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VIII-C: Certified Fixed-Packet Flow, Guarded Events, and Finite Reversible Composition

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Abstract

We give a conditional composition theorem for polygonal descriptions of a declared spinless conical spacetime. At a fixed particle packet, explicit realizations produce correlated affine edge-length laws. Incoming slice advance preserves the finite lengths, while outgoing advance changes genuine crease lengths. A separately installed collar module changes subdivision lengths without changing the embedded slice.

Exact parameter clocks, profile-specific guards, separate incidence and source permissions, and complete output obligations define legal schedules. Relative to explicitly stated realization and transport interfaces, every legal schedule returns an accepted five-component affine matching certificate after every command. Geometric commands preserve the installed packet and reference-frame signature; regular source-table replacement installs a complete new realization. Catalogue replacement is not host evolution: source-table replacement evaluates a complete new realization on description data and does not change $g_{\mu_{\mathrm{H}}}$. That interpretive sentence is sourced from attached typographic parent VIII-ST Version 1 (def:host, prop:fixedhost); it is not an imported theorem.

An explicit five-command history performs source replacement at $s = -1/2$, reaches the incoming particle germ, changes the particle link at a frozen deficit, and continues along the outgoing family. Finitely encoded words have reversible implementations on their composite canonical forward domains, with retained input histories, identity action on internal matter, and explicit resource bounds for this history. Independently, prescribed block channels obey an exact backwards-support inclusion, including untouched references.

The source token is supplied under a semantic promise, not acquired or tested. Local obstruction and separation arguments prevent incomplete packet updates, expectation extraction, record–residual identification, schedule–causality identification, and confusion of code decoding with quantum recovery. No mixed incidence–source germ, physical embedding of the schedule, polygon Hamiltonian, spacetime emergence, or holographic identification is constructed.

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Problem, contribution, and logical scope

Landmark VIII-A defines a finite affine matching interface for a declared spinless conical geometry [17]. Landmark VIII-B constructs a variable-deficit realization family and a finite promised source table [18]. The present paper supplies a scheduling layer: fixed-packet movement, guarded incidence, regular source replacement, and finite reversible composition.

The polygon literature studies evolving descriptions of 2 + 1-dimensional gravity [2, 3, 4]. The construction here is narrower. We prescribe realizations and derive their length laws; we do not identify those laws with a polygon

Hamiltonian or import a general transition catalogue. The spinless conical interpretation is a declared geometric dictionary, motivated by the locally flat 2 + 1-dimensional setting [1], not a consequence of the scheduling theorem.

Contributions.

1. Explicit fixed-packet realizations yield correlated affine length laws, including nonzero outgoing crease rates and a coplanar length-changing collar refinement.

2. A guarded grammar composes regular source replacement and fixed-packet incidence while returning complete matching outputs.

3. One sourced five-command word has exact packet data, a permission trace, canonical report checks, and finite reversible resource bounds.

4. Local proofs state the observation, support, and decoding boundaries needed to interpret this composition correctly.

The contribution is a certified composition framework, not a new particle geometry, source law, measurement primitive, or gravitational dynamics. Destructive readout and the refusal of identification are the Scholar-facing Enter records [8, 9].

Conditional theorem architecture

The required geometric realization and location-transport interfaces are stated in . They are hypotheses of the conditional scheduling theorem. A citation does not replace an interface statement or independently validate its implementation.

By contrast, the completeness, token, record, support, recovery, and non-identification statements added here are proved locally. They are not imported as additional premises from companion manuscripts. Their citations identify corresponding results and comparisons in Cheung's series.

The two substrate profiles are alternatives. Their moving cores are not glued together, and no profile-switching

command is supplied. A collar-refined representation must already be installed before collar flow acts. Source and incidence remain separate command kinds.

toprule Object Status

midrule Realization and transport interfaces Explicit hypotheses of the conditional composition theorem

T0 source token Supplied with a semantic promise; not acquired or verified

Particle incidence At a fixed installed packet in profile P

Four-face exchange In the separate particle-free moving patch of profile A

Collar flow A separately installed module; absent from the hybrid dictionary

Mixed incidence–source germ Not constructed or admitted

Backwards schedule support A computational upper bound; not a physical causal past

Quantum recovery and holographic reconstruction Not conclusions of reversible code decoding

bottomrule

The dependency and source-locator tables in distinguish inherited hypotheses from locally proved statements.

Complete affine matching at every command boundary

Packets and affine frames

Use developed coordinates

$$z = (T, X, Y)^{\mathrm{T}}, \qquad \eta = \operatorname{diag}(-1, 1, 1), \qquad e_0 = (1, 0, 0)^{\mathrm{T}}.$$

Affine isometries act and compose by

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

and

$$(L, b)^{-1} = (L^{-1}, -L^{-1}b).$$

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 packet is

$$\Pi_\mu = (p, \mu, \mathscr{W}_0, e_0, \mathrm{id}, J(\mu)), \qquad \mathscr{W}_0 = \mathbb{R}e_0.$$

Here p is a geometric particle identifier.

For a declared affine frame $A = (L_A, b_A)$, the coherently transported packet has

$$\mathscr{W}_\Pi = A\mathscr{W}_0, \qquad u_\Pi = L_A e_0, \qquad H_\Pi = AJ(\mu)A^{-1}.$$

In particular,

$$H_\Pi(A(te_0)) = A(te_0) \quad \text{for every} t \in \mathbb{R}.$$

The frame, worldline, rest vector, deficit, and holonomy are transported together.

The five-component output

Definition (Complete matching output). For a realized description g, write

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

An accepted output supplies the finite tables, exact equalities, and topological evidence for all of the following obligations:

1. Vertex and overlap matching $\mathscr{V}$. Every proposed transition equals its prescribed affine map on the declared overlap component. Reverse maps are inverses; paired endpoints and shared segments match; face boundaries close; regular small vertex words are affine identities.

2. Particle matching $\mathscr{P}$. The declared deficit, oriented rest frame, affine worldline, and peripheral map agree with

the installed packet.

3. Ordered holonomy evidence $\mathscr{H}$. The ordered words, overlap-component indices, and winding classes are supplied. A positive primitive particle meridian has winding one, not merely a nonidentity matrix.

4. Core–collar matching $\mathscr{K}$. The core and collar share their prescribed boundary realization and transported framing. Their primitive words give the same installed peripheral map.

5. Worldline data $\mathscr{W}$. All charts describe the same singular worldline. Its holonomy fixes that worldline pointwise, rest vectors are transported consistently, and the declared slice intersection lies on it. Embedding, spacelikeness, and nondegeneracy of active cells are separate realization requirements. A germ is accepted as a specified one-sided limiting object, not as a regular cellulation with extra active zero-size cells.

This is the finite matching interface of VIII-A [17, Definition A:def:Ein], restated here. The notation Ein_0 does not mean that a Hamiltonian constraint algebra or a general Einstein initial-data theorem has been proved.

For fixed face charts $\mathcal{A}_f$, seam map $J(\mu)$, and overlap-component exponent n_{gf}, the prescribed transition is

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

Elementary overlap components have $n_{gf} \in \{-1, 0, 1\}$; longer paths retain their individual component data.

Proposition (Output completeness and two independent failures). *The following statements hold for every command output, at every installed μ, in a fixed declared presentation.*

1. *With realization, charts, overlap components, reference framing, and prescribed seam maps fixed, two different proposed values of a required transition cannot both satisfy (E1).*

2. *If $\mu_{\mathrm{old}} \neq \mu_{\mathrm{new}}$ belong to the interval used below, retaining $J(\mu_{\mathrm{old}})$ at the new deficit violates particle/seam matching, although it still fixes $\mathscr{W}_0$ pointwise.*

3. *For $\delta \neq 0$, the affine map*

$$(R(\mu), \delta e_0)$$

preserves $\mathscr{W}_0$ as a set and preserves the rest vector in its linear part, but does not fix $\mathscr{W}_0$ pointwise. It therefore fails (E5). All three statements remain true after coherent conjugation by any declared affine frame A.

Proof. For the first assertion, (E1) requires equality with the single map in . Two accepted proposed maps must therefore equal one another.

The interval below is contained in $(0, 2\pi)$, so distinct deficits in that interval give distinct oriented spatial rotations. Thus $J(\mu_{\text{old}}) \neq J(\mu_{\text{new}})$. Every $J(\mu_{\text{old}})$ nevertheless sends te_0 to te_0. The failure is deficit/seam matching, not pointwise worldline fixation.

For the third assertion,

$$(R(\mu), \delta e_0)(te_0) = (t + \delta)e_0 \neq te_0.$$

Conjugation is injective. Moreover, the conjugated time-shifted map sends $A(te_0)$ to $A((t + \delta)e_0)$. Hence the same distinctions hold in every coherently transported frame.

These are local versions of VIII-A's fixed-presentation completeness and rejected updates [17, Theorems A:thm:A1, A:thm:A4-stale, and A:thm:A4-time]. They do not assert that holonomy alone determines all chart transitions. In particular, matching a few endpoints or a peripheral product is not a substitute for .

Reference-frame signature and worldline distinctions

A chart-based primitive product is generally conjugate to $J(\mu)$. After transport back to the declared reference frame it is exactly $J(\mu)$. We use the latter convention in the persistent signature

$$\text{Sig}\,(g) = (p, \mu, \mathscr{W}_0, e_0, \text{reference framing}, [\gamma]_{\text{primitive}}, J(\mu), \text{collar matching}).$$

Its preservation does not require literal equality of every chart-based matrix.

Three different statements are kept separate:

$$\mathscr{W}_0 \text{is a fixed ambient set,} \qquad J(\mu)|_{\mathscr{W}_0} = \text{id}, \qquad P_s \in \mathscr{W}_0 \text{may vary with} s.$$

Fixed-packet slice advance preserves the first two, not generally the third.

Named access and the supplied-token boundary

Matter, source algebras, and policy T0

A finite named matter interface Γ carries one joint state

$$\rho \in \mathrm{D}(\mathscr{H}_{\Gamma}).$$

Names specify access to declared factors. Classical registers are jointly block diagonal in their distinguished bases, including their correlations with other factors.

A surviving source boundary is an explicitly embedded unital ^*-subalgebra

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

Its accessible state functional is

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

For a fixed Hermitian $B_{\mathrm{src}} \in \mathscr{A}_{\mathrm{src}}$ and fixed κ, a table token m_{src} can carry the semantic promise

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

The example below uses $B_{\mathrm{src}} = Z$ and $\kappa = 1$.

Policy T0. Every sourced history begins with an already supplied classical token. At each sourced command the token must satisfy its declared promise for the current surviving source state. No token-acquisition operation or operational promise test occurs in the history.

"Current token" means correct for the current source functional. It does not mean that the selected packet is already installed before source replacement.

For a fixed token, the promised state class may be convex. The union of classes for different deterministic expectation labels need not be convex. Nothing here implements a state-only deterministic source selection on the full quantum state space.

Proposition (Expectation and affine-label obstructions).

1. *Let $\mathscr{S}$ be a convex state set. If an affine map assigns to every $\rho \in \mathscr{S}$ a classical distribution concentrated at one label,*

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

then γ is constant on $\mathscr{S}$. The statement also holds for a classical outcome space whose distinct labels can be separated by a measurable event.

2. *A circuit acting only on code registers and as the identity on matter cannot, for a fixed independent code input, make its code output depend on an unencoded matter expectation. Requiring that a putative label-producing channel also preserve the matter input does not remove the first obstruction.*

Proof. If two states have distinct labels, affinity gives, for $0 < t < 1$,

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

This is not concentrated at one label. In a general outcome space, an event separating the labels has probability strictly between zero and one. Either conclusion contradicts the assumed deterministic output on the mixture.

For the second assertion, a code-only circuit U_c acts as $U_c \otimes I_\Gamma$. On an independent input $c \otimes \rho$, its code marginal depends on c, not on ρ. Different unencoded expectations therefore cannot select different code outputs. An additional matter-preservation requirement cannot invalidate either argument.

The two arguments correspond to VIII-B's expectation-label obstruction and VII-G's affine obstruction [18, Proposition prop:obstruction], [15, Proposition prop:affine]. They are proved here rather than assumed. They do not prohibit deterministic processing of an already supplied classical token, stochastic instruments, or separately controlled approximations.

Records do not determine residual access

For destructive computational readout of S, with surviving complement B, a specified output is

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

Its codomain contains R and B, not the consumed factor S. A pullback of an output observable is an input observable; it does not restore S as a surviving output name [21, 17].

Proposition (Accessible expectations and residual separation).

1. *For channels Φ, Ψ with common input and output spaces and a fixed output Hermitian B,*

$$\mathrm{Tr}\,(B\Phi(\rho)) = \mathrm{Tr}\,(B\Psi(\rho)) \quad \text{for every input state} \rho$$

if and only if

$$\Phi^*(B) = \Psi^*(B).$$

On a restricted state class, only the corresponding annihilator condition follows; operator equality need not follow.

2. *Identical classical record channels do not imply identical channels on the record–residual output algebra.*

Proof. Trace duality turns the first equality into

$$\mathrm{Tr}\,(\rho(\Phi^*(B) - \Psi^*(B))) = 0.$$

A Hermitian operator with zero expectation in every state is zero. Restricting the tested states restricts this conclusion to their real linear span.

For the second assertion, let $\Delta_Z(\rho) = P_0\rho P_0 + P_1\rho P_1$ on a qubit and define

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

Their record marginals are the same constant record. For $\rho = |+\rangle\langle +|$, their residual difference is $X/2$, so

$$\frac{1}{2}\|\mathscr{G}(\rho) - \mathscr{F}(\rho)\|_1 = \frac{1}{2}.$$

The full residual algebra distinguishes them.

These statements sharpen the source boundary in the notation used here, in agreement with VII-E's accessible-observable and residual-obstruction results [14, Proposition prop:accessible and Theorem thm:residual-obstruction]. A produced record can become a source only when its surviving register and source algebra are explicitly named. Record agreement alone does not justify using an unnamed residual observable as a source.

No readout or residual-changing instrument occurs in the T0 word constructed below.

Configurations, clocks, and command domains

Assumption (Deterministic spectator-blind control). Equal geometry, controller data, permissions, declared geometric resources, source embedding, and explicitly accessible inputs select the same command, applicability result, geometric support, complete output certificate, original-name transport, and successor controller state.

Geometric commands do not read internal matter, occupancy, source tokens, or spectator number. A source-table command reads its declared classical token. Spectator locations and implementation histories have separately reserved storage and do not affect geometric capacity guards.

Source-table replacement remains evaluation of a complete new realization on description data; it does not change $g_{\mu_{\mathrm{H}}}$. Catalogue replacement is not host evolution [19]. This is a local interpretive remark, not an imported VIII-ST theorem.

This is a declared controller interface, not a general no-signalling theorem for nonlinear feedback. The continuum source law of VIII-B remains its nonlinear Option N. Its promised table restriction is not an expectation extractor or an implementation of that continuum law on arbitrary unknown states.

Definition (Scheduled configuration). A scheduled configuration is

$$C = (g, \Pi, m, \mathrm{profile}, s, \sigma, \tau, h, v_G, v_{\mathrm{src}}, m_{\mathrm{src}}; \Gamma, \rho, \ell; \mathscr{R}, \mathrm{history}),$$

where:

1. g is a certified regular geometry or certified one-sided germ;

2. Π is its installed packet, and m is a table index, or * in a semantic continuum description;

3. profile $\in \{\mathrm{P}, \mathrm{A}\}$ fixes the substrate;

4. s, σ are the particle-family and four-face parameters; an unused parameter is inactive metadata;

5. τ is an execution/flow clock;

6. h includes incidence mode, source stage, schedule stage, module, and finite controller data;

7. v_G, v_{src} are separate nonnegative integer permissions;

8. m_{src} is an optional classical source token;

9. $\ell : \Gamma \to \mathrm{Cell}(g)$ specifies abstract locations;

10. $\mathscr{R}$ reserves geometric resources separately from spectator, location, and implementation-history storage. For profile P,

$$\text{module} \in \{\text{slice}, \text{collar}, \text{none}\}.$$

Collar mode has an active parameter t_{col}, holds s fixed and regular, and uses its already installed refined dictionary. Profile A uses its own slice module and dictionary.

No command changes profile, silently refines the dictionary, or uses implementation history as a source observable.

Exact clocks and germ modes

Finite codes use exact dyadic parameters

$$s = j2^{-d}, \qquad \sigma = j_A 2^{-d_A}, \qquad t_{\mathrm{col}} = j_{\mathrm{col}} 2^{-d_{\mathrm{col}}}.$$

Recorded execution slots satisfy

$$\tau = k\Delta\tau, \qquad \Delta\tau > 0.$$

A geometric segment can be parametrized by

$$s = s_a + v_s(\tau - \tau_a),$$

or the analogous law for σ or t_{col}. Only designated endpoint codes need lie on the finite grid.

Incoming and outgoing germs at zero have the same exact parameter but different incidence modes. We write 0^- and 0^+ for those modes, not for rounded real numbers.

A discrete incidence or source command may consume an execution slot while leaving its slicing parameter fixed. No continuous interpolation of that discrete command is asserted. The execution clock is not identified with proper time or a relational lapse.

Interface Contract (Four admitted command kinds). Each command returns the complete output of , canonical finite reports when applicable, and certified original-name transport.

1. G: fixed-packet flow within one declared module and incidence epoch. Slice advance has nonnegative parameter speed. A particle slice segment may end at the incoming germ or begin at the outgoing germ, but may not cross zero internally. Collar flow requires profile P, a regular fixed s, and the prescribed collar window.

2. $\mathrm{E}_{3\text{--}6}$: profile P, unrefined slice module, incoming mode, exact $s = 0$, and $v_G \geq 1$. It selects the outgoing germ at the same packet, decreases v_G by one, and recomputes the incidence and matching tables.

3. E_A: profile A, incoming mode, exact $\sigma = 0$, and $v_G \geq 1$. It performs the certified four-face exchange away from the particle, decreases v_G, and preserves the ambient packet.

4. $\mathrm{S}_{\mathrm{tab}}$: profile P, unrefined slice module, source stage zero, exact regular parameter $s = -1/2$, a supplied table token satisfying its semantic promise, and $v_{\mathrm{src}} \geq 1$. It installs the complete realization at the token's packet and the same s, decreases v_{src}, and sets source stage to one. No command combines source replacement and incidence. Every admitted command acts as the identity on internal matter in a T0 history. Acceptance is conjunctive: every realization requirement and every obligation (E1)–(E5) is required.

The contract specifies admitted domains and outputs. Its geometric existence and transport content is supplied by

the explicit interfaces in the next section. Source replacement is evaluation of the complete particle constructor at the selected table entry, not a deficit-label write with stale charts.

Realization interfaces and explicit data

Particle-family geometry

Set

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

$$\alpha = \frac{2\pi - \mu}{3},\ a = \frac{2\sqrt{2}}{3}\cos\frac{\alpha}{2}, \qquad b_{\mu} = \frac{3}{5}\sin\alpha.$$

The subscript distinguishes b_{μ} from report precision b.

In the cut development put

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

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

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

The last ray is identified with the first by $J(\mu)$, since $3\alpha = 2\pi - \mu$. Cell indices are cyclic modulo three after seam identification; the developed rays $e_0, \ldots, e_3$ are kept distinct before that identification.

Define

$$\rho_c = \xi + \zeta, \qquad h_{\mathrm{lin}} = a(\xi + \zeta),\ k_{\mu} = b_{\mu}\min\{\xi, \zeta\},$$

$$F_s^{(\mu)} = s + \min\{2, \max\{h_{\mathrm{lin}}, s + k_{\mu}\}\}.$$

The ambient regular metric is the ultrastatic cone metric $-dT^2 + ds^2_{C_{\mu}}$; the graph is $T = F_s^{(\mu)}$.

Use

$$r = \frac{2}{a}, \qquad B = \frac{1}{a}, \qquad C = \frac{1}{2a - b_{\mu}}, \qquad z_{\alpha} = \cos\alpha, \qquad S_{\alpha} = \sin\alpha.$$

The particle intersection and outer vertices are

$$P_{s} = \begin{cases} (s,0,0), & s \le 0, \\ (2s,0,0), & s \ge 0, \end{cases} \qquad A_{i} = re_{i}, \qquad D_{i} = 4e_{i},$$

with $T(A_{i}) = T(D_{i}) = 2 + s$. Spatial vertex notation is supplemented by its displayed time coordinate.

For $s > 0$,

$$B_{i} = Bs\,e_{i}, \quad T(B_{i}) = 2s, \qquad C_{i} = Cs(e_{i} + e_{i+1}), \quad T(C_{i}) = 2s + b_{\mu}Cs.$$

Incoming core faces are

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

Outgoing core faces are

$$U_{i}^{-} = [P, B_{i}, C_{i}], \qquad T = 2s + b_{\mu}\zeta,$$

$$U_{i}^{+} = [P, C_{i}, B_{i+1}], \qquad T = 2s + b_{\mu}\xi,$$

$$V_{i} = [B_{i}, A_{i}, A_{i+1}, B_{i+1}, C_{i}], \ T = s + a(\xi + \zeta).$$

The collar-side faces

$$Q_{i} = [A_{i}, D_{i}, D_{i+1}, A_{i+1}]$$

and exterior are horizontal at $T = 2 + s$. The annular collar $7/2 \le \rho_{c} \le 4$ has resting plane orientation. Its height varies with s.

Lemma (Uniform coefficients and cap separation). *For every $\mu \in I$,*

$$0 < b_{\mu} \le \frac{3}{5} < a, \qquad \frac{129}{200} < a < \frac{137}{200}, \qquad \frac{1}{a - b_{\mu}/2} < \frac{29}{10} < r < \frac{7}{2}.$$

For $0 < s \le 1$, the outgoing star is strictly inside the cap:

$$\rho_{c}(C_{i}) = 2Cs = \frac{s}{a - b_{\mu}/2} < \frac{29}{10} < r.$$

Proof. Write $\alpha/2 = \pi/4 + \varepsilon$, where $|\varepsilon| \le \pi/120 < 11/420$. Then

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

The inequalities $\cos\varepsilon \geq 1 - \varepsilon^2/2$ and $|\sin\varepsilon| \leq |\varepsilon|$ give

$$\frac{2}{3}\Big(1 - \frac{1}{2}(11/420)^2 - \frac{11}{420}\Big) < a < \frac{2}{3}\Big(1 + \frac{11}{420}\Big).$$

The left bound exceeds 129/200, and the right bound is below 137/200. Since $0 < \alpha < \pi$, $b_{\mu} > 0$, and $b_{\mu} \leq 3/5 < 129/200 < a$. Consequently,

$$\frac{1}{a - b_{\mu}/2} < \frac{200}{69} < \frac{29}{10}, \qquad \frac{400}{137} < r < \frac{400}{129} < \frac{7}{2}.$$

The remaining claims follow from .

Interface Contract (Particle realization and germ transport). For every $\mu \in I$ and $s \in [-1, 1]$, the particle constructor supplies the realization above, with:

1. embedded spacelike faces and exterior, with physical branch gradient norms $2\sqrt{2}/3$, 3/5, and 0;

2. positive active cells on each regular epoch;

3. exactly one incidence value, $s = 0$, and the specified incoming and outgoing germs;

4. the affine charts and prescribed overlap components below;

5. complete accepted (E1)–(E5), including identity regular words and positive primitive core and collar words;

6. identity abstract transport through $\mathrm{E}_{3\text{--}6}$ of the persistent labels specified in . This is the realization interface corresponding to VIII-B's persistence theorem, specializing at μ_0 to VII-F [18, Theorem thm:persistence], [20]. The interface is an explicit hypothesis; no independent validation of all predecessor certificate tables is asserted here.

The displayed graph also explains the absence of an additional branch event. For $s \leq 0$, $h_{\mathrm{lin}} \geq s + k_{\mu}$. For $s > 0$, the new triangles are bounded by the vertices B_i, C_i; separates them from the cap.

For reference, the induced areas of compact faces are

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

$$\operatorname{Area}(U_i^{\pm}) = \frac{2}{5} S_\alpha BCs^2 \quad (s > 0), \qquad \operatorname{Area}(Q_i) = \frac{1}{2} S_\alpha (16 - r^2).$$

These follow by multiplying projected areas by the constant spacelike area factors 1/3, 4/5, and 1, respectively.

The outgoing star lies strictly inside the incoming core triangle, so the displayed active areas are positive.

Finite particle lengths

Put

$$L_\alpha = \sqrt{2(1 - z_\alpha)},$$

$$W_\alpha = \sqrt{(C - B)^2 + C^2 + 2z_\alpha C(C - B) - b_\mu^2 C^2}.$$

The unrefined finite dictionary has three slots of each of eight types:

$c\|c\|c$type	$s < 0$	$s > 0$
hline e_i	$r\sqrt{1 - a^2}$	$(r - Bs)\sqrt{1 - a^2}$
$c_i = [A_i, A_{i+1}]$	rL_α	rL_α
$t_i = [A_i, D_i]$	$4 - r$	$4 - r$
$o_i = [D_i, D_{i+1}]$	$4L_\alpha$	$4L_\alpha$
$u_i = [P, B_i]$	inactive	Bs
$v_i = [P, C_i]$	inactive	$Cs\sqrt{2(1 + z_\alpha) - b_\mu^2}$
$w_i^- = [B_i, C_i]$	inactive	$W_\alpha s$
$w_i^+ = [C_i, B_{i+1}]$	inactive	$W_\alpha s$

The persistent slot e_i realizes $[P, A_i]$ before the event and $[B_i, A_i]$ after it.

Inactive slots are not incoming edges. At a germ, born-slot lengths have zero outgoing limit but the slots are metadata, not additional active zero-size cells. Their zero reports are coding conventions, not intrinsic incoming derivatives.

Charts and ordered words

For a spatial gradient g, $|g| < 1$, let

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

with $\mathscr{B}(0) = I_3$. In the first sector,

$$g_h = \begin{pmatrix} a \\ a\tan(\alpha/2) \end{pmatrix}, \quad g_- = \begin{pmatrix} 0 \\ b_\mu / S_\alpha \end{pmatrix}, \quad g_+ = \begin{pmatrix} b_\mu \\ -b_\mu z_\alpha / S_\alpha \end{pmatrix}.$$

Their norms are $2\sqrt{2}/3, 3/5, 3/5$, and their Lorentz factors are $3, 5/4, 5/4$.

With $O_i = \mathrm{diag}(1, \mathrm{Rot}(i\alpha))$, the adapted charts are

$c\|l$face	$\mathcal{A}_f(z)$
hline V_i	$O_i \mathscr{B}(g_h) O_i^{-1} z - 3 s e_0$
U_i^-	$O_i \mathscr{B}(g_-) O_i^{-1} z - \frac{5}{2} s e_0$
U_i^+	$O_i \mathscr{B}(g_+) O_i^{-1} z - \frac{5}{2} s e_0$
Q_i, exterior	z

The first three rows flatten their plane intercepts to zero. The identity charts on horizontal faces retain the constant face height $2 + s$; adaptation does not require the same intercept in every chart.

Canonical overlaps are . For a closed ordered word based in f_0, telescoping gives

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

The integer $N(\gamma)$ is supplied by the winding evidence, not inferred from the matrix alone. For example, at $\mu_0 = \pi/2$, different windings can have the same rotational matrix.

Within an epoch, linear chart parts remain fixed, while translations and plane intercepts change. Thus orientations remain fixed, not literal spacetime locations.

The separate four-face profile

Profile A uses the four-face patch of VII-E at the ambient packet Π_{μ_0} [14]. In local coordinates (x, y), set

$$p_A = \frac{3}{5}, \quad q_A = \frac{5}{13}, \quad a_A = \frac{4}{5}, \quad b_A = \frac{12}{13}, \quad \delta_A = b_A - a_A = \frac{8}{65},$$

and

$$f_E = p_A x + a_A \sigma, \qquad f_W = -p_A x + a_A \sigma,$$

$$f_N = q_A y + b_A \sigma, \qquad f_S = -q_A y + b_A \sigma,$$

$$H_\sigma = \min\{2 + \sigma, \max(f_E, f_W, f_N, f_S)\}.$$

The rectangle is

$$[-14/3, 14/3] \times [-6, 6],$$

placed by $(X, Y) = (20 + x, 20 + y)$, away from the particle and seam. The central lengths are

$$\ell_{EW} = -\frac{16}{25}\sigma \quad (\sigma < 0), \qquad \ell_{NS} = \frac{16}{39}\sigma \quad (\sigma > 0).$$

Each of four mixed arms has length

$$\ell_{\text{arm}} = \begin{cases} (10 + \sigma)\sqrt{1921}/75, & \sigma < 0, \\ (26 + \sigma)\sqrt{1921}/195, & \sigma > 0. \end{cases}$$

The inner cap rectangle has half-widths

$$X_\sigma = \frac{10 + \sigma}{3}, \qquad Y_\sigma = \frac{26 + \sigma}{5}.$$

For a fixed corner-spoke subdivision of its horizontal annulus, each spoke to the corresponding outer corner has length

$$\sqrt{(14/3 - X_\sigma)^2 + (6 - Y_\sigma)^2} = \frac{\sqrt{34}}{15}(4 - \sigma).$$

The cap sides have lengths $2X_\sigma, 2Y_\sigma$, and outer rectangle sides have lengths $28/3, 12$. These supply the finite patch length dictionary. Any additional ambient dictionary is part of the following interface and is not silently identified with the particle dictionary.

Interface Contract (Four-face realization and exchange). For $\sigma \in [-1, 1]$, the installed profile-A constructor supplies:

1. an embedded spacelike capped graph, with slope bound 3/5, the displayed patch dictionary, and a complete

declared ambient finite dictionary with affine within-epoch length laws;

2. exactly one four-face adjacency exchange, at $\sigma = 0$, with positive noncentral cells;

3. adapted affine charts, identity contractible patch words, and complete accepted ambient (E1)–(E5);

4. a certified boundary interface with its resting exterior, with particle and seam outside the moving incidence patch;

5. fixed ambient packet Π_{μ_0}, fixed exterior particle incidence, and certified original-name transport through the exchange. The transport may identify junction labels. A finite implementation must retain enough input information to reverse that identification. No source command is admitted in this profile.

The interface includes the required ambient matching, not merely identity words inside the contractible patch. A resting exterior orientation does not imply that every exterior slice point is stationary.

Derived fixed-packet flow

Correlated length rates

For local flow time $t = \tau - \tau_a$, write

$$\ell_e(t) = \ell_e(0) + t v_e, \qquad \beta_e^{\mathrm{rate}} = \operatorname{arsinh}(v_e).$$

Chosen units make the rate parameter dimensionless. It is not identified with a Lorentz rapidity between face frames.

For particle slice advance $s = s_a + v_s t$, $v_s \geq 0$, incoming active finite lengths have zero rates. In the outgoing epoch,

$$\begin{array}{cc} c|c\text{type} & v_e \\ \text{hline}\, e_i & -v_s B\sqrt{1-a^2} \\ u_i & v_s B \\ v_i & v_s C\sqrt{2(1+z_\alpha)-b_\mu^2} \\ w_i^-, w_i^+ & v_s W_\alpha \end{array}$$

and c_i, t_i, o_i are frozen.

For example, on $e_{i} = [B_{i}, A_{i}]$,

$$\Delta x = (r - Bs)e_{i}, \qquad \Delta T = (2 + s) - 2s = 2 - s = a(r - Bs).$$

Hence

$$\ell(e_{i}) = \sqrt{|\Delta x|^{2} - (\Delta T)^{2}} = (r - Bs)\sqrt{1 - a^{2}},$$

and its rate is the first row of . On $u_{i} = [P, B_{i}]$, both endpoints have time $2s$, so $\ell(u_{i}) = Bs$. The shrinking and growing rates are correlated by the same vertices and parameter; they are not independently assigned.

For $\sigma = \sigma_{a} + v_{A}t$, $v_{A} \geq 0$, the four-face central rates are

$$-\frac{16}{25}v_{A}, \qquad \frac{16}{39}v_{A}$$

on their respective epochs. The arm rates are

$$\frac{v_{A}\sqrt{1921}}{75}, \qquad \frac{v_{A}\sqrt{1921}}{195}.$$

Cap-side rates are $2v_{A}/3, 2v_{A}/5$, corner-spoke rates are $-v_{A}\sqrt{34}/15$, and outer rectangle sides are frozen. Additional ambient rates are the declared laws of .

A separately installed collar module

Fix $\mu \in I$ and a regular $s = s_{a}$. In an already refined collar representation, let

$$E_{i}(t_{\mathrm{col}}) = R_{\mathrm{col}}(t_{\mathrm{col}})e_{i}, \qquad T(E_{i}) = 2 + s_{a}, \qquad R_{\mathrm{col}}(t_{\mathrm{col}}) = \frac{15}{4} + \frac{t_{\mathrm{col}}}{8}, \qquad -1 \leq t_{\mathrm{col}} \leq 1.$$

Replace each Q_{i}, in this installed representation, by

$$Q_{i}^{\mathrm{in}} = [A_{i}, E_{i}, E_{i+1}, A_{i+1}], \qquad Q_{i}^{\mathrm{out}} = [E_{i}, D_{i}, D_{i+1}, E_{i+1}].$$

For $t_{\mathrm{col}} = t_{\mathrm{col},a} + v_{\mathrm{col}}(\tau - \tau_{a})$,

$$\begin{array}{ccc} c|c|c\text{edge} & \ell_e & d\ell_e/d\tau \\ \text{hline}\,[A_i, E_i] & R_{\mathrm{col}} - r & v_{\mathrm{col}}/8 \\ [E_i, D_i] & 4 - R_{\mathrm{col}} & -v_{\mathrm{col}}/8 \\ [E_i, E_{i+1}] & R_{\mathrm{col}} L_\alpha & v_{\mathrm{col}} L_\alpha/8 \end{array}$$

with multiplicity three per row. All other edges are frozen.

Lemma (Collar realization). *The collar module is embedded and nondegenerate on its full window, has no incidence event, and preserves the installed packet and reference-frame signature. Its embedded slice and particle intersection are unchanged.*

Proof. By ,

$$r < \frac{7}{2} < \frac{29}{8} \le R_{\mathrm{col}} \le \frac{31}{8} < 4.$$

Thus $R_{\mathrm{col}} - r > 1/8$ and $4 - R_{\mathrm{col}} \ge 1/8$. Ring lengths are positive because $0 < \alpha < \pi$. The horizontal areas are

$$\frac{1}{2} S_\alpha (R_{\mathrm{col}}^2 - r^2), \qquad \frac{1}{2} S_\alpha (16 - R_{\mathrm{col}}^2),$$

both positive. The two refined faces partition exactly the original horizontal face, so their union has not moved.

All new faces have the identity reference chart. Ordinary transitions are identities and seam transitions remain $J(\mu)$. Shared segments, regular words, and primitive core–collar matching are therefore unchanged. Since s_a is fixed, so is P_{s_a}. These checks give the complete matching output.

Adjacent collar faces have zero relative boost, although their subdivision lengths may have nonzero rates. This separates β_e^{rate} from a canonical boost variable.

Theorem (Certified fixed-packet flow). *Relative to , the following are spectator-blind geometric commands:*

1. *particle-family slice advance at fixed $\mu \in I$, within one incidence epoch;*

2. *four-face advance within one epoch of its installed window;*

3. *collar advance at fixed regular s, within its installed t_{col}-window. Their represented lengths have the derived affine laws and the declared four-face laws.*

On every compact regular subinterval, active finite lengths and compact face areas have positive minima, and no additional collision occurs. Particle slice advance may end at the incoming germ or begin at the outgoing germ. Collapsed born slots there remain unoccupiable metadata.

Every output returns complete accepted Ein_0*, with the same installed packet and reference-frame signature. No flow reads internal matter, occupancy, a source token, or spectator number.*

Proof. Substitution of the affine parameter law into gives the particle rates. The preceding endpoint calculation derives representative shrinking and growing laws directly. The four-face and collar laws follow by the same substitution.

Positive continuous lengths and areas on a regular epoch have positive minima on compact subintervals. The cap-separation estimate of excludes contact of the particle star with the cap. The four-face interface excludes noncentral collisions, and proves the collar assertion.

For particle flow, chart translations update by ; canonical overlaps telescope to . Regular words have winding zero, and positive primitive core and collar words have winding one. Transport to the reference frame therefore yields $J(\mu)$. The inherited interface supplies the remaining realization and worldline checks. The ambient worldline stays fixed even though its slice intersection changes.

The four-face interface supplies complete ambient matching, not only patch identities. The collar matching was checked directly. In every case, the rule depends only on declared geometric data, parameters, resources, and transport. The inaccessible matter and spectator data are not read.

Theorem C1 is kinematics within certified realizations. It does not derive a Hamiltonian, prescribe a relational lapse, or impose equal proper-time increments in different face frames.

Guarded incidence and location transport

Theorem (Restricted catalogue and isolation). *Within the admitted windows:*

1. *the unrefined particle slice module has only* $\mathrm{E}_{3\text{--}6}$*, at* $s = 0$*, with the installed packet frozen;*

2. *the four-face profile has only* E_{A}*, at* $\sigma = 0$*, with the particle outside the moving incidence patch and its packet frozen;*

3. *regular within-epoch flow introduces no additional incidence;*

4. *the collar module has no incidence event on its full window. This is isolation in the prescribed families, not genericity among arbitrary slicings.*

Proof. The particle constructor supplies the two decompositions and their germs. Born vertices are proportional to s, their nonzero length coefficients are positive by spacelikeness, and the star remains strictly inside the cap. The supplied incidence value is therefore the sole coalescence in this window.

In profile A, each central length in has its sole zero at $\sigma = 0$. Noncentral cells remain positive by the four-face interface. Within-epoch flow preserves these incidence diagrams. The collar conclusion is .

A particle hop, two-particle collision, or another classical transition does not enter this catalogue merely by being named. It requires its own realization and full output interface.

Persistent labels and germ metadata

The particle persistent labels are

$$P,\ A_i,\ D_i,\ e_i,\ c_i,\ t_i,\ o_i,\ V_i,\ Q_i$$

and the declared exterior labels. Their abstract transports through $\mathrm{E}_{3\text{--}6}$ are identities.

toprule Label class At the particle germ Location convention

midrule Persistent labels above Valid persistent limiting cells Valid on both sides; identity abstract transport

$B_i, C_i, U_i^{\pm}, u_i, v_i, w_i^{\pm}$ Outgoing germ metadata Not incoming locations; active only for $s > 0$

Collapsed new slots as zero-size cells Not active cells Not occupiable at the germ

Four-face junction labels Separate profile Use its certified transport; retain input information if needed

bottomrule

The identity label e_{i} changes realization from $[P, A_{i}]$ to $[B_{i}, A_{i}]$. Identity abstract transport is not a stationary developed trajectory or unchanged incidence relation.

Legal words and complete-output induction

Definition (Legal schedule). A legal schedule is a finite chronological word in

$$\{\mathrm{G}, \mathrm{E}_{3\text{--}6}, \mathrm{E}_{A}, \mathrm{S}_{\mathrm{tab}}\}$$

with declared parameters, modules, and supports, satisfying:

1. every input lies in its command's certified domain;

2. flow preserves the packet and module and does not cross an incidence value internally;

3. source replacement satisfies its regular boundary, stage, token-promise, module, and source-permission conditions;

4. incidence satisfies its exact profile, germ-mode, clock, and incidence-permission conditions;

5. no command combines source replacement and incidence;

6. all commands after source replacement use the newly installed packet, charts, collar, realization, and report dictionary;

7. original names occupy valid input locations and receive their certified transport;

8. no unsupported profile or module conversion occurs;

9. every output satisfies all realization requirements and (E1)–(E5), including . Canonical code predicates concern finite indices, exact clocks, reports, permissions, locations, and stages. The token promise is instead a hypothesis about the matter state, not a circuit-tested predicate.

Theorem (Scheduling and complete-output induction). *Every legal schedule returns complete accepted* Ein_{0} *and valid original-name locations after every command. Geometric commands preserve the currently installed packet and reference-frame signature. A source command returns the complete newly installed packet and*

signature.

Under , two aligned legal executions with equal initial geometric/controller inputs, resources, permissions, declared accessible inputs, and original matter reductions have equal geometric outputs, controller outputs, and original-name transports. Their original matter reductions remain equal. Inaccessible spectator extensions do not change geometric decisions.

At every command boundary, the incomplete outputs of are rejected. This conclusion is not restricted to the initial reference packet.

Proof. Proceed by induction from the certified initial configuration. A flow output is complete by Theorem C1. An incidence output is complete by the appropriate realization/germ interface and Theorem C2, and uses the certified transport in .

At S_{tab}, the regular parameter remains $s = -1/2$. Evaluation of the particle constructor at the promised table entry returns the full new realization, including new rays, seam, charts, collar, and matching data. Persistent incoming labels remain valid. Only the source permission and source stage change in addition to the installed geometric data. Legality places this complete output in the next command's domain. This proves certificate and location induction.

For paired executions, deterministic control selects equal commands, guards, geometric outputs, transports, and successor controller states from equal declared inputs. Every T0 command is the identity on internal matter. For a spectator extension $\widetilde{\rho}$ with original reduction ρ,

$$\operatorname{Tr}\left((B \otimes I_N)\widetilde{\rho}\right) = \operatorname{Tr}\left(B\rho\right)$$

for each accessible original observable B. Equal original reductions thus give equal accessible functionals. The classical tokens are separately required to agree and satisfy their promises; no extraction step is used. Separately reserved spectator storage prevents a spectator-number capacity guard.

Finally, acceptance includes the complete obligations after each command. The local calculations in apply at the

packet installed at that boundary, including after a source replacement.

A hybrid word need not preserve its initial signature from start to finish. Its geometric subwords preserve whichever packet is currently installed; a source command can change that packet.

An explicit promised sourced history

Finite packet table

For $q \geq 6$, define

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

This is the promised table of VIII-B [18, Theorem thm:finite]. Every entry lies in I, since

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

At $q = 6$, $\mathscr{T}_6 = \{-1, 0, 1\}$.

For $\alpha_m = (2\pi - \mu_m)/3$,

$$z_{\alpha_m} = \frac{2t_m}{1 + t_m^2}, \qquad S_{\alpha_m} = \frac{1 - t_m^2}{1 + t_m^2},$$

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

The rays and seam matrices have rational entries; the finite coordinates, charts, and lengths are algebraic. The real number μ_m itself is specified symbolically, not approximated by a floating-point angle. Exact derivations appear in

.

Initial state, token, and permissions

Use a surviving source qubit with

$$\mathscr{A}_{\mathrm{src}} = \mathrm{L}(\mathbb{C}^2), \qquad B_{\mathrm{src}} = Z, \qquad \kappa = 1.$$

For the $q = 6$ history, supply token $m_{\mathrm{src}} = 1$, and take

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

Because $0 < z_{+} < 6/64 < 1$, ρ_{+} is a state and

$$\mathrm{Tr}(\rho_{+}Z) = z_{+}, \qquad \mu_0 + \mathrm{Tr}(\rho_{+}Z) = \mu_1.$$

The same word is defined on every state satisfying this fixed-token promise, including compatible spectator extensions.

Initially install Π_{μ_0}, independently of the source state, and set

$$s = -1, \quad \nu_G = \nu_{\mathrm{src}} = 1, \quad \text{module} = \text{slice},$$

with incoming mode and source stage zero. All original names occupy valid persistent incoming labels. Choose $d \geq 1$, $\Delta\tau = 1$, and slots $k = 0, \ldots, 5$. Each flow segment has $\nu_s = 1/2$.

The chronological word is

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

Installed packet and final lengths

After source replacement,

$$\mu_1 = \frac{\pi}{2} + 6\arctan(1/64),$$

$$a_1 = \frac{130}{3\sqrt{4097}}, \qquad b_1 = \frac{3\,4095}{5\,4097},$$

$$r_1 = \frac{3\sqrt{4097}}{65}, \qquad B_1 = \frac{3\sqrt{4097}}{130},\ C_1 = \frac{1}{2a_1 - b_1}.$$

The ray generator is

$$e^{i\alpha_1} = \frac{128 + 4095i}{4097}.$$

Every subsequent face, chart, overlap, and report uses these installed coefficients rather than the reference table.

At $s = 1/2$,

$$T(P) = 1, \quad B_i = \frac{B_1}{2} e_i, \quad C_i = \frac{C_1}{2}(e_i + e_{i+1}), \quad T(A_i) = T(D_i) = \frac{5}{2},$$

and

$$\ell(e_i) = \frac{3}{4} r_1 \sqrt{1 - a_1^2}, \qquad \ell(u_i) = \frac{B_1}{2},$$

$$\ell(v_i) = \frac{C_1}{2} \sqrt{2(1 + z_{\alpha_1}) - b_1^2}, \ \ell(w_i^{\pm}) = \frac{W_{\alpha_1}}{2}.$$

toprule Step Command s Packet (v_G, v_{src}) Certificate and intersection

midrule 0 Initial -1 μ_0 $(1, 1)$ Reference realization; $P = (-1, 0, 0)$

1 G $-1/2$ μ_0 $(1, 1)$ Regular source input; $P = (-1/2, 0, 0)$

2 $\mathrm{S}_{\mathrm{tab}}$ $-1/2$ μ_1 $(1, 0)$ Complete new family; $P = (-1/2, 0, 0)$

3 G 0^- μ_1 $(1, 0)$ Incoming germ; $P = (0, 0, 0)$

4 $\mathrm{E}_{3\text{--}6}$ 0^+ μ_1 $(0, 0)$ Outgoing germ, frozen packet; $P = (0, 0, 0)$

5 G $1/2$ μ_1 $(0, 0)$ Outgoing realization; $P = (1, 0, 0)$

bottomrule

Theorem (The five-command T0 history). *The data above make a legal five-command history. Every command returns complete accepted* Ein_0*. Its only deficit change occurs at the regular source command* $s = -1/2$*. The particle-link event occurs at the frozen installed deficit* μ_1*.*

Internal matter is unchanged, persistent original locations remain valid under identity abstract transport, and permissions have exactly the displayed trace. The uniform particle branch-gradient bound is $2\sqrt{2}/3 < 1$*.*

Proof. The first flow remains in the incoming reference epoch and ends at the regular source boundary. The token satisfies the promise, source stage is zero, and source permission is one. Thus $\mathrm{S}_{\mathrm{tab}}$ installs the complete μ_1 family at

the same parameter, decreases only source permission, and changes source stage to one.

The next flow reaches the incoming germ of the installed family. The incidence guard is exact, incidence permission is one, and $\mathrm{E}_{3\text{--}6}$ holds μ_1 fixed while selecting the outgoing germ. The final flow lies in the outgoing epoch. Theorem C3 supplies all matching and location conclusions.

For source-off token $m_{\mathrm{src}} = 0$ with $\mathrm{Tr}\,(\rho Z) = 0$, the analogous source command returns the reference family. Source-off does not mean identity on an arbitrary nonreference initial packet.

Finer-table encoding of the same history. The symbol μ_1 above denotes the $q = 6$ entry. At $q > 6$, the identical physical packet has index

$$m_{\star} = 2^{q-6}, \qquad t_{m_{\star}} = 1/64.$$

Since $m_{\star} \le 2^{q}/40$ and is an integer, $m_{\star} \le K_q$. Finer encodings of this history use token and installed index $m_{\star}$, not index one.

Prescribed schedule support

A geometric word does not itself specify a local quantum substrate. For matter computations between geometric commands, independently supply a finite metric site space (X, d_X), site spaces $\mathscr{H}_x$, and

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

Every classical controller or record wire read by a local operation must be included in its declared site interface. All channels in this section are unconditional; selective normalized updates are not substituted for trace-preserving channels.

Lemma (Regional determination is adjoint inclusion). *Let Ψ be a channel on the finite site interface, and let $N, Y \subseteq X$. Its output reduction on Y is determined by the input reduction on N, for all input states, if and only if*

$$\Psi^{*}(\mathscr{A}(Y)) \subseteq \mathscr{A}(N).$$

The implication from inclusion remains valid with an untouched reference, provided equality is imposed on the joint N–reference input reductions.

Proof. The inclusion makes every output expectation an input expectation of an operator in $\mathscr{A}(N)$, so equal reductions give equal outputs.

Conversely, suppose a Hermitian output observable has pullback $B \notin \mathscr{A}(N)$. Let $K \neq 0$ be the Hermitian Hilbert–Schmidt orthogonal component of B outside $\mathscr{A}(N)$. Since the identity belongs to $\mathscr{A}(N)$, $\operatorname{Tr} K = 0$. For sufficiently small $\varepsilon > 0$,

$$\rho_{\pm} = I/\dim \mathscr{H}_X \pm \varepsilon K$$

are states with equal reductions on N, but their tested output expectations differ by $2\varepsilon \operatorname{Tr}(KB) = 2\varepsilon \operatorname{Tr}(K^2) > 0$. This contradicts determination. Hermitian observables span the algebra.

Tensoring the inclusion with the reference matrix algebra proves the final assertion.

This is the local comparison underlying the schedule statements in VII-E, En05-A, En03-A, and the algebraic formulation of En05-C [14, 22, 23, 24]. No result from those manuscripts is needed as a premise of the proof.

Theorem (Backwards support for prescribed block channels). *For ticks $r = 1, \ldots, T$, let $\mathscr{B}_r$ be prescribed partitions of X, with $\operatorname{diam}(B) \leq \Delta$, and let*

$$\Phi_r = \operatorname{bigotimes}_{B \in \mathscr{B}_r} \Phi_{r,B},$$

where every $\Phi_{r,B}$ is CPTP on its fixed block interface.

For $0 \leq u \leq t \leq T$, define

$$N_{t,t}(Y) = Y,$$

$$N_{u,t}(Y) = \bigcup \{B \in \mathscr{B}_{u+1} : B \cap N_{u+1,t}(Y) \neq \varnothing\} \quad (u < t).$$

Then

$$(\Phi^{*}_{u+1} \circ \cdots \circ \Phi^{*}_{t})(\mathscr{A}(Y)) \subseteq \mathscr{A}(N_{u,t}(Y)),$$

and

$$N_{u,t}(Y) \subseteq \{x : d_X(x, Y) \le (t-u)\Delta\}.$$

Equal input reductions on $N_{u,t}(Y)$ give equal output reductions on Y. With an untouched finite-dimensional reference R, equal joint input reductions on $N_{u,t}(Y) \cup R$ give equal joint output reductions on $Y \cup R$.

The scheduled ancestor set is an upper bound on dependence. It need not be the minimal influence region and is not identified with a spacetime causal past.

Proof. At one backwards tick, a block disjoint from the current support acts on an identity factor. Its adjoint is unital and preserves that identity. All remaining support can enlarge only within the union of blocks meeting the current support. Backwards induction gives .

A point added at one step is within Δ of a point in the previous backwards set. The triangle inequality proves . For $Y = \varnothing$, all backwards sets are empty and the conclusion is trivial.

The reduced-state conclusions follow from . In the referenced version, block adjoints act as identities on R, so the pullback lies in $\mathscr{A}(N_{u,t}(Y)) \otimes \mathrm{L}(\mathscr{H}_R)$. Equality of the joint input reduction is the required hypothesis; equality on the ancestor sites alone is insufficient for a joint referenced conclusion.

Ancestry, influence, and physical cones

If a prescribed two-site block channel is the identity, the schedule can include both sites in $N_{u,t}(Y)$, although an observable on one site pulls back to that site alone. Scheduled reachability therefore does not imply actual influence. This is the upper-bound distinction emphasized in En05-A and VII-J [22, Theorem thm:cone], [25, Theorem thm:release].

A physical directional-containment theorem would additionally require an independently certified map from the timed site network into the conical spacetime, compatible with every communication operation. It would need, for

example, a proved inclusion of each embedded ancestor region in the appropriate geometric causal past. No such embedding is part of Theorem C5. VII-J's physical containment is conditional on that additional certification; it does not discharge the present interface [25]. The independently certified embedding remains a hypothesis, not a premise. Operational consistency does not, by itself, select the Lorentzian host geometry [35]. An operational wormhole-certificate comparison [33] is a source record at this existing causal-containment / transport non-identification; it is not a new transport theorem of the present sheet.

A scalar speed comparison is not directional containment. On a square lattice of spacing a_0, a cardinal hop or wait per tick of duration τ_0 has asymptotic reachable velocities

$$|v_x| + |v_y| \le a_0/\tau_0.$$

The vector

$$\left(\frac{a_0}{\sqrt{2}\,\tau_0}, \frac{a_0}{\sqrt{2}\,\tau_0}\right)$$

has Euclidean norm a_0/τ_0, but is outside that diamond. A scalar norm bound does not provide a missing directional inclusion.

Channel commutation is not algebraic microcausality. The equality $\Phi\Psi = \Psi\Phi$ is a statement about operations. The relation

$$[\mathcal{A}(O_1), \mathcal{A}(O_2)] = 0$$

for spacelike regions is a statement about a separately defined observable net and its spacetime assignment. The former alone does not define or prove the latter. Indeed, identity channels commute on a qubit, although its observables X, Z do not commute. En06-A accordingly requires a matching observable-limit hypothesis for its algebraic microcausality statement [26, Theorem thm:algmicro].

Theorem C5 cannot be applied across an arbitrary state-dependent source law by calling that law a local channel. Nor does spectator-blind geometric control certify a local controller envelope. Feedback must include every read

control in a separately specified local hybrid channel, as distinguished in VII-G [15, Theorem thm:locality].

Finite reversible implementation

Finite dictionaries and canonical reports

Fix finite packet tables, parameter grids, controller widths, location dictionaries, and a prescribed finite word. A finite word in a continuum family, without such an encoding, does not by itself define a finite implementation problem.

For particle codes, exact lengths determine canonical reports

$$Q_e = \lfloor 2^b \ell_e \rfloor, \qquad b \geq 0.$$

Inactive incoming born slots have canonical report zero. At a germ, their limiting reports are zero and germ mode distinguishes the two codes.

Packet index, exact clock, module, and mode reconstruct the exact realization and complete matching data. Reports are redundant consistency data, not independently variable lengths. Exact algebraic comparisons determine their floors, including equality cases. The particle bounds in show that $b + 4$ bits suffice for each of the 24 reports.

Four-face and collar codes use their own installed dictionaries. They are not silently stored in the unrefined hybrid block. Unbounded exterior cells add no finite-edge reports to that block.

Retaining classical input information to make a deterministic update reversible is standard in reversible computation [5]. The following finite synthesis lemma supplies the explicit bound used here.

Lemma (Forward-domain permutation completion). *Let $H \geq 1$, $D \subseteq \{0,1\}^H$, and $f : D \to \{0,1\}^H$ be deterministic. Suppose an allocated stage field separates designated input and output sets, so that*

$$I = \{(x, 0_H) : x \in D\}, \qquad O = \{(f(x), x) : x \in D\}$$

are disjoint. Put $N = 2H$.

There is a permutation realizing

$$(x, 0_H) \operatorname{longmapsto} (f(x), x) \quad (x \in D).$$

For $N \geq 3$*, NOT, CNOT, and Toffoli gates implement it on clean-work inputs with at most* $N - 2$ *additional work bits and*

$$4N(2N - 1)|D|$$

elementary gates. Work returns to zero. For $N = 2$*, no work bits are needed and the same bound holds. An adjacent exchange on a one-bit register, when needed in another encoding, is a single NOT.*

Proof. Retaining x makes the designated output map injective. Transpose each disjoint pair

$$(x, 0_H) \leftrightarrow (f(x), x)$$

and fix all other words. This defines a permutation.

For one transposition, choose a shortest Hamming path $v_0, \ldots, v_\ell$, with $\ell \leq N$. Its endpoint exchange is

$$(v_0 v_1)(v_1 v_2) \cdots (v_{\ell-1} v_\ell)(v_{\ell-2} v_{\ell-1}) \cdots (v_0 v_1),$$

using $2\ell - 1 \leq 2N - 1$ adjacent-word exchanges.

An adjacent exchange flips one target conditioned on a specified pattern of all $N - 1$ other logical bits. Surrounding NOTs convert negative controls, using at most $2(N - 1)$ NOTs. For $N \geq 3$, a Toffoli chain computes the conjunction into $N - 2$ clean bits, a CNOT flips the target, and the chain is reversed. This uses $2(N - 2)$ Toffoli gates and one CNOT. Thus the total is at most $4N - 5 < 4N$, with clean work restored.

For $N = 2$, one CNOT, possibly surrounded by two NOTs, suffices. Multiplication by the path bound and number of transpositions proves .

Hamming-path intermediate words need not encode admissible geometries. The lemma is an existence and synthesis bound, not an efficiency or physical-time bound.

Composite code domains and separate semantic classes

Let $F_L \cdots F_1$ denote a prescribed finitely encoded word, with deterministic canonical code maps. For each command let D_i^{code} be its finite domain. Define

$$D_W^{\text{code}} = \left\{ c : c \in D_1^{\text{code}}, ?F_1 c \in D_2^{\text{code}}, \ldots, F_{L-1} \cdots F_1 c \in D_L^{\text{code}} \right\}.$$

The domain includes canonical reports, exact clocks, finite indices, permissions, valid locations, and stage data.

Separately, $\Im_W(c)$ is the class of matter states for which every supplied token along the decoded word satisfies its current semantic promise. Membership is not a finite circuit test.

Let $\iota(c)$ append all required clean history and work registers. Each command receives a fresh history block. Previous histories remain retained and inaccessible to geometric control. An allocated monotone schedule-stage field separates each command's designated input and output sets.

Theorem (Finite reversible composition). *Fix a finite encoding and a prescribed legal word with deterministic canonical code maps and certified finite location transports. There are reversible command circuits $U_1, \ldots, U_L$, fresh retained histories, and reusable clean work such that, at every command boundary,*

$$\mathrm{Dec}\,(U_i \cdots U_1 \iota(c)) = F_i \cdots F_1(\mathrm{Dec}\,(c)), \quad c \in D_W^{\text{code}}, \quad 1 \le i \le L.$$

The decoder ignores implementation histories.

The recorded figshare comparison of readout, recovery, and the limits of geometric response [34] is a source record at this existing reversible-implementation discussion; it is not a new magic theorem of the present sheet.

The complete circuits act as the identity on internal matter. For $\rho \in \Im_W(c)$, the decoded outputs are the accepted outputs of Theorem C3, with valid original locations. No circuit verifies this semantic membership.

No geometric decoder or admissibility assertion is assigned to arbitrary off-domain words or intermediate synthesis states. Theorem C4's word has the bounds in .

Proof. At each boundary, a canonical command has a finite deterministic output map. Flow changes exact

parameters and recomputes canonical reports. Incidence changes germ mode, permission, and incidence data. Source replacement evaluates the complete new packet-indexed representation. None of these maps reads internal matter.

Apply with stage separation and a fresh geometric history to every command. Earlier histories are acted on by identities. Clean work can be reused after uncomputation.

Location transport is a finite deterministic map conditioned on the geometric input. If it is noninjective, use a separately reserved history of the input location word and the same completion argument. The implementation may consult retained geometric input to execute the already selected location map; this does not make histories accessible source inputs or permit history-dependent geometric decisions.

On , each canonical output is in the next command's domain, so decoder correctness follows by induction. Tensoring all code and location gates with the identity on $\mathscr{H}_{\Gamma}$ preserves internal matter, including its correlations with untouched references. The semantic promise and Theorem C3 then give the accepted decoded execution.

The last hybrid command sets schedule stage and slot to five, $s = 1/2$, outgoing mode, and permissions $(0, 0)$. It assigns all 24 reports from . Its fresh history retains the preceding geometric word. The persistent e_i reports change at every report precision $b \geq 0$, as proved in ; the final command is not a clock-only update.

Explicit hybrid budget

Let $b \geq 0$, $d \geq 1$, $q \geq 6$, and $r_G, r_{\mathrm{src}} \geq 1$. At $q > 6$, use to encode the same physical history.

One current unrefined particle block contains: toprule Field Bits

midrule Schedule stage $0, \ldots, 5$ 3

Incidence mode 1

Incidence and source permissions $r_G + r_{\mathrm{src}}$

Signed exact slice clock $d + 2$

Execution slot $0, \ldots, 5$ 3

Current packet index $q + 2$

Source token $q + 2$

Fixed identifier metadata 11

Twenty-four canonical finite reports $24(b + 4)$

bottomrule The eleven metadata bits are fixed symbolic identifiers, not variable geometric parameters. Profile and module are fixed as $\mathrm{P}, \mathrm{slice}$. Thus

$$H = 24b + d + 2q + r_{G} + r_{\mathrm{src}} + 120.$$

Source stage is decoded from schedule stage a:

$$\chi(a) = \begin{cases} 0, & a = 0, 1, \\ 1, & a = 2, 3, 4, 5. \end{cases}$$

The source command has input schedule stage one and source stage zero. This is an encoding of the same guard, not an enlarged source domain.

Five fresh H-bit histories, the current H-bit block, and $2H - 2$ reusable clean work bits require $8H - 2$ geometric bits.

For this word, all original locations lie in a fixed persistent dictionary of at most 64 entries. The persistent particle labels and three exterior sector labels need at most 28 entries. Six bits per location suffice, and every transport is the identity. Reserve one six-bit initial location history per name; it remains valid throughout the word. For n original names, including the surviving source name,

$$\begin{aligned} M_{\mathrm{hyb}} &= 8H - 2 + 12n \\ &= 192b + 8d + 16q + 8r_{G} + 8r_{\mathrm{src}} + 958 + 12n. \end{aligned}$$

The initial location histories can be copied with $6n$ CNOT gates. These are computational-basis copies of classical

location words, not copies of unknown quantum matter.

Put $T_q = 2K_q + 1$. At a fixed prescribed stage, clocks, mode, and metadata are fixed, and reports are determined by the packet. A conservative input count per geometric command is

$$Q_{\max} = T_q^2 2^{r_G + r_{\mathrm{src}}}.$$

The table factors allow current packet and token to vary independently. Validity and permission guards only reduce this count. With $N = 2H$, a sufficient gate bound is

$$5 \cdot 4N(2N - 1)Q_{\max} + 6n.$$

At $q = 6, d = 1, r_G = r_{\mathrm{src}} = 1$,

$$H = 24b + 135, \qquad Q_{\max} = 36.$$

The actual fixed-input history of Theorem C4 has a smaller domain.

The budget excludes internal matter, offline symbolic table preparation, token acquisition, and continuous geometric interpolation. It is not a gate-locality, thermodynamic, or physical-time bound.

Rejected interpretations and independent comparisons

Mixed commands and incomplete packet outputs

The fragment

$$\mathrm{incoming}s = 0 \ ; \ \mathrm{S}_{\mathrm{tab}}$$

is illegal: the source command is certified at the regular boundary $s = -1/2$, not at the incidence stratum.

An $\mathrm{E}_{3\text{--}6}$ command that also writes a new source-selected packet index is not admitted. Its certificate assumes a frozen packet. An OR guard involving v_G and v_{src} does not construct a common mixed realization.

Source replacement must update the entire realization. Retaining the reference seam rotation or old charts fails the complete output contract at a changed deficit. The stale-rotation and time-translation failures remain distinct by ,

in every declared affine frame.

The four-face exchange cannot be turned into a sourced particle event by enlarging a written support. Its moving incidence diagram remains away from the particle; identity contractible patch words do not replace the primitive ambient matching.

Code decoding is not a quantum-return decoder

The map Dec in Theorem C6 interprets canonical classical code words as geometric descriptions and ignores retained histories. It is not a CPTP decoder from an independently justified restricted quantum output. The complete reversible permutation can be inverted when all its registers are retained; this does not certify recovery from the current code block after histories are discarded.

For example, the completion

$$|x\rangle|0\rangle \longmapsto |f(x)\rangle|x\rangle$$

retains input distinctions in the second register when f merges two inputs. Ignoring that register loses those distinctions. Even a coherent basis-history copy is not a destructive measurement performed by the scheduling word.

The following standard finite statements make the distinction precise. They are independent comparison results, not premises of C1–C6.

Proposition (Full-code recovery and record-only obstruction). *Let* $\mathcal{N}: \mathrm{L}(\mathscr{H}) \to \mathrm{L}(\mathscr{Q})$ *be CPTP.*

1. *A CPTP left inverse on the entire input code exists if and only if a complete Stinespring complementary channel is a replacement channel*

$$\widehat{\mathcal{N}}(X) = \mathrm{Tr}(X)\omega$$

for a fixed state ω*. Equivalently, for Kraus operators* E_i*, every* $E_j^{\dagger}E_i$ *is a scalar multiple of* $I_{\mathscr{H}}$*.*

2. *Let* $\dim \mathscr{H} = D \geq 2$*. If* $\mathscr{E}$ *is measure-and-prepare and* $\mathscr{D}$ *is any CPTP decoder to* $\mathscr{H}$*, then in half-diamond*

normalization,

$$\frac{1}{2}\| \mathscr{D}\mathscr{E} - \mathrm{id}_{\mathscr{H}} \|_{\diamond} \geq 1 - \frac{1}{D}.$$

In particular, the bound applies when only a finite classical record is retained. Computational dephasing attains the bound. The first statement concerns the full input code, not arbitrary subsystem or subalgebra recovery.

Proof. A standard complement has entries

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

It is a replacement channel exactly when $E_j^{\dagger} E_i$ is scalar for every i, j. If $\mathscr{D}\mathscr{N} = \mathrm{id}$, with decoder Kraus operators K_a, the rank-one Choi matrix of the identity implies $K_a E_i = c_{ai} I$. Hence

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

Conversely, diagonalizing the scalar Gram matrix gives

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

With $\Pi = \sum_i W_i W_i^{\dagger}$, the channel

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

for any fixed state τ is a CPTP left inverse.

For the second assertion, a normalized maximally entangled input $|\Phi_D\rangle$ gives a separable reference–decoded-output state under every measure-and-prepare channel followed by a decoder. Its overlap with Φ_D is at most $1/D$: this follows for product vectors by Cauchy–Schwarz and for separable states by convexity. Testing the Bell projector gives .

A channel to a finite classical register has form

$$X \mathrm{longmapsto} \sum_x \mathrm{Tr}\,(F_x X)|x\rangle\langle x|;$$

a decoder prepares a state for each x, so the composite is measure-and-prepare. A finite adaptive process with only a final classical output has the same channel form.

For attainability, if $Z_D = \sum_{j=0}^{D-1} e^{2\pi ij/D}|j\rangle\langle j|$, computational dephasing is

$$\Delta_D = \frac{1}{D}\sum_{k=0}^{D-1} \mathrm{Ad}_{Z_D^k}.$$

The triangle inequality gives half-diamond distance at most $(D-1)/D$ from the identity, while the Bell test gives the matching lower bound.

The full-code criterion is the corresponding specialization of quantum error correction [6], restated in Oai280-C [27, Theorem thm:complement]. Measure-and-prepare channels are entanglement breaking [7]; the quantitative record-only comparison appears in Hawk04-B [32, Theorem thm:classical].

For subsystem recovery the complement need not be constant on the whole input. For example, tracing out a nuisance subsystem preserves the logical subsystem while returning the nuisance state to a nonconstant complement. Neither recovery criterion is silently identified with geometric decoding.

Clock, collar, and Einstein non-identifications

The flow clock is an execution parameter. No scalar-clock field, relational observable, or lapse constraint has been defined. The relational lapse considered in Em02-E has additional background, clock, and domain data absent here [28, Theorem thm:lapse]. The Scholar-facing clock comparison is En09-A [16]: a destructive clock consumes a finite encoding, not the geometric time axis.

The collar is a geometric annulus used for affine matching and subdivision. No boundary quantum algebra, entropy extremization, boundary CFT, or bulk–boundary reconstruction map is supplied. It is not an entanglement wedge. The finite operator reconstruction comparison in XVII-A does not identify this collar with its independent boundary model [29, Remark rem:no-wedge].

Proposition (Conservation and trace do not impose Einstein dynamics). *Symmetry, conservation, and zero*

trace of a tensor do not imply that it sources the metric on which it was calculated.

Proof. On three-dimensional Minkowski space, let

$$t_{\mu\nu} = \operatorname{diag}(2\varepsilon, \varepsilon, \varepsilon), \qquad \varepsilon > 0.$$

It is constant, symmetric, conserved, and traceless for $\eta = \operatorname{diag}(-1, 1, 1)$. Yet $G_{\mu\nu}(\eta) = 0$, while $t_{\mu\nu} \neq 0$. Thus $G_{\mu\nu}(\eta) = \kappa t_{\mu\nu}$ fails for any nonzero κ.

This elementary counterexample is independent of a field-theoretic source construction. It is the same logical separation emphasized in Oai282-A and Oai282-B [30, Proposition prop:einstein], [31, Proposition prop:einstein]. The symbol Ein_0 remains the five-check matching packet of .

A rounded length is not an incidence clock. A rate parameter is not a face boost. An abstract location is not a stress tensor, mass assignment, or developed trajectory. Retained implementation history is not a source measurement record. A token promise is not an operational test.

Conclusion and the four missing interfaces

The conditional composition statement is

$$\text{boxed}\begin{array}{c}\text{certified fixed-packet flow + guarded fixed-packet incidence}\\ \text{+promised regular source replacement}\\ \Rightarrow \text{complete accepted}\mathrm{Ein}_0\text{after every legal command.}\end{array}$$

The explicit word separates its source change from its particle incidence. Its final flow changes genuine crease lengths and necessarily changes persistent-edge reports. Its finite implementation retains histories and leaves internal matter untouched.

Four missing interfaces remain outside this theorem.

1. Mixed germ. A successor must construct one common realization, both appropriate one-sided germs, complete ordered affine words through the mixed stratum, core–collar and worldline matching, valid location transport, and a canonical forward-domain decoder. None is supplied by combining the two existing permission guards.

2. Token acquisition. A successor must specify an operational instrument, its named output algebra, residual ownership, current-source interpretation, and controlled error. T0 supplies a token but constructs no such instrument.

3. Directional dominance. A successor must provide an independently certified physical embedding and an exact or controlled directional inclusion for the same timed network and access interface. Scheduled ancestry and a scalar speed bound do not provide it.

4. Canonical dynamics and a larger catalogue. A successor must specify a dynamical law, its proper gauge and time conventions, and complete certificates for every additional admitted event. The cited polygon literature is context, not an unstated Hamiltonian premise.

The package is not a derivation of classical spacetime from quantum data, a Page curve, an evaporation theorem, or a holographic identification. No characteristic quantum product or inherited gravitational quantum coefficient is constructed.

The separately inherited documentary status

$$\mathrm{O.1} = \mathrm{texttt}\,NOT_CLOSED$$

is unchanged. This is a scope statement, not a new universal nonexistence theorem or an independent audit of that programme.

appendix

Exact algebraic and resource checks

Packet-table identities

Let $t = t_m$ and $u = \arctan t$. Then

$$\alpha_m = \frac{\pi}{2} - 2u.$$

The double-angle identities give

$$\cos \alpha_{m} = \frac{2t}{1 + t^{2}}, \qquad \sin \alpha_{m} = \frac{1 - t^{2}}{1 + t^{2}},$$

and

$$\cos \frac{\alpha_{m}}{2} = \frac{1 + t}{\sqrt{2}\sqrt{1 + t^{2}}}.$$

These prove . For rational t, $e^{i\alpha_{m}}$ has rational real and imaginary parts, as do its finite powers. Furthermore,

$$e^{i\mu_{m}} = i(e^{2iu})^{3}, \qquad e^{2iu} = \frac{1 - t^{2} + 2it}{1 + t^{2}},$$

so the seam rotation has rational entries. The remaining displayed finite data are algebraic.

At $t = 1/64$,

$$1 + t^{2} = \frac{4097}{4096}, \qquad \cos \alpha_{1} = \frac{128}{4097}, \qquad \sin \alpha_{1} = \frac{4095}{4097}.$$

This proves . The finer-table index in is in $\mathscr{T}_{q}$ and has exactly the same rational t.

Representative born lengths

For $v_{i} = [P, C_{i}]$,

$$\Delta T = b_{\mu} C s, \qquad \Delta x = C s(e_{i} + e_{i+1}),$$

so

$$\ell(v_{i})^{2} = C^{2} s^{2}(2(1 + z_{\alpha}) - b_{\mu}^{2}).$$

For $\bar{w_{i}} = [B_{i}, C_{i}]$,

$$\Delta T = b_{\mu} C s, \qquad \Delta x = s((C - B)e_{i} + C e_{i+1}),$$

giving $W_{\alpha}^{2} s^{2}$. The plus edge has the same length by reflection.

The corresponding displacements are nonzero for $s > 0$ and lie in faces of gradient norm below one. Hence the born coefficients are strictly positive. The persistent e_{i} rate is negative for positive flow speed; positivity of a

length does not require positivity of its rate.

A conservative report-width bound

By ,

$$r < \frac{7}{2}, \qquad B < \frac{200}{129}, \qquad 2C < \frac{29}{10}.$$

For $0 \le s \le 1$,

$$\ell(e_i) < \frac{7}{2}, \quad \ell(c_i) < 7, \quad \ell(t_i) < 4, \quad \ell(o_i) < 8, \quad \ell(u_i) < \frac{200}{129}.$$

An induced spacelike length is no larger than its projected spatial displacement, so

$$\ell(v_i) \le |C_i| < \frac{29}{10},$$

and

$$\ell(w_i^{\pm}) \le |B_i| + |C_i| < \frac{200}{129} + \frac{29}{10} < 8.$$

The same conservative bound covers incoming active values. Thus all represented finite particle lengths are below 8, and in particular below 16. Unsigned b + 4-bit reports suffice.

The final flow changes reports at every precision

Let

$$L_{\mathrm{in}} = r_1\sqrt{1 - a_1^2} = 2\sqrt{a_1^{-2} - 1}.$$

The proven coefficient bounds imply

$$\frac{3}{5} < a_1 < \frac{1}{\sqrt{2}}, \qquad 2 < L_{\mathrm{in}} < \frac{8}{3}.$$

Since $B_1 = r_1/2$, the final persistent length is

$$L_{\mathrm{final}} = \left(r_1 - \frac{B_1}{2}\right)\sqrt{1 - a_1^2} = \frac{3}{4}L_{\mathrm{in}},$$

and

$$\frac{3}{2} < L_{\text{final}} < 2.$$

For every integer $b \geq 0$,

$$\lfloor 2^{b} L_{\text{in}} \rfloor \geq 2^{b+1}, \qquad \lfloor 2^{b} L_{\text{final}} \rfloor \leq 2^{b+1} - 1.$$

The outgoing germ has the same limiting persistent length L_{in} as the installed incoming epoch. Therefore the final flow necessarily changes the e_{i} reports, including at $b = 0$.

Permission and register arithmetic

The permission trace is

$$(1,1) \to (1,1) \to (1,0) \to (1,0) \to (0,0) \to (0,0).$$

Only S_{tab} consumes source permission, and only $\mathrm{E}_{3\text{--}6}$ consumes incidence permission.

The exact slice range $j \in [-2^{d}, 2^{d}]$ fits in $d + 2$ signed bits. The table-index range fits in the allocated $q + 2$ signed bits. Unused signed words are off-domain.

Summing the hybrid fields,

$$H = 3 + 1 + (r_{G} + r_{\text{src}}) + (d + 2) + 3 + (q + 2) + (q + 2) + 11 + 24(b + 4)$$

$$= 24b + d + 2q + r_{G} + r_{\text{src}} + 120.$$

Consequently,

$$8H - 2 + 12n = 192b + 8d + 16q + 8r_{G} + 8r_{\text{src}} + 958 + 12n.$$

At $q = 6, d = 1, r_{G} = r_{\text{src}} = 1$,

$$H = 24b + 135, \quad K_{6} = 1, \quad T_{6} = 3, \quad Q_{\max} = 36.$$

These are exact mathematical arithmetic checks, not reported software execution.

The following are source records, not premises of the theorems proved here. The shredder access interface is recorded in [10]. Observation-boundary comparisons already used on this sheet are named in Scholar-facing form by [14, 15]. IBG and IBGS [11, 12] 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 [13] is a dynamical-host comparison; the hosts 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. The record-only bound used at Proposition is the deposited book [32]; the internal locator remains Hawk04-B thm:classical. En03-A and En05-A already supply the schedule-versus-cone comparison on this parent [23, 22]; no printed title or deposit is invented for those code-only records.

Dependencies and version-qualified source locators

toprule Result Required hypothesis Local work

midrule endfirsthead toprule Result Required hypothesis Local work

midrule endhead C1 Particle and four-face realization interfaces Endpoint length derivations, affine rates, collar realization, reference-frame preservation

C2 Certified particle and four-face germs and isolation Restricted catalogue, cap separation, preservation under flow

C3 Complete command outputs, certified transports, deterministic control Legal-domain composition, complete-output induction, paired executions, rejection at every installed packet

C4 Particle interface and supplied token promise Explicit word, packet algebra, worldline intersections, permission trace

C5 Prescribed finite block channels Local adjoint-inclusion and metric proofs, joint-reference statement, ancestry/influence separation

C6 Finite deterministic canonical maps and transports Permutation completion, composite code domain, separate semantic class, decoder induction, exact hybrid budget

bottomrule

Geometric predecessor locators. The main textual locators are:

• VIII-A, attached typographic parent Version 3 [17]: A:def:Ein, A:thm:A1, A:thm:A4-stale, A:thm:A4-time.

• VIII-B, attached typographic parent Version 3 [18]: thm:dictionary, thm:persistence, thm:source-map, thm:finite.

The persistence and finite-table results were called B3 and B5 in the supplied earlier revision plan; textual labels avoid dependence on export numbering.

• VII-E, version 1: its four-face realization, exchange, transport, and ambient matching interface.

• VII-F, version 1: the fixed-deficit particle realization and persistent-label convention.

Comparison locators, not additional hypotheses. toprule Manuscript Local role in VIII-C

midrule VIII-B; VII-G Expectation-token and affine deterministic-label obstructions

VII-E; Landmark I Accessible adjoint images, residual/record distinction, destructive ownership

En05-A; En03-A; En05-C Scheduled support and regional determination

VII-J; En06-A Independently certified physical containment; algebraic microcausality is a separate interface

Oai280-C; Hawk04-B Full-code recovery and record-only quantum-return obstruction

Em02-E; XVII-A Relational lapse and entanglement-wedge non-identifications

Oai282-A; Oai282-B Conservation and trace do not imply Einstein dynamics

bottomrule

The supplied excerpts and realization data support these comparisons. The Enter Calculus Companion provides manuscript identifiers and passage locators; it is not a proof checker. A relationship, citation, registry entry, or restatement is not an independent verification. Stable full versions of any unpublished realization certificates relied upon should accompany technical review.

Focused revision and boundary ledger

toprule Issue Treatment in this revision

midrule Incomplete output updates Acceptance includes every realization and matching obligation at every command boundary and every installed deficit

Fixed-presentation uniqueness Prescribed transitions are unique only with charts, components, framing, and seam data fixed; holonomy alone is insufficient

Rate interpretation Signed rates are derived and correlated; their arsinh parameters are not canonical boosts

Plane motion Chart translations and intercepts update even when orientations remain fixed

Germs and occupancy Collapsed born slots are metadata, not active zero-size cells

Token semantics Exact code predicates and matter-state promises are separated; no expectation extraction or test is constructed

Record and residual access Equal records do not determine residual channels; surviving source algebras must be named

Support and references Scheduled ancestry is an upper bound; referenced equality uses joint ancestor–reference reductions

Physical causality Directional containment requires an independent physical embedding; channel commutation does not define microcausality

Reversible implementation Retained input makes code updates injective; ignored history need not preserve an unknown quantum code

Final reports Persistent-edge reports necessarily change for every $b \geq 0$

Finer tables The $q = 6$ index-one packet has index 2^{q-6} at finer precision

Unconstructed interfaces Mixed germs, token acquisition, physical directional inclusion, and canonical polygon

dynamics remain outside the package

bottomrule

Declarations

Materials. This theoretical manuscript uses no empirical dataset. The local proofs, explicit command word, exact packet formulas, length derivations, finite completion construction, and resource arithmetic are contained in this file. Realization and transport interfaces are stated explicitly; their predecessor sources are version-qualified below.

Verification and submission boundary. All claimed checks here are analytical arguments under the printed hypotheses. No successful pdfLaTeX build, executed notebook, numerical certificate, machine proof, independent referee validation, or laboratory realization is asserted. An actual submission should supply responsible author metadata, stable access to the unpublished geometric certificates, a clean build, and independent technical review. The four missing interfaces cannot be supplied by stronger wording.

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