\ F_1 = U_0^+,\ F_2 = U_1^-,\ F_3 = U_1^+,\ F_4 = U_2^-,\ F_5 = U_2^+, \qquad \mathcal{A}_j^\star = \mathcal{A}_{F_j}.$$

Its six-factor word is

$$\begin{aligned}&(\mathcal{A}_0^\star J(\mathcal{A}_5^\star)^{-1})(\mathcal{A}_5^\star(\mathcal{A}_4^\star)^{-1})(\mathcal{A}_4^\star(\mathcal{A}_3^\star)^{-1})\\ &\cdot(\mathcal{A}_3^\star(\mathcal{A}_2^\star)^{-1})(\mathcal{A}_2^\star(\mathcal{A}_1^\star)^{-1})(\mathcal{A}_1^\star(\mathcal{A}_0^\star)^{-1}) = \mathcal{A}_0^\star J(\mathcal{A}_0^\star)^{-1}.\end{aligned}$$

It has one positive seam crossing, winding one, and transported product J. At $s = 0$ the nonvanishing core meridian certifies the common peripheral signature of both germs.

A power $J(\mu)^k$ can be the identity at a rational rotation angle. That equality does not erase winding: k remains part of the marked certificate.

Corollary (Peripheral reduction in this presentation). *After the realized geometry, overlap components, charts, and seam have been fixed, every closed word is determined by its winding through . Regular words have winding zero and one primitive meridian determines all peripheral powers. Core/collar agreement must still be checked in the same transported frame.*

Proof. Equation gives the first two assertions. The punctured cone is topologically a punctured plane; angular lifting identifies its loop classes with integer winding. The core and collar checks are the two explicit winding-one words of Lemma .

This reduction is a statement *after realization*. It does not recover embedding or individual transitions from one holonomy.

Persistence and complete realization

Theorem (Principal persistence theorem). *For every $\mu \in I$, formulas , , and construct a spinless conical slicing family with the following properties:*

1. *all affine spatial branch gradients have norm at most $\lambda_* < 1$, uniformly in μ;*

2. *graphs descend through rays and the seam, are embedded, and are globally acausal;*

3. *regular-face induced metrics are at least* 1/9 *times the corresponding spatial metrics;*

4. *the family is strictly ordered by ;*

5. *exactly one event of the declared cellulation occurs, at* $s = 0$, *changing the particle link from three to six;*

6. *every regular slice, the common limiting slice, and both fixed-deficit incidence germs have complete certificates (E1)–(E5). The particle intersection is . Primitive core, collar, and outgoing-star maps are* $J(\mu)$ *in the reference framing and* $AJ(\mu)A^{-1}$ *in the declared framing.*

At $\mu = \mu_0$, *all displayed data specialize to the reference formulas in Appendix .*

Proof. Lemmas , , and establish descent, uniform gradients, localization, embedding, the metric lower bound, acausality, ordering, and particle times. Lemmas , , and establish the realized cellulation, nondegeneracy, and unique event.

Lemma verifies endpoints, segments, closure, canonical transitions, regular local words, marked ordered words, and primitive core/collar agreement. Lemma verifies spinless packet matching and pointwise worldline fixation. The graph supplies the slice intersection, and the rest vector is the declared transported **t**. These are all five checks.

A common $A \in \mathrm{ISO}^{+}(2,1)$ transports the spacetime, faces, rest splitting, and affine words coherently. Spacelikeness, embedding, and acausality are preserved. The metric comparison is with the transported spatial metric; it is not an assertion about an unrelated fixed Cartesian time splitting after a boost.

At the event, outgoing collapsed slots are germ metadata, while the limiting slice uses the active incoming triangles. The core meridian supplies its noncollapsing peripheral witness. Finally, substituting $\alpha = \pi/2$ proves the appendix identities.

toprule Requirement Witness Proof

midrule Geometric preconditions Graph, physical gradients, exact lengths, and areas Lemmas –

(E1) Developed polygons, canonical transitions, regular words Lemma

(E2) Deficit, oriented seam rotation, fixed axis Theorem ; Lemma

(E3) Ordered words and retained integer winding Equations –

(E4) Primitive core and collar words in one frame Lemma

(E5) P_{s}, worldline, rest vector, pointwise fixation Lemmas ,

bottomrule

Corollary (Parameter regularity of labelled data). *On each incidence epoch and its one-sided germ, the finite coefficient, ray, vertex, gradient, chart, length, and area tables are Lipschitz in μ, uniformly over the allowed s. The graphs are jointly continuous on the common topological template.*

Proof. The finite table formulas are smooth in μ on a neighbourhood of I. Denominators stay away from zero by Lemma . Each active edge radical has a positive continuous coefficient on the compact interval, so its square root is smooth there. Born lengths are smooth coefficients times s and born areas are smooth coefficients times s^{2}. Bounded derivatives prove the uniform Lipschitz assertions. Joint graph continuity follows directly from continuous minimum and maximum on the glued coordinate template.

This compares labelled data, not identical incoming and outgoing raw cell lists.

Expectation selection and spectator invariance

Fix $\kappa \in \mathbb{R}$ and define the admitted state domain

$$\mathscr{D}_{\mathrm{src}} = \{\rho \in \mathscr{D}(\mathscr{H}_{\Gamma}) : \mu_{0} + \kappa I_{f}(\rho) \in I\},$$

with the declared classical restrictions when present. For a fixed interpolation flag $\theta \in [0,1]$, put

$$\mu_{\theta}(\rho) = \mu_{0} + \theta\kappa I_{f}(\rho).$$

The principal rule uses $\theta = 1$. The domain is convex, although it need not be nonempty for every choice of fixed

source and coupling.

Theorem (Sourced semantic constructor). *On $\mathscr{D}_{\mathrm{src}}$, the rule*

$$\rho \operatorname{longmapsto} \Pi_A(\mu_\theta(\rho))$$

is well defined. For a fixed declared frame, its deficit and homogeneous affine matrix data are Lipschitz in the input state. In particular,

$$\begin{aligned} |\mu_\theta(\rho) - \mu_\theta(\sigma)| &= \theta|\kappa||\operatorname{Tr}((\rho - \sigma)j[f])| \\ &\le \theta|\kappa|\|j[f]\|_{\mathrm{op}}\|\rho - \sigma\|_1. \end{aligned}$$

Substitution into Theorem returns the complete new geometry and certificate, evaluated at $s_c = -1/2$, with internal matter unchanged.

If $I_f(\rho) = 0$, $\kappa = 0$, or $\theta = 0$, the geometric output is the reference family at μ_0.

Proof. The interval I is convex and contains μ_0. Thus $\mu_\theta(\rho) \in I$ whenever $\rho \in \mathscr{D}_{\mathrm{src}}$. Trace duality proves .

For the spectral norm,

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

With tildes denoting homogeneous affine matrices,

$$\left\|\widetilde{A}(\widetilde{J}(\mu) - \widetilde{J}(\nu))\widetilde{A}^{-1}\right\|_{\mathrm{op}} \le \left\|\widetilde{A}\right\|_{\mathrm{op}}\left\|\widetilde{A}^{-1}\right\|_{\mathrm{op}}|\mu - \nu|.$$

The remaining fixed packet components do not vary.

The geometric construction was proved independently for every scalar $\mu \in I$, so substitution is not circular. The stated controls set the selected deficit to μ_0.

Source-off does not mean identity on an arbitrary old deficit: it selects the reference family. Permission and history may still change.

Theorem (Spectator invariance). *Suppose $\widetilde{\rho}$ extends ρ by spectator names N and $\operatorname{Tr}_N\widetilde{\rho} = \rho$. Then:*

1. *the named source functional, including I_f, is unchanged;*

2. *for fixed declared geometry and frame, the constructed geometry and certificate are unchanged;*

3. *under Assumption , equal complete declared inputs and accessible source functionals give equal applicability, output certificates, original-name transport, and successor controller data. Entangled spectator extensions are allowed. The sourced step preserves the original matter reduction.*

Proof. For every $a \in \mathscr{A}_{\mathrm{src}}$,

$$\mathrm{Tr}\,((a \otimes I_N)\widetilde{\rho}) = \mathrm{Tr}\,(a\rho).$$

The geometry depends on matter only through the selected scalar deficit, proving the first two assertions. The additional controller conclusion is exactly conditional on Assumption . Identity action on matter preserves its original reduction.

Equality of the one scalar I_f suffices for this geometric constructor. Equality of an arbitrary controller's output requires its declared input agreement; it cannot be inferred merely from one current unless that controller is declared to factor through that current.

A consumed name is absent from the codomain of . Pulling an observable back through a readout channel does not make the consumed input name a surviving output name. If a produced record is explicitly included in the source algebra, invariance refers to that record-containing interface; it does not assert a record-blind deferred-readout comparison.

Affinity and expectation-acquisition obstructions

The semantic deficit in is affine as a scalar expectation. Assigning a *definite classical packet* with that deficit is a different operation.

Proposition (Affine obstruction to definite packet selection). *Let $\mathscr{S}$ be a convex state set and suppose an affine map assigns each state a probability measure concentrated at one classical packet:*

$$T(\rho) = \delta_{\gamma(\rho)}.$$

If distinct packets are separated by measurable events, then γ is constant on $\mathscr{S}$.

Consequently, if $\theta\kappa \neq 0$ and I_f takes two distinct values on $\mathscr{D}_{\mathrm{src}}$, the sourced constructor cannot be the definite classical output of an affine channel on that domain.

Proof. If $\gamma(\rho) \neq \gamma(\sigma)$, choose a measurable event containing one packet and not the other. For $0 < t < 1$, affinity gives

$$T(t\rho + (1-t)\sigma) = t\delta_{\gamma(\rho)} + (1-t)\delta_{\gamma(\sigma)}.$$

The chosen event has probability strictly between zero and one, so this measure is not concentrated at one packet. The mixture belongs to $\mathscr{S}$, a contradiction. For the application, distinct selected deficits distinguish the packets.

This locally proves the obstruction reported in VII-G [16]. It does not prohibit deterministic processing of an already supplied classical label.

Proposition (Deterministic expectation-label obstruction). *A channel with fixed auxiliary input cannot output a deterministic classical label $\ell(\rho)$ for every state on the full convex state space if at least two labels occur. The impossibility remains if the matter output is additionally required to equal the input.*

A circuit acting only on classical code registers, and as identity on internal matter, cannot make a fixed code input's output depend on an unencoded matter expectation.

Proof. Choose states assigned distinct labels ℓ_1, ℓ_2. Linearity forces the label marginal on their equal mixture to be

$$\frac{1}{2}|\ell_1\rangle\langle\ell_1| + \frac{1}{2}|\ell_2\rangle\langle\ell_2|,$$

which is not a deterministic label. The additional identity requirement on matter cannot remove this contradiction.

For a fixed code input, a code-only circuit has the same code output for every separate matter state. Therefore it cannot distinguish expectations not represented in that input.

Proposition concerns the channel status of a definite semantic packet assignment. Proposition concerns acquisition

of a deterministic label from unencoded matter. They do not exclude stochastic instruments, repeated-preparation estimation, or approximation with separately specified errors.

A finite algebraic table and reversible realization

The finite construction has four layers:

semantic constructor ← ?algebraic packet table ← ?canonical classical map ← ?reversible circuit.

Decoder equality is asserted only on canonical promised forward inputs, not on arbitrary intermediate circuit words.

Algebraic packet entries

Fix an integer $q \geq 6$ and define

$$K_q = \left\lfloor \frac{2^q}{40} \right\rfloor, \quad \mathcal{I}_q = \{-K_q, \ldots, K_q\}, \quad T_q = 2K_q + 1,$$
$$t_m = m2^{-q}, \quad \mu_m = \mu_0 + 6\arctan t_m.$$

Since $|t_m| \leq 1/40$,

$$|\mu_m - \mu_0| \leq 6\arctan(1/40) < \frac{3}{20} < \frac{\pi}{20},$$

so every table entry lies in I.

Its geometric coefficients are exactly algebraic:

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

Indeed,

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

Thus $e^{i\alpha_m}$ has rational real and imaginary parts, as do the powers giving the rays. Also

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

has rational components, so the seam matrix is rational.

The angle label μ_m need not be an algebraic number. The geometric data reconstructed from its symbolic identity are algebraic. At dyadic s, gradients, boosts, vertices, lengths, and areas are real algebraic.

Exact report floors are therefore decidable by algebraic-number comparison with dyadic thresholds, including equality. The finite length bound below gives a finite threshold range. These comparisons are a mathematical construction of the table; no executed table generation is claimed.

The source promise

For a concrete nontrivial example, take one named surviving qubit, with

$$\mathscr{A}_{\mathrm{src}} = L(\mathbb{C}^2), \qquad j[f] = Z, \qquad \kappa = \theta = 1,$$

where $Z = \mathrm{diag}\,(1, -1)$. A supplied token $m_{\mathrm{src}} \in \mathscr{T}_q$ has the promise

$$\mathrm{Tr}\,(\rho Z) = 6\arctan t_{m_{\mathrm{src}}}.$$

Every token has a nonempty promised matter class. For example,

$$\rho_m = \frac{1}{2}(I + 6\arctan(t_m)Z)$$

is a density operator because the coefficient has absolute value less than 3/20. Spectator extensions preserving the source reduction are admitted.

For another fixed source and nonzero κ, retain only entries whose required expectation $(\mu_m - \mu_0)/\kappa$ is attainable.

Definition (Canonical promised forward configuration). A forward configuration consists of a fixed canonical classical word c, with definite token and packet indices, together with an arbitrary matter state ρ satisfying for that token. Spectators and external references may be included in ρ. The required history and work words are zero.

A block-diagonal mixture of such configurations can be processed branchwise by the circuit. Decoder equality

then means equality of the *branchwise decoded ensemble*. It does not identify that ensemble with applying the nonlinear semantic constructor once to the unconditional averaged matter state. In a correlated code–matter mixture, the promise is conditional on each occupied classical block.

Canonical blocks and reports

The cell dictionary in Appendix has 55 entries, so six location bits suffice. At the source boundary, only valid incoming labels are admitted.

Fix integers

$$p_{\mathrm{rep}} \geq 0, \qquad p_{\mathrm{clk}} \geq 1, \qquad w_{\mathrm{src}} \geq 1.$$

The clock stores $s = j2^{-p_{\mathrm{clk}}}$. A source input has the exact integer

$$j = -2^{p_{\mathrm{clk}}-1},$$

representing $s = -1/2$. No event decision is inferred from a rounded length report.

For each of the 24 finite slots, store

$$Q_e = \lfloor 2^{p_{\mathrm{rep}}} \ell_e \rfloor;$$

inactive slots have report zero. All finite lengths are less than 16. Indeed, compact endpoint spatial norms are at most 4:

$$|A_i| = r < 4, \qquad |B_i| \leq \beta < 4, \qquad |C_i| \leq 2\chi < 200/69 < 4, \qquad |D_i| = 4.$$

The developed spatial distance between two endpoints is at most 8, and a spacelike edge's induced length is no larger than its spatial length. Hence $p_{\mathrm{rep}} + 4$ report bits suffice.

Fix injective encodings of $\mathscr{T}_q$ into the index fields and of $j \in [-2^{p_{\mathrm{clk}}}, 2^{p_{\mathrm{clk}}}]$ into the clock field. The stated widths suffice. All admitted metadata values are fixed.

A canonical geometric input x has stage 0, incoming incidence mode, the exact source clock, indices $m_{\mathrm{old}}, m_{\mathrm{src}} \in \mathscr{T}_q$

, permission $1 \le \nu_{\mathrm{src}} \le 2^{w_{\mathrm{src}}} - 1$, fixed metadata, and the canonical reports for $\mu_{m_{\mathrm{old}}}$.

A second B-bit block stores complete geometric input history. Each original matter name has six location bits and six name-history bits, reserved separately.

The decoder reconstructs the entire family from its packet index, clock, and fixed symbolic formulas. Reports are consistency data; they are not the underlying exact geometry. The decoder ignores implementation history and returns the matter state unchanged.

The classical update and permutation extension

Define $f(x)$ by setting stage to 1, replacing the packet index by m_{src}, decreasing permission by one, and recomputing reports. Token, clock, incidence mode, and metadata are retained. Prescribe

$$(x, 0_B) \mathrm{longmapsto} (f(x), x).$$

The number of canonical *geometric* inputs is

$$Q = T_q^2(2^{w_{\mathrm{src}}} - 1).$$

Matter states and name locations are not counted by Q.

Outputs are distinct because they retain x. Input and output sets are disjoint because their first-block stage bits differ. Exchange each input word with its prescribed output and fix every other $2B$-bit word. This defines a product P_{geo} of Q disjoint transpositions.

Retaining input history is the elementary reversible-computation principle associated with Bennett [3]; the gate basis is the classical reversible basis associated with Toffoli [4]. The bound needed here is proved directly. The recorded figshare comparison of readout, recovery, and the limits of geometric response [34] is a source record at this existing reversible-synthesis discussion; it is not a new magic theorem of the present sheet.

Lemma (Clean-work transposition synthesis). *Let $N \ge 3$. A permutation of N logical bits that is a product of Q specified transpositions has a NOT–CNOT–Toffoli realization using $N - 2$ clean work bits and at most*

$$4N(2N-1)Q$$

gates. On work-zero inputs, its logical action is the permutation and work returns to zero.

Proof. Join the endpoints of one transposition by a shortest Hamming path of length $h \le N$. Exchange successive path words going forward, then going backward along all but the final edge. This uses $2h-1 \le 2N-1$ adjacent-word transpositions and restores every intermediate path word.

An adjacent-word transposition flips its differing bit controlled on one specified pattern of the other $N-1$ bits. Conjugating negative controls by NOT gates costs at most $2(N-1)$ gates. Compute the conjunction of the positive controls into $N-2$ clean work bits by a Toffoli chain, use one CNOT to flip the target, and reverse the chain. This costs another $2(N-2)+1$ gates and restores work. The total is $4N-5 < 4N$ per adjacent exchange. Summing proves .

Implementation theorem

Theorem (Finite promised-table realization). *Fix integers $p_{\mathrm{rep}} \ge 0$, $p_{\mathrm{clk}} \ge 1$, $q \ge 6$, $w_{\mathrm{src}} \ge 1$, and $n \ge 1$ original matter names, including the named source qubit.*

On the canonical promised forward domain of Definition , with valid incoming locations and clean name history, the table step has an exact NOT–CNOT–Toffoli realization U using

$$\begin{aligned} M &= 4B-2+12n \\ &= 96p_{\mathrm{rep}} + 4p_{\mathrm{clk}} + 8q + 4w_{\mathrm{src}} + 458 + 12n \end{aligned}$$

classical bits, excluding internal matter and external references, and at most

$$G \le 4(2B)(4B-1)T_q^2(2^{w_{\mathrm{src}}}-1) + 6n$$

gates.

Clean synthesis work returns to zero. Internal matter, its external references, and valid location words are unchanged. Complete geometric input history is retained. Writing U also for its identity extension to matter, the decoder satisfies

$$\mathrm{Dec}\,(U(c,\rho)) = G_{\mathrm{src}}(\mathrm{Dec}\,(c,\rho))$$

on this domain, with $\kappa = \theta = 1$ *and the fixed table metadata.*

Proof. Apply Lemma to P_{geo} with $N = 2B$. It realizes on the forward domain and restores $2B - 2$ work bits.

The promise gives

$$\mu_0 + \mathrm{Tr}\,(\rho Z) = \mu_{m_{\mathrm{src}}}.$$

The decoder therefore reconstructs exactly the geometry and certificate of Theorems and . Exact algebraic floors provide the canonical output reports. The parameter stays at $s = -1/2$, so valid incoming abstract cell labels remain valid after packet replacement.

For each name, copy each of its six location bits into its clean name-history bit, controlled by the output stage bit. Each copy is one Toffoli with stage and location as controls, using $6n$ gates. Locations are unchanged and no name bit influences a geometric output.

There are $2B$ logical geometric/history bits, $2B - 2$ work bits, and $12n$ location/history bits, giving . The synthesis bound and name copies give . No gate acts on internal matter or references. The decoder ignores implementation history, proving .

The theorem is an existence construction with explicit resource bounds, not an efficient compilation claim or an execution record. It neither acquires nor verifies the token. Intermediate gate words and arbitrary words in the permutation completion need not decode as geometric configurations.

toprule Bit inventory Amount

midrule Current geometry B

Retained geometric history B

Clean synthesis work $2B - 2$

Locations and name histories $12n$

Internal matter Untouched; excluded from M

bottomrule toprule Gate inventory Bound

midrule Geometric permutation $4(2B)(4B-1)Q$

Name-history copies $6n$

Internal matter gates 0

bottomrule

Smallest table example. For $q = 6$, $K_6 = 1$ and $\mathscr{T}_6 = \{-1, 0, 1\}$. Take old index 0, token +1, stage 0, and permission 1. The promise is $\mathrm{Tr}\,(\rho Z) = 6\arctan\,(1/64)$. The update installs $\pi/2 + 6\arctan\,(1/64)$, sets stage to 1 and permission to 0, recomputes reports at $s = -1/2$, and retains the original word in history. Matter and locations are unchanged.

Classical table decoding is not quantum recovery

The decoder Dec in is a mathematical interpretation of exact classical codes. It is not a channel recovering an unknown quantum state from a classical record. For precision, the two relevant finite-dimensional comparisons are proved here.

For channels with the same input and output quantum spaces, use the half-diamond convention

$$d_{\diamond}(\Phi, \Psi) = \frac{1}{2}\|\Phi - \Psi\|_{\diamond}.$$

The diamond norm permits an untouched reference; in the statements below it suffices to test a maximally entangled input for a lower bound.

Full-code recovery and the complete complement

Proposition (Exact full-code criterion). *Let $\mathcal{N}\colon L(\mathscr{H}_Q) \to L(\mathscr{H}_B)$ be a channel with Kraus operators $E_i : \mathscr{H}_Q \to \mathscr{H}_B$. The following are equivalent:*

1. *a channel* $\mathscr{D}$ *satisfies* $\mathscr{D}\mathscr{N} = \mathrm{id}_Q$*;*

2. $E_i^\dagger E_j = c_{ij} I_Q$ *for scalar coefficients;*

3. *a complete complementary channel is a replacement channel,* $\widehat{\mathscr{N}}(X) = \mathrm{Tr}\,(X)\omega$ *for a fixed state* ω*. The criterion concerns recovery of the whole input matrix algebra, not merely a subsystem.*

Proof. The standard complementary channel has matrix entries

$$[\widehat{\mathscr{N}}(X)]_{ij} = \mathrm{Tr}\,(E_i X E_j^\dagger) = \mathrm{Tr}\,(X E_j^\dagger E_i).$$

This proves equivalence of (ii) and (iii).

If K_a are Kraus operators of a left inverse, the operators $K_a E_i$ form a Kraus family for the identity channel. Its Choi matrix has rank one, so each $K_a E_i = c_{ai} I_Q$. Trace preservation of $\mathscr{D}$ then gives

$$E_j^\dagger E_i = \sum_a E_j^\dagger K_a^\dagger K_a E_i = \sum_a \overline{c_{aj}} c_{ai} I_Q.$$

Conversely, diagonalize the positive scalar matrix in (ii) by a Kraus-basis change. Remove zero Kraus operators and write

$$E_i = \sqrt{\lambda_i} W_i, \qquad W_i^\dagger W_j = \delta_{ij} I_Q, \qquad \sum_i \lambda_i = 1.$$

The isometry ranges are orthogonal. Put $\Pi = \sum_i W_i W_i^\dagger$ and choose a fixed state τ on Q. Then

$$\mathscr{D}(Y) = \sum_i W_i^\dagger Y W_i + \mathrm{Tr}\,((I_B - \Pi)Y)\tau$$

is completely positive and trace preserving, and $\mathscr{D}\mathscr{N} = \mathrm{id}_Q$.

This is the full-code Knill–Laflamme criterion [5], also locally reported in Oai280-C [23]. "Complete" means the environment of a Stinespring dilation, including purifying factors, not a selected environmental record.

For example, $\mathscr{N} = \mathrm{Tr}_S$ on $Q_L \otimes S$ exactly returns the subsystem Q_L, but its complement returns the input-dependent S marginal. Subsystem recovery is not a left inverse on the full $Q_L \otimes S$ algebra.

Record-only recovery

Proposition (Sharp record-only obstruction). *Let* $\dim \mathscr{H}_Q = d \geq 2$. *If a channel* $\mathscr{E}$ *is measure-and-prepare and* $\mathscr{D}$ *is any channel returning Q, then*

$$d_\diamond(\mathscr{D}\mathscr{E}, \mathrm{id}_Q) \geq 1 - \frac{1}{d}.$$

The bound is attained by basis readout followed by basis-state preparation. It does not apply when an authorized input-dependent quantum memory is also retained.

Proof. A measure-and-prepare map has the form

$$\mathscr{E}(X) = \sum_z \mathrm{Tr}\,(F_z X)\sigma_z, \qquad F_z \geq 0, \quad \sum_z F_z = I.$$

Applying it and then $\mathscr{D}$ to half of $|\Phi_d\rangle = d^{-1/2}\sum_i |i,i\rangle$ gives a separable reference–output state. For density operators α, β,

$$\langle \Phi_d | \alpha \otimes \beta | \Phi_d \rangle = \frac{1}{d}\mathrm{Tr}\,(\alpha^{\mathrm{T}}\beta) \leq \frac{1}{d}.$$

Convexity gives the same upper bound for the separable output. Testing the Bell projector yields trace distance at least $1 - 1/d$ from the ideal output, proving .

For sharpness, computational dephasing is

$$\Delta_d = \frac{1}{d}\sum_{b=0}^{d-1} \mathrm{Ad}_{Z_d^b}, \qquad Z_d = \mathrm{diag}\,(1, e^{2\pi i/d}, \ldots, e^{2\pi i(d-1)/d}).$$

The triangle inequality bounds $\|\mathrm{id} - \Delta_d\|_\diamond$ by $2(1 - 1/d)$. The Bell lower bound gives equality.

The measure-and-prepare characterization is standard [6]; the quantitative comparison is also reported in Hawk04-B [32]. The proof above is independent of that manuscript.

Remark (Application to the present implementation). For a fixed classical input, the table circuit acts as identity on internal matter and every reference. Its matter channel therefore has a trivial constant complement and trivial exact recovery. This is not recovery from the source token.

The classical table decoder reconstructs geometry, not matter. Retained classical history makes the code update injective; it is not a quantum diary encoder or a record-only quantum decoder. Neither recovery comparison supplies expectation acquisition or a physical source instrument.

Intrinsic slice defects

The intrinsic particle defect of a slice need not equal the spacetime deficit in the packet.

On an incoming core face, the induced oblique metric is

$$G_h = G_\alpha - \binom{a}{a}(a \;\; a).$$

The boundary ray tangents have squared norm $1 - a^2$ and inner product $z_\alpha - a^2$. Thus

$$\theta_h(\mu) = \arccos\left(\frac{z_\alpha - a^2}{1 - a^2}\right), \qquad \kappa_P^-(\mu) = 2\pi - 3\theta_h(\mu).$$

On U_i^-, the ray and bisector tangents have oblique coordinates $(1, 0)$ and $(1, 1)$. Their angle satisfies

$$\cos\theta_k = \frac{1 + z_\alpha}{\sqrt{2(1 + z_\alpha) - b^2}}, \qquad \tan\theta_k = \frac{\sqrt{S_\alpha^2 - b^2}}{1 + z_\alpha} = \frac{4}{5}\tan\frac{\alpha}{2}.$$

Consequently,

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

Positive-definite face metrics give $0 < \theta_h < \pi$ and $0 < \theta_k < \pi/2$.

At μ_0,

$$\kappa_P^- = 2\pi - 3\arccos(-4/5), \qquad \kappa_P^+ = 2\pi - 6\arctan(4/5).$$

Neither replaces μ in (E2).

Proposition (Intrinsic compact-patch audit). *For every regular slice, the total intrinsic interior angle defect of $\rho \le 4$ is μ. The same holds for the common limiting slice, counting its active cells only.*

Proof. The patch is a piecewise Euclidean metric disk. Triangulate the simple faces without changing their metrics. The triangle angle sum and Euler identity for a disk give

$$\sum_{v \in \operatorname{int} K_s} \kappa_v + \sum_{v \in \partial K_s} (\pi - \theta_v) = 2\pi.$$

At each outer vertex D_i, the two resting sector corners have total interior angle $\pi - \alpha$. Hence boundary turning totals 3α, and

$$\sum_{v \in \operatorname{int} K_s} \kappa_v = 2\pi - 3\alpha = \mu.$$

At $s = 0$, the active incoming core triangles and collar form the same limiting disk. Collapsed outgoing slots contribute no extra vertices or faces.

Other interior defects compensate for the change in the particle's slice defect. This audit complements, but does not replace, the affine peripheral certificate.

Non-identifications and separate successor obligations

What the constructor does not derive

The source rule is a deterministic semantic substitution into a preconstructed geometric dictionary, called Option N in the series. Option N selects among catalogue descriptions of prescribed cones; it is not a host-metric update. When its packet output varies, Proposition prevents interpreting it as a definite classical output of an affine channel.

No relation $\mu = 8\pi Gm$ is derived. No stress-energy normalization, gravitational action, quantum state prescription for a field source, or renormalized source instrument is supplied. The symbol Ein_0 denotes exactly the five-check matching packet, not an Einstein tensor or an Einstein equation.

For completeness, even familiar stress-tensor identities do not supply such a missing equation.

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

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

Proof. This independent counterexample is in 3 + 1 dimensions. Take $\eta_4 = \mathrm{diag}\,(-1, 1, 1, 1)$ and the massless scalar $\varphi = aT$, with $a \neq 0$. Its improved flat-space stress is

$$t_{\mu\nu} = \partial_\mu\varphi\,\partial_\nu\varphi - \frac{1}{2}\eta_{4,\mu\nu}(\partial\varphi)^2 + \frac{1}{6}(\eta_{4,\mu\nu}\mathrm{Box} - \partial_\mu\partial_\nu)\varphi^2.$$

Since $\mathrm{Box}\,\varphi^2 = -2a^2$, direct substitution gives

$$t_{00} = \frac{a^2}{2}, \qquad t_{ii} = \frac{a^2}{6}, \qquad t_{0i} = t_{ij} = 0 \quad (i \neq j).$$

This constant tensor is symmetric, conserved, and traceless. However $G_{\mu\nu}(\eta_4) = 0$ and $t \neq 0$. For $G_{\mathrm{N}} > 0$, the proposed equation fails.

This separates the same implication discussed in Oai282-A and Oai282-B [26, 27] without importing a field theorem from either.

Source, collar, lapse, and catalogue separations

1. *Finite source versus field-theoretic insertion.* The source $j[f]$ is a fixed finite Hermitian matrix. No comparison map identifies it with a sharp insertion, a ramp coefficient, a field carrier input, or an inherited characteristic coefficient. The documentary non-admission record of XIV-J [28] is not repaired by selecting a conical packet. The separately named IX-A, X-A, and XII-A objects are not premises here; no unprovided theorem about them is asserted.

2. *Collar versus holographic boundary.* The resting collar is a geometric annulus with identity charts. No boundary state algebra, holographic encoder, entanglement wedge, or bulk/boundary identification is constructed. The comparison in XVII-A [25] concerns a different finite operator interface. AdS/CFT error-correction and wedge-reconstruction results [7, 8] are external comparisons, not premises of this zero-cosmological-constant cone construction.

3. *Parameter versus relational lapse.* The installed incidence parameter remains an input of the family. Remark

computes only its local kinematical normal speed; it is not the relational lapse of Em02-E [24].

4. *Catalogue versus proof transfer.* Every OpenAI family mentioned in the revision record remains an external catalogue entry, not a theorem used here. The separate OpenAI catalogue is not identified with the Cheung manuscript series [30, 31]. No claim in this paper changes the documentary status O.1 = NOT_CLOSED, recorded in XVI-O [29]. That label is not a newly proved mathematical assertion of this paper.

5. *Catalogue versus host, and non-global hyperbolicity.* As already recorded above, changing μ changes a description, not $g_{\mu_{\mathrm{H}}}$. On this prescribed family, the regular product is not globally hyperbolic. That non-global-hyperbolicity statement is a source record of attached typographic parent VIII-ST Version 1 (prop:nonGH) [20], not a theorem of the present sheet.

6. *Finite angle is not class* (C). Official VIII-Defect-A Version 2 [21] records, as a documentary stop, that a finite angle on this family is not class (C), and that the radiation coexistence host is not a bounce and not a vacuum selector. Official Big-Vac-A Version 2 [22] is the sibling source record for that vacuum sentence. Neither record is a premise, and neither relabels a theorem of this sheet.

This construction is not spacetime emergence, a Page curve, an island construction, a bounce, a vacuum-energy selection, or holographic identification. The ambient geometric dictionary is explicitly supplied before its expectation selection.

The following are source records, not premises of the theorems proved here. The shredder access interface is recorded in [11]. The Scholar-facing clock comparison is En09-A [17]: a destructive clock consumes a finite encoding, not the geometric time axis. The record-only bound used below is the deposited book [32]; the internal locator remains Hawk04-B thm:classical. IBG and IBGS [12, 13] are named only as corpus records: this package does not supply a conical Green or a spin-1/spin-2 inverse. Official I-D-v5 [14] is a dynamical-host comparison; the cones of this sheet stay 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. Attached typographic parent VIII-C Version 3 [19] remains a separate project, not a premise.

Separate successors

Hybrid schedules. A fixed-packet flow, a command grammar, legal permission histories, and support bounds for prescribed matter channels require their own theorems. VIII-C [19] is documented as the successor that composes regular source replacement with frozen-deficit incidence. No VIII-C theorem is absorbed as a premise or result here. A schedule-support region is not thereby a spacetime causal past.

Mixed incidence–deficit germ. Neither Theorem nor the finite table constructs a simultaneous incidence and deficit change. A successor would have to provide, at minimum:

1. one justified common limiting realization and a declared variable-deficit seam convention;

2. both one-sided cell germs, with embedding, spacelikeness, and active-cell nondegeneracy on their domains;

3. complete overlap maps and winding-marked affine words through the mixed stratum;

4. coherent worldline, rest-frame, and abstract-label transports;

5. exact incidence/source guards and permission accounting;

6. a canonical forward-domain representation and decoder theorem, including its source promise or acquisition errors. This is a missing-object checklist, not an existence theorem or a universal obstruction.

Expectation acquisition. Approximate acquisition requires a separate instrument with a specified preparation class, sample resources, selective residual states, estimation error, and robust-control analysis. Proposition does not provide that instrument. No such instrument for the current of this paper is supplied by the finite token table.

Other excluded constructions. No tessellation Hamiltonian, global hybrid evolution, characteristic distributional product, interacting quantum Ward identity, physical communication schedule, no-signalling theorem for the nonlinear source rule, or 3 + 1-dimensional semiclassical Einstein equation is constructed.

Conclusion

The closed result is

$$\text{boxed}\ \begin{array}{c}\text{fixed named Hermitian source + explicit scalar deficit rule}\\ \text{+independently realized family on } I\\ \Rightarrow \text{a certified sourced spinless cone with one persistent}\\ \text{fixed-deficit three-to-six event of the declared cellulation.}\end{array}$$

The finite theorem adds a representation promise and a reversible classical realization. It does not silently replace that promise by expectation measurement.

appendix

Reference specialization at mu0=pi/2

This appendix defines and checks the reference specialization used in the source-off statement. It is directly verifiable without access to a separately maintained VIII-A source. The correspondence with VIII-A is documentary [18]; no independent file-to-file comparison is claimed.

Cone, graph, and vertices

At $\mu = \mu_0$,

$$\alpha = \frac{\pi}{2}, \quad z_\alpha = 0, \quad S_\alpha = 1, \quad a = \frac{2}{3}, \quad b = \frac{3}{5}, \quad c = \frac{11}{30}, \quad r = 3, \quad \beta = \frac{3}{2}, \quad \chi = \frac{15}{11}.$$

Write $d_i = e_i(\mu_0)$. The graph is

$$F_s^{(0)} = s + \min\left\{2, \max\left\{\frac{2}{3}(\xi+\zeta), s + \frac{3}{5}\min\{\xi,\zeta\}\right\}\right\}.$$

The rays are successive right-angle boundary rays of three sectors; d_3 is the developed upper seam copy.

The vertices and times become

$$A_i = 3d_i, \qquad D_i = 4d_i, \qquad B_i = \frac{3}{2}s\,d_i, \qquad C_i = \frac{15}{11}s(d_i + d_{i+1}),$$

$$T(A_i) = T(D_i) = 2 + s, \qquad T(B_i) = 2s, \qquad T(C_i) = \frac{31}{11}s.$$

The particle time remains s for $s \le 0$ and $2s$ for $s \ge 0$. The resting collar is $7/2 \le \rho \le 4$.

With $A = \mathrm{id}$, the packet is

$$(\mathrm{p}, \pi/2, \mathscr{W}_0, \mathbf{t}, \mathrm{id}, J_0), \qquad J_0 = J(\pi/2).$$

The timelike **t** is not the spatial ray d_0.

Lengths, one-sided laws, and areas

At the reference point,

$$L_\alpha = \sqrt{2}, \qquad W_\alpha = \frac{3\sqrt{65}}{22}.$$

The full finite length table specializes to toprule Slot Incoming Outgoing

midrule r_i^{rad} $\sqrt{5}$ $\sqrt{5}(1 - s/2)$

r_i^{crest} $3\sqrt{2}$ $3\sqrt{2}$

r_i^{conn} 1 1

r_i^{outer} $4\sqrt{2}$ $4\sqrt{2}$

u_i inactive $(3/2)s$

v_i inactive $(3\sqrt{41}/11)s$

$w_i^{\pm}$ inactive $(3\sqrt{65}/22)s$

bottomrule For the last two constants,

$$\chi\overline{\sqrt{2 - b^2}} = \frac{15}{11}\sqrt{\frac{41}{25}} = \frac{3\sqrt{41}}{11},$$

and

$$W_\alpha^2 = \left(-\frac{3}{22}\right)^2 + \left(\frac{15}{11}\right)^2 - \frac{9}{25}\left(\frac{15}{11}\right)^2 = \frac{585}{484}.$$

The persistent radial derivatives are 0 and $-\sqrt{5}/2$. Born right slopes are $3/2$, $3\sqrt{41}/11$, and $3\sqrt{65}/22$.

The areas are

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

These follow from $r = 3$, $\beta\chi = 45/22$, and $S_{\alpha} = 1$. The branch-boundary normal speed is

$$\left((2/3)^2 + (1/15)^2\right)^{-1/2} = \frac{15}{\sqrt{101}}.$$

Charts and words

The reference gradients are

$$g_h = (2/3, 2/3)^{\mathrm{T}}, \qquad g_{-} = (0, 3/5)^{\mathrm{T}}, \qquad g_{+} = (3/5, 0)^{\mathrm{T}}.$$

Their boosts are

$$B_h = \begin{pmatrix} 3 & -2 & -2 \\ -2 & 2 & 1 \\ -2 & 1 & 2 \end{pmatrix}, \qquad B_x = \begin{pmatrix} 5/4 & -3/4 & 0 \\ -3/4 & 5/4 & 0 \\ 0 & 0 & 1 \end{pmatrix}, \qquad B_y = \begin{pmatrix} 5/4 & 0 & -3/4 \\ 0 & 1 & 0 \\ -3/4 & 0 & 5/4 \end{pmatrix}.$$

Thus

$$\begin{aligned} \mathcal{A}_{V_i}(z) &= O_i B_h O_i^{-1} z - 3s\mathbf{t}, \\ \mathcal{A}_{U_i^{-}}(z) &= O_i B_y O_i^{-1} z - \tfrac{5}{2}s\mathbf{t}, \qquad O_i = \operatorname{diag}(1, \operatorname{Rot}(i\pi/2)). \\ \mathcal{A}_{U_i^{+}}(z) &= O_i B_x O_i^{-1} z - \tfrac{5}{2}s\mathbf{t}, \end{aligned}$$

Resting charts are identities.

The core and collar loops remain $\rho = 29/10$ and $\rho = 15/4$. Their winding marks are one; the core and star words are and with $J = J_0$. The intrinsic audit specializes to

$$\theta_h = \arccos(-4/5), \qquad \theta_k = \arctan(4/5), \qquad \sum_{v \in \operatorname{int} K_s} \kappa_v = \pi/2.$$

Hence the source-off specialization includes the complete displayed graph, cell pattern, vertices, times, lengths, one-sided slopes, areas, adapted charts, seam, primitive words, collar, worldline, rest data, and intrinsic audit.

Cell dictionary and encoding

toprule Code Cell slot

midrule endfirsthead toprule Code Cell slot

midrule endhead 0 P

1–3 A_{i}

4–6 D_{i}

7–9 r_{i}^{rad}

10–12 $[A_{i}, A_{i+1}]$

13–15 $[A_{i}, D_{i}]$

16–18 $[D_{i}, D_{i+1}]$

19–21 V_{i}

22–24 Q_{i}

25–27 B_{i}

28–30 C_{i}

31–33 u_{i}

34–36 v_{i}

37–39 w_{i}^{-}

40–42 w_{i}^{+}

43–45 U_{i}^{-}

46–48 U_{i}^{+}

49–51 Exterior rays

52–54 Unbounded exterior faces

bottomrule

At the incoming source slice, slots 25–48 are invalid locations. Other listed slots have their incoming meanings.

The radial slot is epoch dependent, but source replacement does not cross epochs.

This dictionary abstracts location to a cell label. It does not encode a continuously variable point within a cell.

Source replacement preserves labels, not old developed coordinates.

One possible index encoding stores $m + K_q$ in $q + 2$ bits; one possible clock encoding stores $j + 2^{p_{\mathrm{clk}}}$ in $p_{\mathrm{clk}} + 2$ bits.

Unused strings are invalid. Field order, valid metadata, and encodings are fixed before constructing P_{geo}.

Invalid strings need no geometric interpretation. They complete the update to a permutation. Likewise, no geometric decoding is asserted for nonzero-work inputs or intermediate circuit words.

Dependencies and verification status

toprule Result Mathematical inputs

midrule Accessible-current criterion Finite-dimensional adjoints and spectral separation

Cone dictionary Interval, rays, seam, spinless affine packet

Persistence Oblique metric, retuning, exact graph decomposition, lengths, areas, and localization

Matching certificate Realized polygons, fixed affine extensions, overlap components, winding marks, and primitive meridians

Source constructor Fixed named Hermitian matrix and scalar substitution

Spectator invariance Partial trace; controller conclusion additionally uses Assumption

Finite realization Algebraic table, exact reports, source promise, canonical codes, retained history, and gate synthesis

Recovery comparisons Kraus identities, complete complements, and a Bell test

bottomrule

All proofs used for the new constructor are present in this file. Companion citations identify related interfaces and scope distinctions, not hidden hypotheses.

The main symbolic audits are:

1. constant physical gradient norms ;

2. exact cap and loop clearances –;

3. complete finite lengths and areas , Table , and ;

4. active-cell positivity and the unique event;

5. Lorentz membership and adapted face times –;

6. canonical affine transitions and three- and six-factor words;

7. the reference specialization;

8. rational-tangent table identities;

9. bit and gate totals –;

10. the distinction between fixed-token correctness, branchwise ensembles, and nonlinear unconditional semantics.

Numerical sampling would be diagnostic, not a substitute for the interval proof. Useful independent checks include polygon intersection tests, area signs, adapted chart equations, seam orientation, algebraic report floors, and the reversible word action.

Declarations

Data and materials. This is a theoretical work. No empirical dataset is used. The formulas, finite table specification, matching witnesses, proofs, and reversible resource accounting are included here.

Bibliographic scope. Cheung references are identified by manuscript name, version where supplied, and relevant

local labels or sections. They are not represented as peer-reviewed journal articles. References to the external catalogue are documentary only.

Verification. No successful pdfLaTeX execution, proof-assistant verification, executed numerical diagnostic, independent source comparison, independent referee review, or journal acceptance is asserted. The source is designed as a single-file pdfLaTeX document; a local two-pass build and independent mathematical review remain necessary.

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