En04-B Finite Carriers on Prescribed Enter Spacetimes: Geometric Blindness, the Shredder Cut, and Host-Fibre Certificates

Version 4

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Abstract

We study finite quantum carriers placed on prescribed Enter spacetime hosts, in which the metric is an input and never an output, and ask when a declared finite probe register shows a code-dependent response. The main findings, and why each matters, are the following. (1) Leakage equals the probe radius. For a controlled probe the complete-complement leakage equals the trace-distance radius of the supplied probe states; a quantity defined by an optimization over channels becomes an explicit invariant of the coupling. (2) Optimal response equals the diameter. The largest normalized response of any probe observable is the trace-distance diameter of the probe states, attained by a Helstrom observable, so 1/2D ≤ leak ≤ D and γ ≤ 2 leak; every finite geometric witness is bounded by distinguishability that the coupling itself supplies. (3) Fixed-field sampling. A finite compression of a fixed continuum scalar (current, Wick square, curvature) has zero witness for every code pair exactly when the compressed matrix is scalar; a nonzero witness is a sampling response, not a field or metric update, and a constant field is blind under every coupling. (4) Coupling-slot nonidentifiability. Data that do not depend on the carrier-to-probe coupling, including named host readings and independent phase data, cannot determine leakage or a witness: every rule has two-point error at least half the target separation, which locates the missing declaration exactly. (5) Robust spectator envelope. Within distance ε of a spectator coupling every normalized witness is at most b(ε) = 2ε√(1 − ε^2) (ε ≤ 1/√(2)); the bound is attained for every ε by the declared holonomy observable whenever sin μ ≠ 0, and by a probe Helstrom observable for every μ, so small implementation errors cannot imitate large response. (6) Correlation-hidden response. If the probe marginal stays within δ of a pure state, the complete complement is within the sharp distance φ(δ) = 1/2(δ + √(4δ − 3δ^2)) of a product, replacing the earlier 2√(δ); with both marginals constant and pure outputs, hidden response is at most √(1 − max {0, 2λ_max − 1}^2), attained, while an exact rational certificate shows that this bound fails for mixed outputs. Marginal tests alone cannot certify blindness. (7) Curvature sampling on a curved host. On the settled Host-B neck, with $\mathcal{R}$_B = −2b^2/(a_{∞}^2(ℓ^2 + b^2)^2), finite neck modes give a nonzero sampling witness while the metric and curvature are unchanged; on the constant-curvature host DSS_H every curvature compression is blind. Curvature can be sampled by a probe without being moved by it. (8) Parameter estimation versus quantum recovery. Echo-only reports, however informative about the deficit, give entanglement fidelity exactly 1/d^2, below the shredder value 1/d; host diagnosis is not logical recovery. The echo reading is monotone in the deficit only locally, on compact parameter windows and short gates. (9) Side-register floor. If the complete output is a classical record together with a k-dimensional quantum register that is the only retained quantum system, and the decoder is any record-dependent quantum operation with fresh ancillas, then F_e ≤ k/d and the error is at least 1 − k/d, attained by a cyclic-window channel; with a pre-shared entangled resource the bound fails (teleportation gives F_e = 1 at k = 1), so the floor measures retained quantum access exactly. (10) Conditional cosmological extrapolations. Six proposed extrapolations towards open-system models of primordial perturbations become conditional theorems on declared finite data. If a model supplies a carrier with declared sectors, every joint witness obeys γ ≤ 2 leak, attained by a family in which every marginal on fewer than all sectors is fixed and only an all-sector correlator responds; retained coherence and leakage obey c^2 + 4 leak^2 ≤ 1 for every carrier, with equality v^2 + 4 leak^2 = 1 for pure controlled probes; the curvature sampler reads Δx · ∇$\mathcal{R}$ with an explicit cubic remainder, vanishes for constant curvature of any size, and is exact on the Host-B neck; a normalized response γ excludes every implementation within ε < sin (1/2arcsin γ) of a spectator, sharply; more precise data of an admitted type never identify the coupling, while one coupling-sensitive datum estimates leakage at rate 1/(2√(n)); and classical-looking

records with input-independent marginals can still allow full recovery, while all retained quantum dimension, pre-shared systems included, bounds $F_e \le kd_B/d$. A finite model meets four declared programme criteria at once. This layer matters because it states exactly which finite data a cosmological model must supply before any of these constraints applies, and it corrects the proposed statements where they were loose; none of its results is a cosmological prediction. Several ingredients are standard finite-dimensional facts (diameter bounds, two-point minimax, measure-and-prepare floors); the contribution lies in their integration into a typed host–carrier interface and in the sharp constants. No metric derivation, selected matter law, quantum coefficient, Page curve, or gravitational endpoint is constructed. Standing ledger. No quantum coefficient. The coefficient slot stays unfilled. No Einstein dynamics, derived metric, spacetime emergence, de Sitter state, Page curve, or gravitational endpoint. Host A and Host B stay separate. Host C is not created. O.1 stays NOT_CLOSED. Gate 0 and ST4b stay NOT_SUPPLIED. XV-B is not opened. XVI-N is not discharged. H2, I3, J2, T3 stay unresolved. U6-sel is not moved. Magic is not leakage. Residual response is not geometric response. Readout-and-drop is not physical deletion. A finite probe witness is not an identification with a field or metric degree of freedom. Cited sheets, including OpenAI catalogue entries and Big05-A, are source records and are not premises. Parents are not revised. En05–En09 are not rewritten. No quantum coefficient is admitted. No numerical κ is supplied. Citations identify source records only; no proof transfer. Every newly cited sheet is a source record; not a premise. En04-B is not registered in the companion (its manuscript API route returned 404 on October 25, 2026), and no browse link is claimed for it.

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Introduction

Enter, spacetime Enter, and the shredder philosophy

Cheung's Enter calculus treats runtime quantum names as access rights to tensor factors. Destructive readout consumes the measured name and returns a classical record; surviving quantum systems must be listed separately. Its operational characterization of measurement is restricted to a stated class of strategies and compatibility requirements, not a record-free derivation of all measurement theory [CheungEnter,EntPhil]. The Frontiers in Physics section listing retrieved on October 25, 2026 shows [CheungEnter] as accepted on September 28, 2026 [Frontiers]; its volume and DOI could not be verified on that date (DC-3).

The philosophy relevant here is operational: specify the input, the complete accessible output, the retained reference, and the requested return map before interpreting an information claim. Consumption of an access right is not physical annihilation. Preservation of the complete output is not recovery from one chosen factor [EntPhil,En04A].

Spacetime Enter adds a *prescribed* geometric host to this finite operational interface. In I-B the cone, rods, causal relation, and calibration are inputs. In I-D two different dynamical hosts remain separate inputs [IB,ID]. Neither operation takes a quantum record as input and returns a metric.

The shredder philosophy distinguishes an original unknown quantum code from a classical report about it. A

report can be informative without being a quantum-return channel. I-C makes this distinction quantitative for complete classical output [IC]. The access ledger, a specified reset operation, and a reservoir heat ledger are different objects; a reduced channel alone specifies none of the latter two [ICTh,Landauer].

The Big-series analogy

The Big-series motivation compares a horizon-bounded region with a fixed-size quantum computer: geometry supplies a ``box'', while encoding, redundancy, speed, and algorithms reorganize declared resources. Big01-A separates properties of a prescribed host from capacity promises and external horizon labels [Big01]. Big02-A's dark capacity is an access-relative classification, not a substance [Big02]. Big03-A separates a supplied coefficient evaluation from a derivation and from a selected vacuum term [Big03]. Big04-A and its coefficient sheet separate radiation-label dictionaries, operational data, and coefficient-sensitive supplies [Big04,Big04Coeff].

We use ``Big Bang analogy'' only as a name for this programme of prescribed cosmological comparisons. No cosmological origin, singularity, bounce, or quantum state is inferred from the analogy. The Big05-A source-splitting continuation, treated in v1 only as a plan [Big05Plan], now exists as an unregistered manuscript; it is cited in Section as a parallel source record only [Big05A].

The question and the answer in one line

A finite carrier hosted on a prescribed spacetime can leave its unknown code anywhere in its complete output. The question of this paper is narrow: when does a *declared finite probe* register respond to the code, how large can that response be, and which data determine it? The answer proved below is

$$\text{finite probe response} = \text{distinguishability of the supplied controlled probe states},$$

while a continuum field update and a metric update each need further state, source, dynamical and coupling declarations that are not supplied here.

What is standard and what is new

Several ingredients are standard finite-dimensional facts, and we say so where they are used: trace-norm duality and the diameter bound for observable expectations; the Chebyshev-radius description of a replacement distance; two-point (Le Cam type) minimax lower bounds; scalar-observable blindness; and measure-and-prepare recovery floors [IC,KnillLaflamme,NoHiding]. Their value here lies in their integration into one typed interface on a prescribed host, in which the complete complement, the probe, the host data and the coupling slot are separate objects.

The content that is new, to our knowledge, consists of the following: the identification of complete leakage with the probe radius and of the optimal response with the probe diameter for controlled probes, with an exact saturation criterion (Theorems ,); the equivalence between zero sampled witness and a scalar compression for fixed fields on fixed hosts (Theorem); the coupling-slot nonidentifiability statement for named host data (Theorem); the sharp spectator envelope $b(\varepsilon)$ with its attainment conditions (Theorem); the sharp no-hiding distance $\varphi(\delta)$, the pure-output hidden-response bound and its failure for mixed outputs (Theorem , Proposition); and the side-register floor under an explicit access model, with a counterexample when the model is loosened (Theorem , Proposition). En04-A's exact recovery criterion, Clifford criterion, controlled-rotation formulas, readout-and-drop identity, endpoint continuity and recurrence obstruction are not reopened [En04A].

Main results

- Leakage is the probe radius and optimal response is the probe diameter (Section).
- A fixed field is sampled, not updated (Section).
- Coupling-blind data do not identify the coupling slot (Section).
- Near a spectator, every witness obeys the sharp envelope $b(\varepsilon)$ (Section).
- Response can hide in correlations; the sharp constants and the pure/mixed distinction are given in Section .
- Parameter information is not quantum recovery, and the side-register floor $1 - k/d$ holds exactly under a stated access model (Section).
- Conditional cosmological extrapolations: six proposed extrapolations and a four-criterion programme, each as a

conditional theorem with an attaining witness (Section). Section gives one current example, one curved-host example (the settled Host-B neck) and one echo/access-cut example. Section states the limitations and open problems.

Scope

The paper makes no dynamical, cosmological or foundational quantum-gravity claim. Every host is prescribed; no field equation is solved, no source law is selected, no backreaction is computed, and no probe state is identified with a gravitational degree of freedom. Statements about cosmological hosts are statements about prescribed comparison metrics only. The conditional results of Section have the form ``if a model supplies the declared finite data, then the stated bound holds''; none of them is a cosmological prediction, and none supplies the physical identification of a sector, a coupling or an observable (DC-27).

Organisation and source convention

The main text consists of Sections –. The appendices hold the audit trail, clearly separated from the main text: the framework and results of version 1 (Appendix and the appendices following it), the further certificates of version 2 (Appendix), retained self-derived results (Appendix), release statements (Appendix), plan, package and findings verdicts, the correction ledgers, the crosswalks, the check table, and the retrieval record. All proofs use only definitions printed in this paper; companion manuscripts are documentary source records, not premises. Every label of versions 1 and 2 remains resolvable (Appendix), and every label of version 3 remains resolvable in version 4 (Appendix). The verdicts on the conditional extrapolations, the new corrections and the citation record are in Appendix .

Finite carriers, complete access, and response

All Hilbert spaces in the channel arguments are finite-dimensional. Write $\mathscr{D}(H)$ for the density operators on H.

Definition. A carrier is a declared isometry

$$V : C \to R \otimes E, \qquad \dim C = d \geq 2.$$

The accessible radiation channel and its complete complementary channel are

$$\mathscr{N}_V(X) = \mathrm{Tr}_E\,(VXV^\dagger), \qquad \mathscr{C}_V(X) = \mathrm{Tr}_R\,(VXV^\dagger).$$

Every omitted apparatus or work register belongs to E. A change in what the observer retains changes the access cut and may change the complementary channel.

For channels Φ, Ψ with input C, use the half-diamond normalization

$$d_\diamond(\Phi,\Psi) = \frac{1}{2}\sup_{\omega \in \mathscr{D}(Q\otimes C)} \|(\mathrm{id}_Q \otimes (\Phi-\Psi))(\omega)\|_1, \qquad \dim Q = d.$$

This distance is contractive under channel composition and satisfies the triangle inequality. For a state σ, let

$$\mathscr{T}_\sigma(X) = \mathrm{Tr}\,(X)\sigma.$$

Definition. The residual leakage of V is

$$\delta_{\mathrm{leak}}(V) = \min_{\sigma \in \mathscr{D}(E)} d_\diamond(\mathscr{C}_V, \mathscr{T}_\sigma).$$

The complete residual responds if $\mathscr{C}_V$ is not a replacement channel.

The minimum exists because the finite-dimensional state space is compact and the displayed distance is continuous. Consequently $\delta_leak(V) = 0$ exactly when the complete complement is constant.

Remark. For whole-code recovery from R, constancy of the complete complement is equivalent to the existence of an exact deterministic decoder. This is the established exact-correction/no-hiding structure, recorded in En04-A and En07-A [KnillLaflamme,NoHiding,En04A,En07A]. It is not re-proved or claimed as an advance here. Our shredder theorem takes an exact decoder as explicit data; its proof does not use a cited companion theorem.

Definition. A hosted probe extension has an isometry

$$W : C \to R \otimes E \otimes G,$$

where G is a declared finite laboratory register calibrated using host data. It is not assumed to be a tensor factor of a continuum gravitational field.

Set

$$\mathscr{C}_{EG}(X) = \mathrm{Tr}_R(WXW^\dagger), \qquad \mathscr{C}_G(X) = \mathrm{Tr}_{RE}(WXW^\dagger).$$

Fix a finite set $\mathscr{O}_G \subset \mathscr{B}(G)_sa$ of nonzero Hermitian matrices. For $O \in \mathscr{O}_G$, the response witness is

$$w_O(\rho_1, \rho_0) = \mathrm{Tr}\,(O\,\mathscr{C}_G(\rho_1 - \rho_0)).$$

The declared geometric-probe response is

$$\gamma_{\mathscr{O}_G}(W) = \max_{O \in \mathscr{O}_G} \sup_{\rho_0, \rho_1 \in \mathscr{D}(C)} \frac{|w_O(\rho_1, \rho_0)|}{2\|O\|_\infty}.$$

Here and below, leakage of W uses the complete complement $E \otimes G$.

Lemma. For a fixed $O = O\^\{\dagger\}$, the witness w_O vanishes on all pairs of code states if and only if

$$A_O := W^\dagger(I_{RE} \otimes O)W$$

is a scalar multiple of I_C. Moreover,

$$\gamma_{\mathscr{O}_G}(W) \le \min\{1, 2\delta_{\mathrm{leak}}(W)\}.$$

Thus any nonzero declared probe witness implies complete residual response. The qualitative implication is recorded in [En04A]; it is re-proved here.

Proof. The expectation of A_O is constant on all states exactly when A_O is scalar: evaluating on its normalized eigenvectors proves necessity, and sufficiency is immediate.

For any replacement state σ on EG,

$$\|\mathscr{C}_{EG}(\rho_1 - \rho_0)\|_1 \le \|\mathscr{C}_{EG}(\rho_1) - \sigma\|_1 + \|\mathscr{C}_{EG}(\rho_0) - \sigma\|_1 \le 4d_\diamond(\mathscr{C}_{EG}, \mathscr{T}_\sigma).$$

Partial trace and trace duality give

$$|w_O(\rho_1, \rho_0)| \le 4\|O\|_\infty d_\diamond(\mathscr{C}_{EG}, \mathscr{T}_\sigma).$$

Minimize over σ. The independent upper bound $\gamma_\{\mathscr{O}_G\} \le 1$ follows from the trace distance of states.

par *Non-claim.* The bound concerns a declared finite observation set; it does not make a probe observable a field observable. Sharpness: Theorem . par

Remark. Vanishing of all declared witnesses means blindness of $\mathscr{O}_G$, not necessarily constancy of $\mathscr{C}_G$. The latter conclusion follows if the real span of $\mathscr{O}_G \cup \{I_G\}$ is all of $\mathscr{B}(G)_sa$. Without such coverage, unobserved probe directions remain.

Central theorems: finite response is controlled distinguishability

This section states the six central results. For a set of states write *diam* for its trace-distance diameter, and for a Hermitian matrix *spr (A) = λ_max(A) − λ_min(A)*. All proofs use only the definitions printed here.

Definition. Let $C \cong R \cong \mathbb{C}\^d$, let E be in a fixed pure state $|e_0\rangle$, and let unitaries $U_0, \ldots, U_\{d - 1\}$ on G (the declared coupling) and a reference vector $|g_0\rangle$ be supplied. Put $|\varphi_j\rangle = U_j|g_0\rangle$, $P_j = |\varphi_j\rangle\langle\varphi_j|$, and

$$W_U|j\rangle = |j\rangle_R|e_0\rangle_E|\varphi_j\rangle_G.$$

For a rod or other Hermitian observable O on G write $o_j = \langle\varphi_jrvertO\,|\varphi_j\rangle$, and for $O \neq 0$

$$\gamma_O(W_U) = \sup_{\rho_0, \rho_1 \in \mathscr{D}(C)} \frac{|\mathrm{Tr}\,(O\,\mathscr{C}_G(\rho_1 - \rho_0))|}{2\|O\|_\infty}.$$

Write $D(\rho, \sigma) = 1/2\|\rho - \sigma\|_1$ and define the *probe diameter* and *probe radius*

$$D_{\mathrm{probe}} = \max_{i,j} D(P_i, P_j), \qquad R_{\mathrm{probe}} = \min_{\sigma \in \mathscr{D}(G)} \max_j D(P_j, \sigma).$$

Because R holds $|j\rangle$, the probe marginal is $\mathscr{C}_G(\rho) = \sum_j \rho_jjP_j$ and the complete complement is $\mathscr{C}_EG(\rho) = |e_0\rangle\langle e_0| \otimes \sum_j \rho_jjP_j$: both are classical–quantum in the code basis.

Leakage is the probe radius; optimal response is the diameter

Theorem. For every controlled-probe carrier,

$$\sup_{O = O^\dagger \neq 0} \gamma_O(W_U) = D_{\text{probe}}, \qquad D(P_i, P_j) = \sqrt{1 - |\langle \varphi_i | \varphi_j \rangle|^2}.$$

For each O, $\gamma_O(W_U) = (\max_j o_j - \min_j o_j)/(2\|O\|_\infty)$. The supremum is attained by a Helstrom observable $O_* = \Pi_+ - \Pi_-$ of a diameter-realizing pair (i, j), where $\Pi_\pm$ are the spectral projections of $P_i - P_j$ for its positive and negative eigenvalues.

Proof. For code states ρ_0, ρ_1, $\mathrm{Tr}\,(O\mathscr{C}_G(\rho_1 - \rho_0)) = \sum_j ((\rho_1)_{jj} - (\rho_0)_{jj}) o_j$. Diagonals of states are arbitrary probability vectors, so the supremum of the absolute value is $\max_j o_j - \min_j o_j$, attained on basis states; this is the formula for γ_O. *Upper bound.* $\mathscr{C}_G(\rho_1)$ and $\mathscr{C}_G(\rho_0)$ lie in the convex hull of $\{P_j\}$. The function $(x, y) \mapsto \|x - y\|_1$ is jointly convex, so its maximum over the product of two convex hulls is attained at vertices; hence $|\mathrm{Tr}\,(O(\mathscr{C}_G(\rho_1) - \mathscr{C}_G(\rho_0)))| \le \|O\|_\infty 2D_{\text{probe}}$. *Attainment.* By trace-norm duality $\mathrm{Tr}\,(O_*(P_i - P_j)) = \|P_i - P_j\|_1 = 2D(P_i, P_j)$ with $\|O_*\|_\infty \le 1$, and equality $= 1$ unless $P_i = P_j$. For rank-one projectors, $P_i - P_j$ has eigenvalues $\pm\sqrt{1 - |\langle \varphi_i | \varphi_j \rangle|^2}$.

par *Non-claim.* The optimal observable is a probe observable chosen after the coupling is supplied; it is not a field, curvature or metric observable, and the envelope D_{probe} is not a host functional. par

Theorem. For every controlled-probe carrier,

$$\delta_{\text{leak}}(W_U) = R_{\text{probe}}, \qquad \tfrac{1}{2} D_{\text{probe}} \le \delta_{\text{leak}}(W_U) \le D_{\text{probe}}, \qquad \sup_O \gamma_O(W_U) = D_{\text{probe}} \le 2\delta_{\text{leak}}(W_U).$$

For a fixed nonzero O, $\gamma_O(W_U) = 2\delta_{\text{leak}}(W_U)$ holds if and only if $D_{\text{probe}} = 2R_{\text{probe}}$ and there is a diameter-realizing pair (i, j) with $|o_i - o_j| = 2\|O\|_\infty D(P_i, P_j)$, i.e.?$O/\|O\|_\infty$ is optimal in the trace-norm duality for that pair.

Proof. Here δ_{leak} is computed on the complete complementary output EG, with E in its fixed pure state. For a referenced input ω on $Q \otimes C$ with diagonal code blocks $X_j \ge 0$, $\sum_j \mathrm{Tr}\, X_j = 1$, the classical–quantum form gives $(\mathrm{id}_Q \otimes (\mathscr{C}_{EG} - \mathscr{T}_{e_0 \otimes \sigma}))(\omega) = \sum_j X_j \otimes e_0 \otimes (P_j - \sigma)$, whose half trace norm is at most $\sum_j \mathrm{Tr}\, X_j\, D(P_j, \sigma) \le \max_j D(P_j, \sigma)$; basis inputs attain each term. For an arbitrary replacement state σ' on EG, the input $\mathrm{proj}\, j$ and contractivity of Tr_E give $d_\diamond(\mathscr{C}_{EG}, \mathscr{T}_{\sigma'}) \ge \max_j D(P_j, \mathrm{Tr}_E \sigma')$. Minimizing gives $\delta_{\text{leak}} = R_{\text{probe}}$. The triangle inequality $D(P_i, P_j) \le D(P_i, \sigma) + D(P_j, \sigma)$ gives $D_{\text{probe}} \le 2R_{\text{probe}}$; the choice $\sigma = P_k$ gives $R_{\text{probe}} \le D_{\text{probe}}$. The identity for the supremum is Theorem . Finally $\gamma_O = \max_{i,j} |o_i - o_j|/(2\|O\|_\infty) \le \max_{i,j} D(P_i, P_j) \le D_{\text{probe}} \le 2\delta_{\text{leak}}$; equality throughout forces a pair with $|o_i - o_j| = 2\|O\|_\infty D(P_i, P_j)$ and $D(P_i, P_j) = D_{\text{probe}} = 2\delta_{\text{leak}}$, and conversely.

par *Non-claim.* The saturation criterion concerns one chosen observable; it is not uniqueness of the Helstrom observable. For the equilateral qubit triple, $D_{\text{probe}} = \sqrt{3}/2 < 1 = 2\delta_{\text{leak}}$, so no observable saturates (check N03). par

Both statements are elementary consequences of trace-norm duality and of the classical–quantum form of the complement; their use is that they replace a semidefinite optimization over channels by the geometry of the supplied probe states. The exact arc value $\delta_{\text{leak}} = \tfrac{1}{2}\sin\Delta$ is Theorem in Appendix .

Fixed-field sampling

Theorem. Let h be a fixed prescribed host, U a laboratory region, and f_h a fixed real bounded measurable scalar on U (for example the I-B-VP-0 current component, the I-B-VP Wick square, a stress component, a scalar curvature, or a holonomy profile, each with its source inputs fixed). Let $f_1, \ldots, f_n$ be orthonormal in $L^2(U, \mathrm{dvol}_h)$, let $G = \mathrm{span}\,\{f_a\}$, and define the compression

$$O_f = \Big[\int_U \overline{f_a}\, f_h\, f_b \ \mathrm{dvol}_h\Big]_{a,b}.$$

Let $W: C \to R \otimes E \otimes G$ be any supplied isometry, and put $A_f = W^\dagger(I_{RE} \otimes O_f)W$. With code states ranging over all of $\mathscr{D}(C)$, the following are equivalent:

• $w_{O_f}(\rho_1, \rho_0) = \mathrm{Tr}\,(A_f(\rho_1 - \rho_0)) = 0$ for all code states;

• A_f is scalar on C;

• the sampled expectation $Tr (O_f \mathscr{C}_G(\rho))$ is independent of ρ. Moreover, O_f is scalar if and only if every supplied coupling gives zero witness; if O_f is not scalar, the controlled coupling to two eigenvectors for its extreme eigenvalues gives $|w| = \lambda_{max}(O_f) - \lambda_{min}(O_f) > 0$. If f_h is constant on $\bigcup_a supp\ f_a$ then O_f is scalar. In every case f_h, h, the modes and O_f are unchanged when W varies.

Proof. (i)⇔(iii) since $Tr (O_f \mathscr{C}_G(\rho)) = Tr (A_f \rho)$. (i)⇔(ii): a Hermitian matrix has the same expectation on all states exactly when it is scalar (compare two eigenvectors). If $O_f = cI$, then $A_f = cW^{\dagger}W = cI_C$. If not, take $|\varphi_0\rangle$, $|\varphi_1\rangle$ eigenvectors for λ_{min}, λ_{max} in Definition with $d = 2$; the witness is $o_1 - o_0$. If $f_h = c$ on the supports, then $O_f = c[\langle f_a, f_b\rangle] = cI$. The last sentence holds because O_f is defined from h, f_h, $\{f_a\}$ only.

par *Non-claim.* A nonzero witness is a *sampling* response of the probe; it is not a field update, a source law, or a metric response. No continuum field is constructed and no source formula is re-proved. par

Coupling-slot nonidentifiability

Theorem. Let $D_{adm}(h, W)$ be any admitted-data map whose value does not depend on the carrier-to-probe coupling (for example host data, named readings, independent clock data, and fixed calibration data), and let $T(h, W)$ be a target in a metric space (Y, d_Y). If two accounts (h, W_0), (h, W_1) on the same host have $D_{adm}(h, W_0) = D_{adm}(h, W_1)$ and $d_Y(T(h, W_0), T(h, W_1)) = \Delta_T > 0$, then no rule of the admitted data determines T , and every estimator T satisfies

$$\max_{k\,=\,0,\,1} d_Y(\widehat{T}(D_{\mathrm{adm}}(h, W_k)), T(h, W_k)) \geq \frac{\Delta_T}{2},$$

with equality for a midpoint estimator when $Y = \mathbb{R}$. On one fixed host, the spectator coupling and the arc of width η of Theorem give $\Delta_T = 1/2 \sin \eta$ for leakage and $|\lambda_1 - \lambda_0| \sin^2 \eta$ for the rod witness; the same fixed curvature or current profile gives sampled witnesses 0 and $|\kappa_1 - \kappa_0| \sin^2 \eta$ (Corollary).

Proof. The estimator returns one value y on the common datum, and $\Delta_T \leq d_Y(y, T_0) + d_Y(y, T_1) \leq 2 \max_k d_Y(y, T_k)$. On $\mathbb{R}$ the midpoint attains equality. The special values are Theorems , and Corollary .

par *Non-claim.* The theorem does not exclude a different account in which a declared law fixes the coupling slot; it states that coupling-blind data do not. It instantiates the fibre logic of [Big01] and Lemma ; no proof is transferred. par

The robust spectator envelope

Lemma. Let g be a pure state in any finite dimension and $0 \leq \varepsilon \leq 1$. Then

$$\max \{D(\sigma_1, \sigma_0) : D(\sigma_i, g) \leq \varepsilon\} = b(\varepsilon) := \begin{cases} 2\varepsilon\sqrt{1 - \varepsilon^2}, & \varepsilon \leq 1/\sqrt{2}, \\ 1, & \varepsilon \geq 1/\sqrt{2}. \end{cases}$$

Proof. Attainment. $\psi_{\pm} = \cos t\, g \pm i \sin t\, g^{\perp}$ with $\sin t = \min\{\varepsilon, 1/\sqrt{2}\}$ have $D(\psi_{\pm}, g) = \sin t$ and $D(\psi_+, \psi_-) = \sin 2t$. *Bound.* Let M be an optimal projector, so $D(\sigma_1, \sigma_0) = Tr\, M(\sigma_1 - \sigma_0)$. Put $K = span\{g, Mg\}$; it reduces M. If $\dim K = 1$, g is an eigenvector of M and $Tr\, M\sigma_i$ lies within ε of $Tr\, Mg \in \{0, 1\}$ on one side, so the difference is at most $\varepsilon \leq b(\varepsilon)$ for $\varepsilon \leq \sqrt{3}/2$, and $b = 1$ otherwise. If $\dim K = 2$, $M|_K = proj\ m$ has rank one. The map $\Psi(\sigma) = \Pi_K \sigma \Pi_K + Tr(M_{\perp}\sigma) proj\ m + Tr((I - M_{\perp})\sigma)|m^{\perp}\rangle\langle m^{\perp}|$, with $M_{\perp} = M|_{K^{\perp}}$, is CPTP into K, fixes g, and satisfies $Tr(proj\ m \Psi(\sigma)) = Tr\, M\sigma$. By contractivity it suffices to bound qubit states. In Bloch form, D is half the Euclidean distance; with n the Bloch vector of g, every admissible x satisfies $|x| \leq 1$ and $|x - n| \leq 2\varepsilon$. For $\varepsilon \leq 1/\sqrt{2}$ and $c = (1 - 2\varepsilon^2)n$, the second condition gives $x \cdot n \geq (|x|^2 + 1 - 4\varepsilon^2)/2$, whence $|x - c|^2 \leq 2\varepsilon^2 |x|^2 + 2\varepsilon^2(1 - 2\varepsilon^2) \leq 4\varepsilon^2(1 - \varepsilon^2)$. The admissible set lies in a ball of radius $2\varepsilon\sqrt{1 - \varepsilon^2}$, so $D \leq 2\varepsilon\sqrt{1 - \varepsilon^2}$.

par *Non-claim.* A finite-dimensional geometric fact about states. par

Theorem. Let $W_0 = V \otimes |g_h\rangle$ be a spectator coupling, with $V: C \to R \otimes E$ and g_h pure, and let W be an implemented hosted probe extension with complementary probe channel $\mathscr{C}_G$. Normalize witnesses as in Definition : $\gamma_O = \sup_{\rho_0, \rho_1} |Tr(O \mathscr{C}_G(\rho_1 - \rho_0))| / (2\|O\|_{\infty})$.

• If $D(\mathscr{C}_G(\rho), g_h) \leq \varepsilon$ for every code state ρ (this holds when $d_{\diamond}(\mathscr{C}_{EG}, \mathscr{C}_{EG^{(0)}}) \leq \varepsilon$, and hence when the implemented and spectator channels are within ε), then for every Hermitian $O \neq 0$ and all code states

$$\left|\mathrm{Tr}\,(O\widehat{\mathscr{C}}_G(\rho_1-\rho_0))\right| \le \mathrm{spr}\,(O)\,b(\varepsilon), \qquad \gamma_O(\widehat{W}) \le b(\varepsilon) \le 2\varepsilon,$$

with b as in Lemma .

• If $d_{\diamond}(\mathscr{C}_{EG}, \mathscr{C}_{EG}^{(0)}) \le \varepsilon$, then $|\delta_{leak}(W) - \delta_{leak}(V)| \le \varepsilon$; here $\delta_{leak}(W_0) = \delta_{leak}(V)$, which need not vanish.

• *Attainment and the role of sin μ.* Take a qubit code, $V|j\rangle = |j\rangle_R|e_0\rangle_E$, $G = H_{mode} \otimes \mathbb{C}^2$, $g_h = f_0 \otimes u_0$, $g^{\perp} = f_0 \otimes u_1$, $\sin t = \min\{\varepsilon, 1/\sqrt{2}\}$, and $W_t|j\rangle = V|j\rangle \otimes (\cos t\, g_h + i(-1)^j \sin t\, g^{\perp})$. Then $d_{\diamond}(\mathscr{W}_t, \mathscr{W}_0) = \sin t \le \varepsilon$ for the full channels (hence also for the complements), and the declared holonomy observable built from $H_{\mu} = I_{mode} \otimes R_{\mu}$ of Section satisfies

$$O_{\mu} := \frac{H_{\mu} - H_{\mu}^{\dagger}}{2i} = -\sin\mu\,(I_{\mathrm{mode}} \otimes \sigma_y), \qquad \|O_{\mu}\|_{\infty} = |\sin\mu|,$$

$$w_{O_{\mu}}(\mathrm{proj}\,1, \mathrm{proj}\,0) = 2\sin\mu \sin 2t.$$

Hence the unnormalized witness $2|\sin\mu|\sin 2t$ depends on μ, while the normalized response is $\gamma_{O_{\mu}}(\mathscr{W}_t) = \sin 2t = b(\varepsilon)$ for *every* μ with $\sin\mu \neq 0$. If $\sin\mu = 0$ ($\mu \in \{0, \pi\}$) then $O_{\mu} = 0$ and $(H_{\mu} + H_{\mu}^{\dagger})/2 = \cos\mu\, I_G$ is scalar, so no holonomy observable responds; the probe observable $I_{mode} \otimes \sigma_y$, a Helstrom observable of the pair $\psi_{\pm} = \cos t\, g_h \pm i \sin t\, g^{\perp}$, attains $b(\varepsilon)$ for every μ. For $\varepsilon > 1/\sqrt{2}$ the choice $t = \pi/4$ gives $b = 1$.

• The leakage constant 1 in (ii) is attained: with $\mathscr{C}_{cp}$ the complement of the copy carrier V_{cp} of and $\mathscr{C}_p = (1-p)\mathscr{T}_{I/2} + p\,\mathscr{C}_{cp}$, $\delta_{leak}(\mathscr{C}_p) = p/2 = d_{\diamond}(\mathscr{C}_p, \mathscr{T}_{I/2})$.

Proof. (i) $\mathscr{C}_{EG}^{(0)}(\rho) = \mathscr{C}_E^{V}(\rho) \otimes g_h$, and Tr_E is contractive, so complement closeness gives the hypothesis. Each $\mathscr{C}_G(\rho_i)$ lies in the trace ball of radius ε about g_h; Lemma bounds their distance by $b(\varepsilon)$. For a traceless Hermitian Δ, $|\mathrm{Tr}\, O\Delta| = |\mathrm{Tr}\,(O - cI)\Delta| \le \|O - cI\|_{\infty}\|\Delta\|_1$, and $c = 1/2(\lambda_{max} + \lambda_{min})$ gives $1/2\,\mathrm{spr}\,(O)\|\Delta\|_1$. Since $\mathrm{spr}\,(O) \le 2\|O\|_{\infty}$, $\gamma_O \le b(\varepsilon)$; $b(\varepsilon) \le 2\varepsilon$ is immediate. (ii) The map $\mathscr{C} \mapsto \mathrm{min_sigma}_{\diamond}(\mathscr{C}, \mathrm{repl}\,\sigma)$ is 1-Lipschitz by the triangle inequality, and $\delta_{leak}(W_0) = \delta_{leak}(V)$ is Theorem . (iii) $W_0^{\dagger} W_t = \cos t\, I_C$. For isometries $W, W^{'}$ and a referenced pure input x, the two outputs are pure with overlap $\mathrm{Tr}\,(\rho W^{\dagger} W^{'})$, ρ the code marginal of x; hence $d_{\diamond} = \sqrt{(1 - \min_{\rho} |\mathrm{Tr}\,\rho W^{\dagger} W^{'}|^2)} = \sin t$, and mixed inputs do no better by convexity. With $R_{\mu} = (\cos\mu, -\sin\mu; \sin\mu, \cos\mu)$, $(R_{\mu} - R_{\mu}^{T})/(2i) = -\sin\mu\,\sigma_y$. For $\psi = (\cos t, \pm i \sin t)$, $\langle\psi|\sigma_y|\psi\rangle = \pm\sin 2t$, so $\mathrm{Tr}\,(\sigma_y(\psi_{-} - \psi_{+})) = -2\sin 2t$ and $w_{O_{\mu}} = 2\sin\mu\sin 2t$. Dividing by $2\|O_{\mu}\|_{\infty} = 2|\sin\mu|$ gives $\sin 2t$; with $\sin t = \varepsilon \le 1/\sqrt{2}$, $\sin 2t = 2\varepsilon\sqrt{(1 - \varepsilon^2)} = b(\varepsilon)$. The upper bound (i) shows this is maximal. For $\sin\mu = 0$ the formulas give $O_{\mu} = 0$ and a scalar real part. The pair $\psi_{\pm}$ has $D(\psi_{+}, \psi_{-}) = \sin 2t$ and $\mathrm{Tr}\,(\sigma_y(\psi_{+} - \psi_{-}))/2 = \sin 2t$, so σ_y is optimal in trace-norm duality (check X01). (iv) $\mathrm{diam}\,\mathscr{C}_p(\mathscr{D}(C)) = p$ gives $\delta_{leak} \ge p/2$ by the triangle inequality, and the distance to $\mathscr{T}_{I/2}$ is $p\, d_{\diamond}(\mathscr{C}_{cp}, \mathscr{T}_{I/2}) = p/2$ (check S02).

par *Non-claim.* The implemented coupling is a declared finite perturbation; no physical noise model is supplied. A small witness near a spectator is a robustness statement, not a geometric theorem; the holonomy observable is a declared probe observable, not a curvature or deficit measurement. par

Correlation-hidden response

Write $h(\sigma) = \sqrt{(1 - \max\{0, 2\lambda_{max}(\sigma) - 1\}^2)}$, which equals $2\sqrt{(\lambda_{max}(1 - \lambda_{max}))}$ when $\lambda_{max} > 1/2$ and 1 otherwise, and

$$\varphi(\delta) = \tfrac{1}{2}(\delta + \sqrt{4\delta - 3\delta^2}), \qquad 0 \le \delta \le 1.$$

Theorem. Let $W: C \to R \otimes E \otimes G$ be a hosted probe extension with complete complement $\mathscr{C}_{EG}$ and marginals $\mathscr{C}_E, \mathscr{C}_G$, all finite-dimensional, and write $(\mathscr{C}_E \otimes g)(\rho) = \mathscr{C}_E(\rho) \otimes g$.

• *Exact no-hiding.* If $\mathscr{C}_G(\rho) = g$ for every ρ, with g pure, then $\mathscr{C}_{EG} = \mathscr{C}_E \otimes g$ and $\delta_{leak}(W) = \delta_{leak}(\mathscr{C}_E)$.

• *Sharp robust no-hiding.* If $\langle g|\mathscr{C}_G(\rho)|g\rangle \ge 1 - \delta$ for every ρ, then

$$d_{\diamond}(\mathscr{C}_{EG}, \mathscr{C}_E \otimes g) \le \varphi(\delta), \qquad \delta_{\mathrm{leak}}(\mathscr{C}_E) \le \delta_{\mathrm{leak}}(W) \le \delta_{\mathrm{leak}}(\mathscr{C}_E) + \varphi(\delta).$$

The first bound is optimal for every $\delta \in [0, 1]$: the extension $W_{\delta}|j\rangle = |j\rangle_R \otimes \Psi_{\delta}$, $\Psi_{\delta} = \sqrt{(1-\delta)}\,|a\rangle|g\rangle + \sqrt{(\delta)}\,|b\rangle|g^{\perp}\rangle$ with $a \perp b$, satisfies the hypothesis with equality and has $d_{\diamond}(\mathscr{C}_{EG}, \mathscr{C}_E \otimes g) = \varphi(\delta)$.

Moreover $\varphi(\delta) \le \sqrt{(\delta)} + \delta/2 < 2\sqrt{(\delta)}$ for $0 < \delta \le 1$ and $\varphi(\delta) = \sqrt{(\delta)} + \delta/2 + O(\delta^{3/2})$, so the constant $2\sqrt{(\delta)}$ of version 2 is valid but not optimal, and the optimal leading constant is 1.

• *Pure outputs with constant marginals.* Let code states ρ_0, ρ_1 have *pure* complete-complement outputs $\Psi_0, \Psi_1 \in E \otimes G$ with $\mathrm{Tr}_G \Psi_0 = \mathrm{Tr}_G \Psi_1$ and $\mathrm{Tr}_E \Psi_0 = \mathrm{Tr}_E \Psi_1 = \sigma$. Then

$$|\langle\Psi_0|\Psi_1\rangle| \ge \max\{0, 2\lambda_{\max}(\sigma) - 1\}, \qquad D(\Psi_0, \Psi_1) \le h(\sigma).$$

For every σ and every E with $\dim E \ge \mathrm{rank}\,\sigma$ there are such pairs with equality, realized by a hosted extension $W|j\rangle = |j\rangle_R \otimes \Psi_j$ whose E- and G-marginals are constant.

• *Existence of hidden response.* Constant E- and G-marginals with a nonconstant complete complement occur iff the constant G-marginal has rank at least two. For pure outputs the hidden distance is maximal ($h = 1$) iff $\lambda_{\max}(\sigma) \le 1/2$; for mixed outputs $h(\sigma)$ is not an upper bound (Proposition). Proposition is the case $\sigma = I/2$, $h = 1$.

Proof. (i) A bipartite state with a pure marginal is a product with that marginal; apply this to $(\mathrm{id}_Q \otimes \mathscr{C}_{EG})(\omega)$ for every referenced input. Tensoring with a fixed pure state preserves half-diamond distances to replacement channels, and Tr_G maps a replacement channel to a replacement channel, so $\delta_{\mathrm{leak}}(\mathscr{C}_E \otimes g) = \delta_{\mathrm{leak}}(\mathscr{C}_E)$ (as in Theorem (i)).

(ii) Fix a referenced input ω on $Q \otimes C$ and put $X = Q \otimes E$, $\Omega = (\mathrm{id}_Q \otimes \mathscr{C}_{EG})(\omega)$. Then $(\mathrm{id}_Q \otimes \mathscr{C}_E \otimes g)(\omega) = \Omega_X \otimes g$ and $\langle g|\Omega_G|g\rangle = \langle g|\mathscr{C}_G(\omega_C)|g\rangle \ge 1 - \delta$. It suffices to prove $D(\Omega, \Omega_X \otimes g) \le \varphi(\delta)$ for every state Ω on $X \otimes G$ with $\langle g|\Omega_G|g\rangle \ge 1 - \delta$. *Pure states.* Write $\Psi = u + \chi$ with $u = A \otimes g$ and $\chi \in X \otimes g^{\perp}$, $\|\chi\|^2 = \delta'' \le \delta$. Cross terms vanish under Tr_G, so $\Psi_X \otimes g = \mathrm{proj}\, u + N$ with $N = \mathrm{Tr}_G(\mathrm{proj}\,\chi) \otimes g \ge 0$. Put $\Delta = \mathrm{proj}\,\Psi - \Psi_X \otimes g$ and $B = \mathrm{proj}\,\Psi - \mathrm{proj}\,u$; then $\Delta \le B$ and $\mathrm{Tr}\,\Delta = 0$, so $D(\Psi, \Psi_X \otimes g) = \mathrm{Tr}\,\Delta_+ = \max_{0 \le P \le I} \mathrm{Tr}\,P\Delta \le \max_{0 \le P \le I} \mathrm{Tr}\,PB = \mathrm{Tr}\,B_+$. The operator B has rank at most two, trace δ'', and determinant on its support $-(\|\Psi\|^2\|u\|^2 - |\langle u|\Psi\rangle|^2) = -(1 - \delta'')\delta''$, since $\|u\|^2 = \langle u|\Psi\rangle = 1 - \delta''$. Its positive eigenvalue is $\tfrac{1}{2}(\delta'' + \sqrt{\delta''^2 + 4\delta''(1 - \delta'')}) = \varphi(\delta'')$. *Monotonicity and concavity.* $\sqrt{4\delta - 3\delta^2}$ is the square root of a nonnegative concave function, hence concave; and $\varphi''(\delta) = \tfrac{1}{2} + (2 - 3\delta)/(2\sqrt{4\delta - 3\delta^2}) > 0$ on $(0, 1)$, because for $\delta > 2/3$ the inequality $\sqrt{4\delta - 3\delta^2} > 3\delta - 2$ is equivalent to $(3\delta - 1)(\delta - 1) < 0$. So $\varphi(\delta'') \le \varphi(\delta)$. *Mixed states.* For $\Omega = \sum_i p_i|\Psi_i\rangle\langle\Psi_i|$ with defects δ_i, $\sum_i p_i\delta_i \le \delta$ by linearity, $\Omega_X \otimes g = \sum_i p_i\Psi_{i,X} \otimes g$, and joint convexity of the trace distance gives $D(\Omega, \Omega_X \otimes g) \le \sum_i p_i\varphi(\delta_i) \le \varphi(\sum_i p_i\delta_i) \le \varphi(\delta)$. *Leakage.* $\delta_{\mathrm{leak}}(\mathscr{C}_E) \le \delta_{\mathrm{leak}}(W)$ by contractivity of Tr_G; the upper bound is the 1-Lipschitz property of leakage (Proposition) together with (i)'s identity $\delta_{\mathrm{leak}}(\mathscr{C}_E \otimes g) = \delta_{\mathrm{leak}}(\mathscr{C}_E)$. *Optimality.* For W_δ, $\mathscr{C}_{EG}(\rho) = \Psi_\delta$ for every ρ and $\langle g|\mathscr{C}_G|g\rangle = 1 - \delta$. Here $N = \delta\,\mathrm{proj}\, b \otimes g$ is orthogonal to the support of B, so $\Delta = B - N$ has positive part B_+ and $D = \varphi(\delta)$; the half-diamond distance is at least this value and at most $\varphi(\delta)$ by the bound. Finally $\sqrt{4\delta - 3\delta^2} \le 2\sqrt{(\delta)}$ gives $\varphi \le \sqrt{(\delta)} + \delta/2$, and $\delta/2 < \sqrt{(\delta)}$ for $0 < \delta \le 1$; the expansion is $\sqrt{4\delta - 3\delta^2} = 2\sqrt{(\delta)}(1 - 3/8\delta + O(\delta^2))$ (check X05).

(iii) Both Ψ_0 and Ψ_1 purify σ on G, so $\Psi_1 = (U \otimes I)\Psi_0$ for a unitary U on E (purifications in the same space differ by a partial isometry on the support, which extends to a unitary). Put $\tau = \mathrm{Tr}_G \Psi_0$; the equality $U\tau U^{\dagger} = \tau$ gives $[U, \tau] = 0$, and $\langle\Psi_0|\Psi_1\rangle = \mathrm{Tr}\,(U\tau)$. The nonzero spectrum of τ is that of σ. U is block diagonal on the eigenspaces of τ; on an eigenspace of eigenvalue $\mu_k > 0$ and multiplicity m_k, $\mathrm{Tr}\,U_k$ is a sum of m_k unimodular numbers. Hence $\mathrm{Tr}\,(U\tau) = \sum_i \lambda_i e^{i\theta_i}$, summed over the nonzero eigenvalues of σ with multiplicity, for some phases. If $\lambda_{\max} > 1/2$ the top eigenvalue is simple and $|\mathrm{Tr}\,(U\tau)| \ge \lambda_{\max} - (1 - \lambda_{\max}) = 2\lambda_{\max} - 1$. For pure states $D = \sqrt{(1 - |\langle\Psi_0|\Psi_1\rangle|^2)}$, which gives the bound. *Attainment.* Take $\Psi_0 = \sum_i \sqrt{(\lambda_i)}\, e_i \otimes s_i$ in a Schmidt basis and $U = \mathrm{diag}\,(e^{i\theta_i})$ on $\mathrm{span}\{e_i\}$. If $\lambda_{\max} > 1/2$, $\theta = 0$ on the top vector and π elsewhere gives $2\lambda_{\max} - 1$. If $\lambda_{\max} \le 1/2$, each weight is at most the sum of the others, so the weights close a polygon and some phases give $\sum_i \lambda_i e^{i\theta_i} = 0$. For $W|j\rangle = |j\rangle_R \otimes \Psi_j$, the register R removes the off-diagonal terms, so $\mathscr{C}_{EG}(\rho) = \sum_j \rho_{jj}\Psi_j$ and both marginals are constant (check X02).

(iv) If the constant G-marginal is pure, (i) gives a constant complement. If it has rank at least two, (iii) with $\lambda_{\max} < 1$ gives $h(\sigma) > 0$. The pure-output statement is (iii); the mixed statement is Proposition .

par *Non-claim.* No-hiding is not contradicted: the complete complement is nonconstant whenever response is hidden. The optimality in (ii) is for the distance to the product channel; the upper leakage constant $\varphi(\delta)$ is not claimed optimal. No field or metric observable is involved. par

Proposition.

• There are states *ω_0, ω_1* on $E \otimes G = \mathbb{C}^3 \otimes \mathbb{C}^2$ with rational entries, equal *E*-marginals, and *G*-marginals both equal to $\sigma = diag\,(7/10, 3/10)$, such that

$$D(\omega_0, \omega_1) \geq 0.9479 > h(\sigma) = \frac{\sqrt{21}}{5} \approx 0.91652.$$

They are the complete-complement outputs on $|0\rangle$, $|1\rangle$ of the hosted extension $W|j\rangle = |j\rangle_R|\Omega_j\rangle_{FEG}$, with *Ω_j* a purification of *ω_j* and *F* retained in the accessible output; its *E*- and *G*-marginals are constant.

• If *ω_0, ω_1* are diagonal in a product basis (classical outputs) with equal *E*-marginals and equal *G*-marginal *σ*, then $D(\omega_0, \omega_1) \leq \min\{1, 2(1 - \lambda_{max}(\sigma))\} \leq h(\sigma)$.

Proof. (i) The certificate was produced from a semidefinite-programme optimum by rounding to rationals, exact projection onto the affine marginal constraints and mixing with $1/1000(I/3 \otimes \sigma)$. It is verified in exact rational arithmetic (check X03): both matrices are symmetric with all principal minors nonnegative, hence positive semidefinite; both *G*-marginals equal *σ* and the *E*-marginals coincide; a rational matrix *P* with *P* and $I - P$ positive semidefinite (all principal minors) has $\ell = Tr\,P(\omega_0 - \omega_1)$ with $\ell > 0$ and $\ell^2 > 21/25 = h(\sigma)^2$. By trace-norm duality $D(\omega_0, \omega_1) \geq \ell \approx 0.94800$. For *W*, the register *R* removes off-diagonal terms and $Tr_F\,|\Omega_j\rangle\langle\Omega_j| = \omega_j$, so $\mathscr{C}_{EG}(\rho) = \sum_j \rho_{jj}\omega_j$, whose marginals are constant. (ii) Let *p_0, p_1* be the distributions and *g_{*}* the label of *λ_max*. Equal *E*-marginals give, for each *e*, $p_0(e, g_{*}) - p_1(e, g_{*}) = \sum_{g \neq g_{*}} (p_1(e, g) - p_0(e, g))$, so $\sum_e |p_0(e, g_{*}) - p_1(e, g_{*})| \leq \sum_{e, g \neq g_{*}} |p_0 - p_1| \leq 2(1 - \lambda_{max})$. Hence the total variation is at most $1/2 \cdot 2 \cdot 2(1 - \lambda_{max})$. Finally $2(1 - \lambda) \leq 2\sqrt{(\lambda(1 - \lambda))} = h(\sigma)$ for $\lambda \geq 1/2$, and $h(\sigma) = 1$ for $\lambda \leq 1/2$.

par *Non-claim.* The exact maximum of hidden response for mixed outputs is not determined here. Numerically (alternating semidefinite programmes, check X04) the maxima are *0.95086* for $(\dim E, \dim G, \lambda_{max}) = (3, 2, 0.7)$ and *0.61573* for *(4, 2, 0.9)*, against $h = 0.91652$ and *0.6*, and no gain over *h* was found for *(2, 2, 0.7)*; these values are numerical records, not theorems. par

Parameter estimation versus quantum recovery; the side-register floor

Theorem. Let $\mathscr{K}_{\lambda}(X) = Tr\,(X)\,\omega_{\lambda}$ be the complete accessible output, with *ω_{λ}* a classical or quantum report depending on a host parameter *λ* but not on the logical input. Then $\mathscr{K}_{\lambda}$ may be parameter-informative ($\omega_{\lambda_1} \neq \omega_{\lambda_2}$) while, for every decoder $\mathscr{D}$ into *C*,

$$F_e(\mathscr{D}\mathscr{K}_{\lambda}) = \frac{1}{d^2} \quad \text{exactly}, \qquad d_{\diamond}(\mathscr{D}\mathscr{K}_{\lambda}, \mathrm{id}_C) \geq 1 - \frac{1}{d^2},$$

with equality in the second bound for $\mathscr{D}(\omega_{\lambda}) = I/d$. This replacement floor $1 - 1/d^2$ is a different quantity from the shredder floor $1 - 1/d$ of Theorem : there the output retains the classical code record and the best decoder re-prepares it (*Δ_d*), here no input information survives.

Proof. $\mathscr{D}\mathscr{K}_{\lambda} = \mathscr{T}_{\tau}$ with $\tau = \mathscr{D}(\omega_{\lambda})$. On Φ_d the output is $I/d \otimes \tau$, and $\langle\Phi_d|(I/d \otimes \tau)|\Phi_d\rangle = Tr\,(\tau)/d^2 = 1/d^2$. Testing with Φ_d gives the lower bound; equality for $\tau = I/d$ is Theorem (iii) (checks N08, P06).

par *Non-claim.* Host diagnosis is not logical quantum recovery. An echo appended to retained quantum radiation does not make the joint output classical (Theorem). par

Definition. A *side-register shredder* of dimension *k* for the code $C \cong \mathbb{C}^d$ consists of a finite record set *X* and a quantum instrument $\{\mathscr{N}_x\}_{x \in X}$, $\mathscr{N}_x: \mathscr{B}(C) \to \mathscr{B}(K)$ completely positive with $\sum_x \mathscr{N}_x$ trace preserving and $\dim K = k$. Its complete accessible output is the classical–quantum state $\sum_x proj\,x \otimes \mathscr{N}_x(\rho)$ on $X \otimes K$. The access model is:

• the record *x* is classical and the register *K* is the *only* retained quantum system; in particular the decoder holds no system that was correlated in advance with the code, the encoder, or *K* (no pre-shared entanglement);

• a decoder is any channel $\mathscr{D}: \mathscr{B}(X \otimes K) \to \mathscr{B}(C)$; equivalently, a family of channels $\mathscr{D}_x: \mathscr{B}(K) \to \mathscr{B}(C)$ applied after reading *x*. Record-dependent quantum operations and fresh ancillas in fixed states are allowed, and a randomized decoder is a convex combination of such channels, hence again of this form. The resulting whole-code channel is $\mathscr{D} \circ \mathscr{S} = \sum_x \mathscr{D}_x\mathscr{N}_x$.

Theorem. In the access model of Definition , every decoder satisfies

$$F_e(\sum_x \mathscr{D}_x\mathscr{N}_x) \le \frac{k}{d}, \qquad d_\diamond(\sum_x \mathscr{D}_x\mathscr{N}_x, \mathrm{id}_C) \ge 1 - \frac{k}{d}.$$

Both bounds are attained for every $1 \le k \le d$ by the cyclic-window channel $\Lambda_k = 1/k\sum_{j=0}^{d-1} Ad_{P_j}$, P_j the projector onto $\{j, \ldots, j+k-1\} \bmod d$, implemented with record j, register $K \cong ran\ P_j$ and decoder ``embed back'': $F_e(\Lambda_k) = k/d$ and $d_\diamond(\Lambda_k, id) = 1 - k/d$. For $k = 1$ this is Theorem ; for $k = d$ the floor is 0.

Proof. Write $\mathscr{N}_x = \sum_a A_{x,a} \cdot A_{x,a}^\dagger$ with $A_{x,a}: C \to K$, and $\mathscr{D}_x = \sum_b B_{x,b} \cdot B_{x,b}^\dagger$ with $B_{x,b}: K \to C$ (a fresh ancilla and a record-dependent unitary or measurement are absorbed in the Stinespring form of $\mathscr{D}_x$). The whole-code channel has Kraus operators $K_{x,a,b} = B_{x,b}A_{x,a}$, each of rank at most k. For an operator K of rank at most k with range projector Π, Cauchy–Schwarz gives $|Tr\ K|^2 = |Tr\ (\Pi K)|^2 \le Tr\ \Pi\ Tr\ K^\dagger K \le k Tr\ K^\dagger K$. Hence $F_e = d^{-2}\sum |Tr\ K_{x,a,b}|^2 \le kd^{-2} Tr \sum K^\dagger K = k/d$. Testing on the maximally entangled state gives $d_\diamond \ge 1 - F_e$. Convex combinations preserve the bound since F_e is affine. *Implementation of Λ_k.* Each basis vector lies in exactly k windows, so $\sum_j P_j = kI$ and $\mathscr{N}_j(\rho) = 1/k V_j P_j \rho P_j V_j^\dagger$, with $V_j: ran\ P_j \to K$ unitary, is an instrument; the decoder $\mathscr{D}_j(\tau) = V_j^\dagger \tau V_j$ gives Λ_k. *Sharpness.* Λ_k is the Schur multiplier of the circulant $C = 1/k\sum_j 1_{P_j} 1_{P_j}^T succeq 0$ with unit diagonal. Its zero Fourier eigenvalue is k, so $C - k/d 11^T succeq 0$ with diagonal $1 - k/d$; thus $\Lambda_k = k/d id + (1 - k/d)\Psi$ for a channel Ψ and $d_\diamond(\Lambda_k, id) \le 1 - k/d$. Each Kraus operator $P_j/\sqrt{k}$ has trace $\sqrt{k}$, so $F_e = d^{-2} \cdot d \cdot k = k/d$ (checks S05, X06).

par *Non-claim.* A classical record with a retained quantum side register is not a complete classical shredder (Definition). The floor is a statement about the declared access model, not about any physical radiation process. par

Proposition.

• *Pre-shared entanglement.* Let the encoder and decoder share a maximally entangled state on $A \otimes B$, $dim\ A = dim\ B = d$, with B retained by the decoder. With $k = 1$ (no register) and a d^2-valued record, the teleportation protocol gives a whole-code channel equal to id_C, so $F_e = 1 > 1/d$.

• *A coherent record.* If the record is kept as a quantum system of dimension $|X| \ge d$ rather than read, the isometric encoding gives $F_e = 1$ with $k = 1$. Hence the bound of Theorem measures the retained quantum access exactly: the relevant dimension is that of all retained quantum systems, including pre-shared ones.

Proof. (i) Measuring $C \otimes A$ in a basis $\{\Phi_x\}_{x=1}^{d^2}$ of maximally entangled states leaves B in $T_x \rho T_x^\dagger$ for a unitary T_x determined by x, each outcome with probability $1/d^2$; the record-dependent correction $T_x^\dagger$ returns ρ. This is the standard teleportation identity [Teleport]; for $d = 2$ the whole-code channel is computed explicitly in check X06 ($F_e = 1$). The register is trivial, but the decoder holds the d-dimensional system B, which the model of Definition excludes. (ii) The record is then a retained quantum system of dimension at least d; the identity embedding has $F_e = 1$.

par *Non-claim.* The teleportation counterexample uses a pre-shared resource outside the access model; it does not contradict Theorem and supplies no physical channel. par

Three examples

The three examples below instantiate the central theorems on named source-record data. Every cited formula is a source record, quoted after a read-only retrieval (Appendix); none is a premise of a proof.

A current example: a fixed continuum current is sampled, not updated

Definition. For the prescribed cone with $\alpha = 1 - \mu/2\pi$, a charged-field holonomy parameter $0 \le \beta < 1$ declared as host data, and a laboratory radius $r_0 > 0$, put

$$J(h) = \frac{\beta(1-\beta)(2\beta-1)}{12\pi^2\alpha^2 r_0^2}, \qquad P(h) = \frac{\alpha^{-2} - 1}{48\pi^2 r_0^2}.$$

These are the printed $d\varphi$-component of the charged Friedrichs vacuum current of [IBVP0] and the neutral Friedrichs Wick square of [IBVP], evaluated at r_0 (source record; not a premise). Each is represented on the

probe by *o(h)I_G*, an admissible scalar representative in the sense of Definition (i).

Theorem. Let *o ∈ {J, P}*.

• For every hosted probe extension *W*, spectator or not, *W^{†}(I_RE ⊗ o(h)I_G)W = o(h)I_C*; every witness of *o(h)I_G* vanishes.

• *o* factors through the host data map *D_H*. Replacing the spectator coupling by the supplied coupling , or by any other coupling, leaves *o* unchanged, although the rod witness changes from *0* to *(λ_1 − λ_0)sin^2 η*.

• The reading of *J* can depend on the code only through an additional declared *source supply s: 𝒟(C) → [0, 1), β = s(ρ)*. Even then *J* does not identify *β*: *J(β) = −J(1 − β)* and *J = 0* at *β ∈ {0, 1/2}*, so a source supply with *s(ρ_0) = 0, s(ρ_1) = 1/2* changes the declared holonomy and has zero current witness.

Proof. (i) *W^{†}W = I_C*. (ii) *J* and *P* are functions of *(α, β, r_0)*, which are host data; Lemma gives fibre constancy, and Theorem gives the rod witness. (iii) Without *s*, *(α, β, r_0)* do not depend on *ρ*. The identity *β(1 − β)(2β − 1) ↦ (1 − β)β(1 − 2β)* under *β ↦ 1 − β* proves the antisymmetry, and the zeros are read off.

par *Non-claim.* No new field theorem is proved; the formulas of I-B-VP and I-B-VP-0 are quoted, not re-derived. A source supply *s* is a code-to-host law and is not constructed here; it would change host data, not merely a probe state. The holonomy parameter *β* is not the deficit *μ*. par

Theorem is the scalar case of Theorem . It does *not* say that every finite sample of a fixed, spatially varying current is code-blind.

Proposition. Fix *(α, β)* with *β ∉ {0, 1/2}*, so that the recorded component *j_{φ}(α, β, r) = β(1 − β)(2β − 1)/(12π^2α^2r^2)* is nonzero and strictly monotone in *r*. Let *f_0, f_1* be normalized modes with disjoint supports in separated radial ranges of a regular laboratory, and *j_a = ∫ |f_a|^2 j_{φ} dvol*, so *j_0 ≠ j_1*. For the controlled sampler *|0⟩ ↦ |0⟩_R|f_0⟩*, *|1⟩ ↦ |1⟩_R(cos η|f_0⟩ + sin η|f_1⟩)*,

$$w_{J_{\mathrm{samp}}}(\mathrm{proj}\,1, \mathrm{proj}\,0) = (j_1 - j_0)\sin^2\eta, \qquad J_{\mathrm{samp}} = \mathrm{diag}\,(j_0, j_1),$$

and the continuum current is unchanged.

Proof. Disjoint supports make the compression diagonal (Theorem); the two probe expectations are *j_0* and *j_0cos^2 η + j_1sin^2 η* (check F01). Monotonicity in *r* and separated ranges give *j_0 ≠ j_1*.

par *Non-claim.* The orthonormal component *j_{φ̂} = j_{φ}/(αr)* is not interchanged with *j_{φ}*. A sampler coupling and a continuum response law are different interfaces. I-B-G constructs Green operators after a named extension on a spacetime that is not globally hyperbolic [IBG], [IBG], and the one-channel Ward selector of [IBVPCR] is a different demand; neither is selected by a sampler. par

A curved-host example: curvature sampling on the Host-B neck

The flat I-B laboratory and the constant-curvature host *DSS_H* are both blind to curvature sampling; a nonconstant prescribed curvature profile is needed, and the settled Host-B neck supplies one.

Definition. Let *DSS_H* be the prescribed de Sitter host of [Big01] (source record; not a premise), with flat-chart metric *g_H = −c^2 dt^2 + e^2Ht dx^2* on the chart of [Big01]. The metric, *H*, *c* and the orientation are inputs. A curvature-label observable is *R_HI_G* with *R_H = 12H^2/c^2*, the scalar curvature recorded in [Big01] and recomputed symbolically for the flat chart in Appendix .

Theorem. On *DSS_H*:

• every declared finite carrier admits the ideal hosting of Theorem along the comoving curve *t ↦ (t, x_0)*, which is timelike;

• the spectator extension is exactly probe-blind and preserves leakage, by the same proof as Theorem ;

• every scalar label observable, in particular *R_HI_G*, has zero witness under *every* coupling, and since *R* is constant on *DSS_H*, every finite compression of the curvature function is scalar (Theorem); a responding curvature sampler needs a host with nonconstant curvature (Corollary);

• the leakage values *0* and *1/2* of occur on the same *DSS_H* host, so leakage is not a host functional there; every host-only estimate has two-point worst-case error at least *1/4* (exactly *3/8* for qubit codes, Theorem). Local flatness of the I-B laboratory is therefore not the reason for blindness: *R = 0* there and *R_H ≠ 0* here.

Proof. (i) *g_H(∂_t, ∂_t) = −c^2 < 0*; the placement argument of Theorem uses only a timelike curve and finite unitary completion. (ii) The proof of Theorem is algebraic in *V* and *|g_h⟩* and uses no property of the metric. (iii) *W^{†}(I ⊗ cI_G)W = cI_C*, and Theorem . (iv) The computation in the proof of Theorem is host-independent; Lemma gives the floor.

par *Non-claim.* No de Sitter quantum state, no field on *DSS_H*, and no coupling of the code to *H* is constructed. *H* is not derived. The curved host is a comparison host, not Host A, Host B or a Host C. par

Curvature and vacuum-term remark. In the flat chart, *Γ^t_ij = (H/c^2)e^2Htδ_ij* and *Γ^i_tj = Hδ_j^i*, so *Ric[g_H] = (3H^2/c^2)g_H* and *R = 12H^2/c^2* (check F04). A shift *c_0g + c_GG[g]* equals *(c_0 − 3H^2c_G/c^2)g* on this metric, so it does not select *c_0* and *c_G* separately; the recorded vacuum-term separations [Big03] and [Big04] are untouched, and the qualified radiation-label orbit of [Big04Coeff] still requires a data contract omitting the radiation-dictionary parameter. No quantum coefficient occurs.

Corollary. Let *h* be a prescribed host whose scalar curvature $\mathcal{R}_h$ is continuous and nonconstant on *U*. There are normalized *f_0, f_1* with disjoint supports in *U* such that *κ_a = ∫_U |f_a|^2ℛ_h dvol_h* satisfy *κ_0 ≠ κ_1*; the compression is *O_{ℛ} = diag (κ_0, κ_1)*. For the controlled qubit arc *|0⟩ ↦ |f_0⟩*, *|1⟩ ↦ cos η|f_0⟩ + sin η|f_1⟩*,

$$w_{O_{\mathcal{R}}}(\mathrm{proj}\,1, \mathrm{proj}\,0) = (\kappa_1 - \kappa_0)\sin^2\eta,$$

while under spectator hosting the witness is *0*, and *h* and $\mathcal{R}_h$ are unchanged. On a host of constant scalar curvature, such as *DSS_H* with *R = 12H^2/c^2*, every compression of $\mathcal{R}$ is scalar and the witness is *0* for every coupling (Theorem); the corollary therefore does not apply there. An instance is the settled Host-B neck (Theorem).

Proof. Pick *x_0, x_1 ∈ U* with $\mathcal{R}_h(x_0) \neq \mathcal{R}_h(x_1)$; by continuity there are disjoint neighbourhoods on which the values lie in disjoint intervals; normalized modes supported there have different averages, and disjoint supports make the compression diagonal. The witness is *⟨b_{η}rvertO_{ℛ} |b_{η}⟩ − κ_0 = (κ_1 − κ_0)sin^2 η* (check N11). The rest is Theorem .

par *Non-claim.* A curvature-sampling witness is a witness, not curvature backreaction: the curvature function is prescribed and fixed. ``Geometric response is impossible" is false for samplers, and ``sampled response is backreaction" is also false. par

Theorem. On settled Host B (*η ≥ τ_a*, *a_{∞} = 1 + λ*) restricted to *|ℓ| < L_0*, where *Q = 0*, the metric is *a_{∞}^2[−c^2 dη^2 + dℓ^2 + (ℓ^2 + b^2) dφ^2 + dz^2]* and its scalar curvature is

$$\mathcal{R}_B(\ell) = -\frac{2b^2}{a_\infty^2(\ell^2 + b^2)^2},$$

continuous and nonconstant. For disjointly supported normalized neck modes with *κ_0 ≠ κ_1* and the arc carrier of Theorem ,

$$\delta_{\mathrm{leak}} = \tfrac{1}{2}\sin\Delta, \qquad \left|w_{O_{\mathcal{R}}}(|j_{\max}\rangle\langle j_{\max}|, |j_{\min}\rangle\langle j_{\min}|)\right| = |\kappa_1 - \kappa_0|\sin(\theta_- + \theta_+)\sin\Delta,$$

the spectator witness is *0*, and $\mathcal{R}_B$ and *g_B* are unchanged.

Proof. For *dℓ^2 + F^2 dφ^2* the scalar curvature is *−2F^{''}/F*; the *η* and *z* factors are flat products and the constant conformal factor divides by *a_{∞}^2*. With *F = √(ℓ^2 + b^2)*, *F^{''} = b^2/(ℓ^2 + b^2)^{3/2}* (check F05). The rest is Corollary and Theorem (ii).

par *Non-claim.* A curvature sampling witness on a genuinely curved host is not a curvature backreaction witness, and a probe state is not a gravitational degree of freedom. No stress-to-metric coupling is derived. par

An echo and access-cut example

Theorem. Let *s(α)* be the I-C echo functional [IC] (source record; not a premise), the average of the kernel *q(α, u) = −sin (π/α)/(α(cosh (u/α) − cos (π/α)))* against a nonnegative *α*-independent window weight supported in *[0, u_{*}]*; put *q_0(α) = −α^{−1}cot (π/2α)* and *D(α) = 1 − cos (π/α)*.

• *Local short-window monotonicity.* Let *J = [a_J, b_J] ⊂ (1/2, 1]*, *a_J < b_J*, and

$$C_J(u_*) = \sup_{\alpha \in J,\ 0 < u \le u_*} \frac{|\partial_\alpha (q - q_0)(\alpha, u)|}{u^2}.$$

Then *C_J(u_{*}) < ∞*, and whenever *C_J(u_{*})u_{*}^2 < π/2*,

$$|s(\alpha_1) - s(\alpha_2)| \ge (\frac{\pi}{2} - C_J(u_*)u_*^2)|\alpha_1 - \alpha_2| \qquad (\alpha_1, \alpha_2 \in J).$$

Moreover *C_J(u_{*}) ≥ C_J^lead: = 1/2max_{α ∈ J} |d/(dα)(q_0(α))/(α^2D(α))|* for every *u_{*} > 0*, so this method certifies monotonicity only for *u_{*} < (π/(2C_J^lead))^{1/2}*.

• *s* is a function of host data and declared window data; it is constant on every carrier fibre and is not a residual-response witness of any *V*.

• Every decoder fed only the echo reading outputs a code-independent state *τ*, so its whole-code channel is *repl τ*, and

$$d_\diamond(\mathrm{repl}\,\tau, \mathrm{id}_C) \ge 1 - \frac{1}{d^2},$$

with equality for *τ = I/d*. This is strictly above the shredder floor *1 − 1/d* of Theorem .

Proof. (i) The identity *q = q_0D/(D + c)*, *c = cosh (u/α) − 1*, follows from *(1 − cos 2x)cot x = sin 2x* with *x = π/(2α)*. With *x ∈ [π/2, π)*, *q_0^{'}(α) = −(x − sin xcos x)/(α^2sin^2 x) ≤ −π/2*, since *x − sin xcos x* is nondecreasing with value *π/2* at *x = π/2*, and *0 < α^2sin^2 x ≤ 1*. On *J*, *D* has a positive minimum, so *(q − q_0)/u^2 = −q_0c/(u^2(D + c))* is a smooth function of *(α, u^2)* on *J × [0, u_{*}^2]*; its *α*-derivative is bounded, so *C_J(u_{*}) < ∞*. Averaging *∂_{α}q = q_0^{'} + ∂_{α}(q − q_0)* against the weight gives *s^{'} ≤ −π/2 + C_J(u_{*})u_{*}^2*; integrate. As *u → 0*, *(q − q_0)/u^2 → −q_0/(2α^2D)* together with its *α*-derivative, which gives *C_J(u_{*}) ≥ C_J^lead*. (ii) No argument of *s* is a carrier datum. (iii) On *Φ_d*, *Tr (Φ_d(I/d ⊗ τ)) = Tr τ/d^2*, so the trace distance is at least *1 − 1/d^2*. For *τ = I/d* and a pure referenced input with Schmidt coefficients *p_i*, the difference *proj x − ρ_Q ⊗ I/d* has one positive eigenvalue *λ*, which solves *∑_i p_i/(λ + p_i/d) = 1*; concavity of *p ↦ p/(λ + p/d)* and Jensen give *1 ≤ 1/(λ + 1/d^2)*, so *λ ≤ 1 − 1/d^2*. Mixed inputs are convex combinations. Finally *1 − 1/d^2 > 1 − 1/d* for *d ≥ 2*.

par *Non-claim.* The statement is local: a compact window *J* away from *α = 1/2* and a short gate. It is not global deficit identifiability. Numerically (check X07) *C_J^lead = 6. 2376*, *242. 10* and *3870. 6* for *J = [0. 75, 1]*, *[0. 6, 1]* and *[0. 55, 1]*, so the gate lengths this method can certify are at most about *0. 50*, *0. 081* and *0. 020*; the numerical supremum of *C_J(0. 05)* on *[0. 6, 1]* agrees with *C_J^lead* to four digits, but no uniform constant is certified here. For long gates *∂_{α}q* changes sign (for instance *∂_{α}q(0. 55, 3) > 0 > ∂_{α}q(0. 55, 0. 01)*, evaluated numerically), so for windows concentrated at long gates the reading need not be monotone. The source's own separation is qualified (PC-1). No quantum-return decoder and no Page curve follow. par

Corollary. With *c_J = π/2 − C_Ju_{*}^2 > 0*, a reported number *y* with *|y − s(α)| ≤ ε* leaves a consistent-parameter set in *J* of diameter at most *2ε/c_J*. This does not change the echo-only recovery floor *1 − 1/d^2*.

Proof. Two consistent parameters have readings within *2ε*; apply Theorem (i). The floor is Theorem .

par *Non-claim.* No global injectivity through shadow transitions is claimed; the source's own qualified statement stands (PC-1). par

Theorem. Let *V: C → B ⊗ F* be a Stinespring isometry of a channel $\mathscr{Q} = Tr_F\, V \cdot V^{\dagger}$ with complement $\mathscr{C}_V$ on *F*, and let a report *ω* on *A* be prepared independently of the input, with purification *|ψ_{ω}⟩ ∈ A ⊗ A^{'}*. Put *W = V ⊗ |ψ_{ω}⟩*, so the accessible output is $\mathscr{Q} \otimes repl\ \omega$ on *BA* and the complete complement is $\mathscr{C}_V \otimes \mathscr{T}_{\omega^{'}}$ on *FA^{'}*.

• *δ_leak(W) = δ_leak(V)*.

• $inf_{\mathscr{D}}\, d_{\diamond}(\mathscr{D}(\mathscr{Q} \otimes repl\ \omega), id_C) = inf_{\mathscr{D}^{'}}\, d_{\diamond}(\mathscr{D}^{'}\mathscr{Q}, id_C)$, and likewise for *F_e*.

• Constant marginals do not imply an input-independent joint output: in Proposition the *E*- and *G*-marginals of the complement are *I/2* for every input, while the joint *EG* output is *Φ_{±}* and *δ_leak = 1/2*.

Proof. (i) For *σ* on *F*, $d_{\diamond}(\mathscr{C}_V \otimes \mathscr{T}_{\omega^{'}}, \mathscr{T}_{\sigma \otimes \omega^{'}}) = d_{\diamond}(\mathscr{C}_V, repl\ \sigma)$, since tensoring with a

fixed state preserves the trace norm; so $\delta_{leak}(W) \le \delta_{leak}(V)$. Conversely $Tr_{A'}$ is contractive and maps $\mathcal{T}_{\sigma'}$ to $\mathcal{T}_{Tr_{A'}\sigma'}$, so $d_{\diamond}(\mathcal{C}_V \otimes \mathcal{T}_{\omega'}, \mathcal{T}_{\sigma'}) \ge \delta_{leak}(V)$. (ii) A decoder $\mathcal{D}'$ on B gives $\mathcal{D}' \circ Tr_A$; a decoder $\mathcal{D}$ on BA gives $\mathcal{D}'(\cdot) = \mathcal{D}(\cdot \otimes \omega)$ with $\mathcal{D}'\mathcal{Q} = \mathcal{D}(\mathcal{Q} \otimes repl\ \omega)$. (iii) Check V04 and Section 's printed W_{corr}.

par *Non-claim.* The literal equation $\delta_{leak}(\mathcal{Q} \otimes repl\ \omega) = \delta_{leak}(\mathcal{Q})$ of the package is ill-typed, because δ_{leak} is a property of a dilation's complete complement, not of the channel $\mathcal{Q}$; the statement proved is (i)–(ii) (PC-7). If the report depends on the input, leakage can change (check N09). Classicality must be established for the complete retained output, not for selected marginals. par

Conditional cosmological extrapolations

The plan t330u proposes six extrapolations of the central theorems towards open-system models of primordial perturbations, and a programme with four criteria. This section turns each into a *conditional theorem*: if a model supplies the declared finite data, the stated consequence follows, on the finite carrier or on a declared host. Each proof is complete and uses only definitions printed in this paper; each result has an explicit attaining witness and a non-claim. Three arXiv records motivate the questions and are cited only for what their abstracts and texts state [MartinVennin2018a,MartinVennin2018b,Burgess2022]; each is a source record; not a premise. Appendix records the verdicts, the plan corrections and the citation check.

Definition. A *supplied model* is a hosted probe extension $W: C \to R \otimes X$ (Definition , with the complete complement written on X), together with a declared splitting $X = S_1 \otimes \cdots \otimes S_n$ into *sectors* and, where stated, a declared host and modes (Theorem). For a Hermitian $O \ne 0$ on X the *joint witness* is $w_O(\rho_1, \rho_0) = Tr\,(O\,\mathcal{C}_X(\rho_1 - \rho_0))$ and its normalized response is $\gamma_O^{joint} = \sup_{\rho_0,\rho_1} |w_O|/(2\|O\|_\infty)$. An observable acts on k sectors if it is a sum of terms $A \otimes I$ with A supported on at most k of the S_i; an m-point correlator is the expectation of a product of m single-sector observables on m distinct sectors. The words ``environment", ``probe" and ``higher order" refer to these declared finite objects only.

Lemma. If the complete complement has the form $\mathcal{C}_X(\rho) = \sum_j \rho_{jj}\,\omega_j$ for states $\omega_0, \ldots, \omega_{d-1}$ on X (for example if R holds a copy of the code label), then $\delta_{leak}(W) = \min_{\sigma} \max_j D(\omega_j, \sigma)$, and

$$\tfrac{1}{2}\max_{i,j} D(\omega_i, \omega_j) \le \delta_{\mathrm{leak}}(W) \le \min_{k} \max_{j} D(\omega_j, \omega_k).$$

For $d = 2$, $\delta_{leak}(W) = 1/2 D(\omega_0, \omega_1)$.

Proof. The proof of Theorem uses only the classical–quantum form of the complement and applies verbatim with P_j replaced by ω_j and $E \otimes G$ by X. The lower bound is the triangle inequality and the upper bound is the choice $\sigma = \omega_k$. For $d = 2$ the midpoint $\sigma = 1/2(\omega_0 + \omega_1)$ has $D(\omega_j, \sigma) = 1/2 D(\omega_0, \omega_1)$, which meets the lower bound.

par *Non-claim.* This is not a cosmological prediction: it is a finite-dimensional identity about declared states, not a statement about any field. par

Correlation-hidden signatures

Theorem. Let a model supply W and sectors as in Definition .

• For every Hermitian $O \ne 0$ on X, $\gamma_O^{joint} \le diam\ \mathcal{C}_X(\mathcal{D}(C)) \le 2\delta_{leak}(W)$, and $\sup_O \gamma_O^{joint} = diam\ \mathcal{C}_X(\mathcal{D}(C))$. If $\mathcal{C}_X$ is classical–quantum as in Lemma , then also $\delta_{leak}(W) \le \sup_O \gamma_O^{joint}$, and for $d = 2$ $\sup_O \gamma_O^{joint} = 2\delta_{leak}(W)$.

• If every reduced state of $\mathcal{C}_X(\rho)$ on at most k sectors is independent of ρ, then every observable acting on at most k sectors has zero witness; in particular every m-point correlator with $m \le k$ is input-independent, and a nonzero witness requires an observable acting on at least $k + 1$ sectors.

• *Attaining witness.* For $n \ge 2$ qubit sectors and $t \in [0, \pi/2]$ let $|\Gamma_t\rangle = (e^{it}|0\cdots0\rangle + e^{-it}|1\cdots1\rangle)/\sqrt{2}$ and $W_{n,t}|j\rangle = |j\rangle_R|\Gamma_{jt}\rangle_X$ ($j = 0, 1$). Every reduced state on at most $n - 1$ sectors equals $1/2(|0\cdots0\rangle\langle0\cdots0| + |1\cdots1\rangle\langle1\cdots1|)$ for both inputs, $\delta_{leak}(W_{n,t}) = 1/2 \sin t$, and the *product* observable (Pauli matrices σ_x, σ_y) $O_t = \sigma_x^{\otimes(n-1)} \otimes (\sin t\,\sigma_x + \cos t\,\sigma_y)$, $\|O_t\|_\infty = 1$, has $|w_{O_t}(proj\ 1, proj\ 0)| = 2 \sin t$; hence $\gamma_{O_t}^{joint} = \sin t = 2\delta_{leak}(W_{n,t})$, and (i) is attained by an n-point correlator.

• *Scope of the hidden-size bound.* The bound $D \le h(\sigma)$ of Theorem (iii) holds for pure complete-complement outputs only; for mixed outputs it fails (Proposition). The bounds in (i) hold for all outputs.

Proof. (i) For code states ρ_0, ρ_1, trace-norm duality gives $|w_O| \le \|O\|_\infty \|\mathscr{C}_X(\rho_1) - \mathscr{C}_X(\rho_0)\|_1 \le 2\|O\|_\infty diam$, and a Helstrom observable of a diameter-realizing pair attains the supremum. For any σ, $D(\mathscr{C}_X(\rho_1), \mathscr{C}_X(\rho_0)) \le D(\mathscr{C}_X(\rho_1), \sigma) + D(\mathscr{C}_X(\rho_0), \sigma) \le 2d_\diamond(\mathscr{C}_X, repl\ \sigma)$; minimizing over σ gives $diam \le 2\delta_{leak}$. In the classical–quantum case the diameter is $\max_{i,j} D(\omega_i, \omega_j)$ by joint convexity (as in Theorem), so Lemma gives $\delta_{leak} \le diam$ and, for $d = 2$, $\delta_{leak} = 1/2 diam$. (ii) For A supported on a set S of at most k sectors, $Tr((A \otimes I)\mathscr{C}_X(\rho)) = Tr(A\, Tr_{S^c}\, \mathscr{C}_X(\rho))$, which is independent of ρ; sums of such terms inherit this. (iii) Since $e^{\pm it} = \cos t \pm i \sin t$, $|\Gamma_t\rangle = \cos t\, |\Gamma_0\rangle + i \sin t\, |\Gamma^{-}\rangle$ with $|\Gamma^{-}\rangle = (|0\cdots0\rangle - |1\cdots1\rangle)/\sqrt{2}$, so $\langle\Gamma_0|\Gamma_t\rangle = \cos t$ and $D(\Gamma_0, \Gamma_t) = \sin t$. Tracing any nonempty set of sectors kills the coherence $|0\cdots0\rangle\langle1\cdots1|$ because $\langle1|0\rangle = 0$ on a traced sector, which gives the reduced states. Lemma gives $\delta_{leak} = 1/2 \sin t$. A product of n off-diagonal single-qubit factors maps $|0\cdots0\rangle$ to a multiple of $|1\cdots1\rangle$ and back, so only the coherences of Γ_t contribute, and $\langle\Gamma_t|\sigma_x^{\otimes n}|\Gamma_t\rangle = \cos 2t$ and $\langle\Gamma_t|\sigma_x^{\otimes(n-1)} \otimes \sigma_y|\Gamma_t\rangle = Re(-ie^{-2it}) = -\sin 2t$. Hence $\langle O_t\rangle_{\Gamma_t} - \langle O_t\rangle_{\Gamma_0} = \sin t(\cos 2t - 1) - \cos t \sin 2t = -2 \sin t$. The single-qubit factor $\sin t\, \sigma_x + \cos t\, \sigma_y$ has eigenvalues ±1, so $\|O_t\|_\infty = 1$. (iv) is Theorem and Proposition (check Y01).

par *Non-claim.* This is not a cosmological prediction. The sectors are declared qubits, not Fourier modes, and an n -point correlator here is a finite product observable, not a bispectrum or trispectrum. For $n = 4$ the family is a finite analogue of the pattern ``lower-order statistics fixed, a higher-order joint statistic responds"; it is not a model of the Lindblad calculation of [MartinVennin2018b], where the power spectrum is also corrected. par

Coherence–leakage trade-off

Definition. For a qubit code and a hosted extension W with accessible channel $\mathscr{N}_W = Tr_X(W \cdot W^\dagger)$, call a channel $\mathscr{D}$ on the accessible output *label preserving* if $\mathscr{D}\mathscr{N}_W(proj\ j) = proj\ j$ for $j = 0, 1$. The retained coherence is $c(W) = \sup_{\mathscr{D}} |\langle0|\mathscr{D}\mathscr{N}_W(kb\ 01)|1\rangle|$ over label-preserving $\mathscr{D}$ (and $c(W) = 0$ if there is none). Write $\omega_j = \mathscr{C}_X(proj\ j)$ for the environment records and $F(\omega_0, \omega_1) = \|\sqrt{\omega_0}\sqrt{\omega_1}\|_1$ for the fidelity.

Theorem.

• *Pure controlled probes.* For the controlled-probe carrier of Definition with $d = 2$, tracing the probe multiplies the coherence $kb\ 10$ by $\langle\varphi_0|\varphi_1\rangle$; with $v = |\langle\varphi_0|\varphi_1\rangle|$,

$$c(W_U) = v, \qquad D_{\mathrm{probe}} = \sqrt{1 - v^2}, \qquad v^2 + 4\delta_{\mathrm{leak}}(W_U)^2 = 1.$$

• *Every carrier.* For every hosted extension W of a qubit code and every label-preserving $\mathscr{D}$ with coherence $c_{\mathscr{D}} = |\langle0|\mathscr{D}\mathscr{N}_W(kb\ 01)|1\rangle|$,

$$c_{\mathscr{D}} \le F(\omega_0, \omega_1), \qquad c_{\mathscr{D}}^2 + 4\delta_{\mathrm{leak}}(W)^2 \le 1.$$

Hence $c(W)^2 + 4\delta_{leak}(W)^2 \le 1$ and $c(W)^2 + D(\omega_0, \omega_1)^2 \le 1$.

• *Mixed probe records and sharpness.* If $W|j\rangle = |j\rangle_{R_1}|\chi_j\rangle_{R_2X}$ with $R = R_1 \otimes R_2$ retained, then $\delta_{leak}(W) = 1/2 D(\omega_0, \omega_1)$, $c(W) = F(\omega_0, \omega_1)$, and $F^2 + 4\delta_{leak}^2 \le 1$, with equality if and only if $D(\omega_0, \omega_1)^2 = 1 - F(\omega_0, \omega_1)^2$, in particular when the ω_j are pure. The inequality is strict for χ_0 a maximally entangled pair and $\chi_1 = |00\rangle$: $\omega_0 = I/2$, $\omega_1 = proj\ 0$, $c = 1/\sqrt{2}$, $\delta_{leak} = 1/4$, and $c^2 + 4\delta_{leak}^2 = 3/4$.

• *Several alternatives.* For the controlled-probe carrier with $d \ge 2$ and pairwise coherences $v_{ij} = |\langle\varphi_i|\varphi_j\rangle|$,

$$1 - \min_{i,j} v_{ij}^2 \le 4\delta_{\mathrm{leak}}(W_U)^2, \qquad \delta_{\mathrm{leak}}(W_U)^2 \le 1 - \max_k \min_j v_{jk}^2.$$

The first is an equality for $d = 2$ and can be strict for $d = 3$: the equilateral qubit triple has $v_{ij} = 1/2$ and $\delta_{leak} = 1/2$, so $4\delta_{leak}^2 = 1 > 3/4$.

Proof. (i) $\mathscr{N}_W(U(kb\ jk)) = \langle\varphi_k|\varphi_j\rangle kb\ jk$, so the $kb\ 10$ entry carries $\langle\varphi_0|\varphi_1\rangle$ and the identity decoder is label preserving with coherence v; (ii) gives $c \le F(P_0, P_1) = v$. Theorem gives $D_{probe} = \sqrt{1 - v^2}$ and Lemma gives $\delta_{leak} = 1/2 D_{probe}$. (ii) Let $V_{\mathscr{D}}$ be a Stinespring isometry of $\mathscr{D}$ into $C \otimes F^{'}$. Then $W^{'} = (V_{\mathscr{D}} \otimes I_X)W$ is a Stinespring isometry of $\mathscr{D}\mathscr{N}_W$. Because $\mathscr{D}\mathscr{N}_W(proj\ j) = proj\ j$ is pure, $W^{'}|j\rangle = |j\rangle \otimes |\xi_j\rangle$ with

$|\xi_j\rangle \in F^{'} \otimes X$, so $\mathscr{D}\mathscr{N}_W(kb\ 01) = \langle\xi_1|\xi_0\rangle kb\ 01$ and $c_{\mathscr{D}} = |\langle\xi_0|\xi_1\rangle|$. Since $V_{\mathscr{D}}$ acts on R only, $Tr_{F^{'}} |\xi_j\rangle\langle\xi_j| = \omega_j$; Uhlmann's theorem (the overlap of two purifications is at most the fidelity of the purified states) gives $c_{\mathscr{D}} \le F$. The complement of $\mathscr{D}\mathscr{N}_W$ on $F^{'} \otimes X$ is $\rho \mapsto \sum_j \rho_{jj}|\xi_j\rangle\langle\xi_j|$, whose leakage is $1/2\sqrt{(1 - c_{\mathscr{D}}^2)}$ by Lemma and Theorem . Tracing out $F^{'}$ maps it to $\mathscr{C}_X$ and maps replacement channels to replacement channels, so by contractivity $\delta_{leak}(W) \le 1/2\sqrt{(1 - c_{\mathscr{D}}^2)}$. Finally $D(\omega_0, \omega_1) \le D(\xi_0, \xi_1) = \sqrt{(1 - c_{\mathscr{D}}^2)}$ by contractivity of $Tr_{F^{'}}$. (iii) R_1 removes the off-diagonal terms, so $\mathscr{C}_X$ is classical–quantum with records $\omega_j = Tr_{R_2} |\chi_j\rangle\langle\chi_j|$, and Lemma gives the leakage. By Uhlmann's theorem there is a unitary U on R_2 with $\langle\chi_0|(U \otimes I)\chi_1\rangle = F$ (the χ_j purify ω_j in the same space); the decoder that applies U to R_2 controlled on $|1\rangle_{R_1}$ and then discards R_2 is label preserving with coherence F, and (ii) gives $c \le F$. Purifications ψ, φ with $|\langle\psi|\varphi\rangle| = F$ give $D(\omega_0, \omega_1) \le \sqrt{(1 - F^2)}$, so $F^2 + 4\delta_{leak}^2 = F^2 + D^2 \le 1$, with the stated equality condition. In the example $F(I/2, proj\ 0) = Tr\ \sqrt{(1/2 proj\ 0)} = 1/\sqrt{(2)}$ and $D(I/2, proj\ 0) = 1/2$. (iv) Lemma with $D(P_i, P_j) = \sqrt{(1 - v_{ij}^2)}$. The triple $\varphi_k = (\cos(k\pi)/3, \sin(k\pi)/3)$ has $v_{ij} = 1/2$; its leakage $\delta_{leak} = 1/2$ (with $D_{probe} = \sqrt{(3)}/2$) is the trine example of Theorem ; check Y02 recomputes all items by semidefinite programmes.

par *Non-claim.* This is not a cosmological prediction. The pure identity $v^2 + 4\delta_{leak}^2 = 1$ is specific to pure controlled probes; the inequality of (ii) holds for every finite carrier. A model that supplies a retained coherence c and a leakage δ_{leak} with $c^2 + 4\delta_{leak}^2 > 1$ is not a finite carrier of this kind. When R is not a copy of the label, ``coherence" means the decodable coherence $c(W)$ of Definition ; no decoherence rate is computed. par

The gradient sampler

Fix a declared host chart $U \subset \mathbb{R}^m$ with coordinates x, a prescribed scalar curvature $\mathcal{R} \in C^3(U)$, and a convex compact $K \subset U$. Write $\nabla\mathcal{R}$ for the coordinate gradient, $|\cdot|$ for Euclidean norms in the chart, $G_K = \sup_K |\nabla\mathcal{R}|$ and $M_3 = \sup_K \|\nabla^3\mathcal{R}\|$ (operator norm of the trilinear form). A *profile* is a probability measure μ on $\mathbb{R}^m$ with support in the closed unit ball, mean zero and second moment $s_2 = \int |y|^2\, d\mu \le 1$. The *translated modes* of width $w > 0$ at centres x_0, x_1 are $f_a \in L^2(U, dvol_h)$ with $\int g|f_a|^2\, dvol_h = \int g(x_a + wy)\, d\mu(y)$ for bounded measurable g (take $f_a = (\, d\mu_a/\, dvol_h)^{1/2}$ when the translated measure has a density). Write $\Delta x = x_1 - x_0$, $\bar{x} = 1/2(x_0 + x_1)$ and $\mathcal{R}_a = \int |f_a|^2 \mathcal{R}\, dvol_h$ for the sampled averages (written κ_a in Corollary ; they are curvature averages, not a coefficient).

Theorem. Assume $|\Delta x| > 2w$, so the modes have disjoint supports and $O_{\mathcal{R}} = diag(\mathcal{R}_0, \mathcal{R}_1)$, and assume K contains both balls $B(x_a, w)$. For the arc carrier of Theorem with endpoints $\theta_{\pm}$ (code $|0\rangle \mapsto b_{\theta_{-}}$, $|1\rangle \mapsto b_{\theta_{+}}$) the sampler witness is

$$w_{O_{\mathcal{R}}}(\mathrm{proj}\,1, \mathrm{proj}\,0) = (\overline{\mathcal{R}}_1 - \overline{\mathcal{R}}_0)\sin(\theta_- + \theta_+)\sin\Delta,$$

which is $(\mathcal{R}_1 - \mathcal{R}_0)\sin^2\eta$ for the family $\theta_{-} = 0$, $\theta_{+} = \eta$ of Corollary . Moreover:

• *Antisymmetry and constancy.* Exchanging x_0 and x_1 changes the sign of w exactly; if $\mathcal{R}$ is constant on K, then $w = 0$ for every coupling, whatever the size of the constant.

• *Gradient bound.* $|\mathcal{R}_1 - \mathcal{R}_0| \le |\Delta x|\, G_K$.

• *Expansion with remainder.*

$$|\overline{\mathcal{R}}_1 - \overline{\mathcal{R}}_0 - \Delta x \cdot \nabla\mathcal{R}(\bar{x})| \le M_3|\Delta x|\left(\frac{|\Delta x|^2}{24} + \frac{w^2 s_2}{2}\right) \le \frac{M_3|\Delta x|^3}{6}.$$

• *Weak coupling.* For $0 \le \eta \le \pi/2$, $\eta^2 - (\eta^4)/3 \le \sin^2\eta \le \eta^2$, so $w = \eta^2\, \Delta x \cdot \nabla\mathcal{R}(\bar{x}) + E$ with $|E| \le \eta^2 M_3|\Delta x|^3/6 + (\eta^4)/3|\Delta x rvert G_K$.

• *Ordering.* Let region A have $G_{K_A} \le G_A$ (any magnitude of $\mathcal{R}$), and let region B have a direction e with $|e \cdot \nabla\mathcal{R}(\bar{x}_B)| = g_B$. For samplers with the same separation $s = |\Delta x|$ ($\Delta x = se$ in B) and the same arc,

$$|w_A| \le \sin^2\eta\; s\, G_A, \qquad |w_B| \ge \sin^2\eta\,(s\, g_B - M_{3,B}s^3/6),$$

so $|w_B| > |w_A|$ whenever $g_B - M_{3, B}s^2/6 > G_A$ and $\sin\eta \ne 0$; a region of constant curvature ($G_A = 0$) of arbitrary size responds less than any region with a nonzero gradient at small enough s.

Proof. The witness formula is the computation in the proof of Theorem (ii) applied to $O_{\mathcal{R}}$ ($o_{\pm} = \mathcal{R}_0 +$

(ℛ_1 − ℛ_0)sin^2 θ_{±} and *sin^2 θ_{+} − sin^2 θ_{−} = sin (θ_{−} + θ_{+})sin Δ*); disjoint supports make *O_{ℛ}* diagonal (Corollary). (i) The swap exchanges *ℛ_0* and *ℛ_1*; constancy is Theorem . (ii) *ℛ_1 − ℛ_0 = ∫ [ℛ(x_1 + wy) − ℛ(x_0 + wy)] dμ(y)*, and the segment from *x_0 + wy* to *x_1 + wy* lies in *K* by convexity; apply the mean value theorem. (iii) Put *z = x̄ + wy* and *g(s) = ℛ(z + sΔx)* for *|s| ≤ 1/2*. Taylor's theorem with Lagrange remainder for *g(1/2) − g(−1/2)* gives *g^{'}(0) + 1/48(g^{'''}(s_1) + g^{'''}(s_2))*, so *|g(1/2) − g(−1/2) − Δx · ∇ℛ(z)| ≤ M_3|Δx|^3/24*. Next *Δx · ∇ℛ(z) = Δx · ∇ℛ(x̄) + w ∇^2ℛ(x̄)[Δx, y] + r* with *|r| ≤ 1/2w^2|y|^2|ΔxrvertM_3*. Integrating against *μ*, the linear term vanishes because *μ* has mean zero; this gives the first bound. With *w < |Δx|/2* and *s_2 ≤ 1, 1/24 + 1/8 = 1/6*. (iv) *sin^2 η = 1/2(1 − cos 2η)* and *u^2/2 − u^4/24 ≤ 1 − cos u ≤ u^2/2*; then combine (ii) and (iii) with *|sin^2 η − η^2| ≤ η^4/3*. (v) (ii) on *A* and (iii) on *B* (check Y03).

par *Non-claim.* This is not a cosmological prediction. The gradient is a coordinate gradient in a declared chart; the curvature is prescribed and unchanged by the coupling; a sampled difference is not backreaction and the probe is not a gravitational degree of freedom. The remainder bounds are stated for the declared profile class (mean zero, unit support). par

Proposition. On settled Host B with *ℛ_B(ℓ) = −2b^2/(a_{∞}^2(ℓ^2 + b^2)^2)* (Theorem), take modes whose profile is uniform in *ℓ* on *[ℓ_a − w, ℓ_a + w]* times a fixed transverse probability in *(φ, z)*, inside *|ℓ| < L_0*. Then

$$\mathcal{R}_B'(\ell) = \frac{8b^2\ell}{a_\infty^2(\ell^2+b^2)^3}, \qquad \mathcal{R}_B'''(\ell) = \frac{48b^2\ell(5\ell^2-3b^2)}{a_\infty^2(\ell^2+b^2)^5},$$

$$\overline{\mathcal{R}}_a = \frac{\Phi(\ell_a+w)-\Phi(\ell_a-w)}{2w}, \qquad \Phi(\ell) = -\frac{1}{a_\infty^2}\left(\frac{\ell}{\ell^2+b^2}+\frac{1}{b}\arctan\frac{\ell}{b}\right).$$

The mirror placement *ℓ_1 = −ℓ_0* gives *ℛ_1 = ℛ_0* exactly, hence zero witness for every coupling, although *|ℛ_B|* is largest at the throat. For *b = 1, a_{∞} = 1. 3, ℓ = 0. 5, Δℓ = 0. 1, w = 0. 045* (and *L_0 > 0. 6*) the exact difference is *ℛ_1 − ℛ_0 = 0. 120569*, the leading term is *Δℓ ℛ_B^{'}(ℓ) = 0. 121183*, the error *6. 14 × 10^{−4}* lies below *M_3Δℓ^3/6 = 1. 96 × 10^{−3}* (*M_3 = 11. 73*, the maximum of *|ℛ_B^{'''}|* on *[0. 405, 0. 595]*), and at *ℓ = 0. 2*, with *w = 0. 45 Δℓ*, the error falls by a factor *7. 77* when *Δℓ* is halved from *0. 2* to *0. 1*; the mirror averages at *ℓ = ±0. 3, w = 0. 045*, are both *−0. 995448*.

Proof. Differentiation gives *Φ^{'} = ℛ_B* (*d/(dℓ)ℓ/(ℓ^2 + b^2) = (b^2 − ℓ^2)/((ℓ^2 + b^2)^2)* and *d/(dℓ)1/barctan ℓ/b = (ℓ^2 + b^2)/((ℓ^2 + b^2)^2)*) and the displayed derivatives. Since *ℛ_B* depends on *ℓ* only, the average is the *ℓ*-average. *ℛ_B* is even, so mirror intervals have equal averages. The numbers are exact evaluations of the closed form (check Y03); the hypotheses of Theorem hold in the one-dimensional chart *ℓ* with *s_2 = 1/3*.

par *Non-claim.* This is not a cosmological prediction. The numerical values are an illustration on declared values of *b, a_{∞}* and the placement; they are not a measurement, a field amplitude or a coefficient. No Host-B field transfer is constructed. par

Spectator exclusion

Theorem. Let *W_0 = V ⊗ |g_h⟩* and *W* be as in Theorem , with *D(𝒞_G(ρ), g_h) ≤ ε* for every code state. Put, for *0 ≤ γ ≤ 1*,

$$\varepsilon_*(\gamma) = \sin\left(\tfrac{1}{2}\arcsin\gamma\right) = \sqrt{\frac{1-\sqrt{1-\gamma^2}}{2}}.$$

• If a model supplies an observable *O ≠ 0* with normalized response *γ_O(W) ≥ γ*, then *ε ≥ ε_{*}(γ)*. Equivalently, every implementation with *ε < ε_{*}(γ)* is excluded. In unnormalized form, *|w_O| ≤ spr (O)* and *ε ≥ ε_{*}(|w_O|/spr (O))*.

• *ε_{*}* is increasing, *γ/2 ≤ ε_{*}(γ) ≤ γ/√(2), ε_{*}(3/5) = √(1/10)*, and *ε_{*}(1) = 1/√(2)*. For *ε ≥ 1/√(2)* no response level is excluded, since *b(ε) = 1*.

• *Sharpness.* For every *γ ∈ [0, 1]* the attaining family of Theorem (iii) with *sin t = ε_{*}(γ)* has *ε = ε_{*}(γ)* and response exactly *γ*; no larger threshold is valid.

Proof. On *[0, π/4], b(sin t) = 2sin tcos t = sin 2t*, so *b* is a continuous increasing bijection of *[0, 1/√(2)]* onto *[0, 1]* with inverse *ε_{*}*; *sin^2 t = 1/2(1 − cos 2t)* with *cos 2t = √(1 − γ^2) ≥ 0* gives the radical form. (i) Theorem (i) gives *γ ≤ γ_O ≤ b(ε)*; if *ε ≥ 1/√(2)* the claim holds since *ε_{*} ≤ 1/√(2)*, and otherwise apply *ε_{*}*. The

unnormalized form uses $|w_O| \le spr\ (O)b(\varepsilon)$. (ii) $b(\varepsilon) \le 2\varepsilon$ gives $\varepsilon_{*} \ge \gamma/2$; $sin\ 2t = 2sin\ t cos\ t \ge \sqrt{(2)} sin\ t$ for $t \le \pi/4$ gives $\varepsilon_{*} \le \gamma/\sqrt{(2)}$; at $\gamma = 3/5$, $cos\ 2t = 4/5$ and $sin^2\ t = 1/10$. (iii) is Theorem (iii) (check Y04).

par *Non-claim.* This is not a cosmological prediction. ε is a trace or half-diamond distance between declared channels, not an experimental error bar; converting a data uncertainty into ε needs a declared noise model, which is not supplied. par

Degeneracy is not removed by precision
Theorem.

• Let a model supply, for every precision index (a number n of repetitions and a noise level), a data law obtained by applying a declared kernel to the admitted datum $D_{adm}(h, W)$ of Theorem , possibly adaptively, each step depending on (h, W) only through D_{adm}. If $D_{adm}(h, W_0) = D_{adm}(h, W_1)$ and $d_Y(T_0, T_1) = \Delta > 0$, then for every precision index and every randomized estimator $\hat{T}$, $\max_k \mathbb{E}\ d_Y(\hat{T}, T_k) \ge \Delta/2$.

• *One separating observable.* For the arc family W_{η} ($\theta_{-} = 0$, $\theta_{+} = \eta \in [0, \pi/2]$) of Theorem , prepare the code state $|1\rangle$, apply W_{η} and measure $\{|g_1\rangle\langle g_1|, I - |g_1\rangle\langle g_1|\}$ on the probe, n independent times; the outcome frequency is $\hat{p}_n$ with mean $p = sin^2\ \eta$. The estimator $\hat{L}_n = 1/2\sqrt{(\hat{p}_n)}$ of $\delta_{leak}(W_{\eta}) = 1/2 sin\ \eta$ satisfies

$$\sup_{\eta} \mathbb{E}\left|\widehat{L}_n - \delta_{\mathrm{leak}}(W_\eta)\right| \le \frac{1}{2\sqrt{n}},$$

and $(\lambda_1 - \lambda_0)\hat{p}_n$ estimates the rod witness with error at most $|\lambda_1 - \lambda_0|/(2\sqrt{(n)})$.

• *Two accounts.* If the separating datum has outcome probabilities $p_0 \ne p_1$ under two accounts, the likelihood-ratio test errs with probability at most $1/2\ BC^n$, $BC = \sqrt{(p_0 p_1)} + \sqrt{((1 - p_0)(1 - p_1))} < 1$.

Proof. (i) Equal admitted data give equal laws of the whole record at every precision index (for adaptive designs by induction over steps), so a randomized estimator has the same output law under both accounts. The triangle inequality $\Delta \le d_Y(y, T_0) + d_Y(y, T_1)$ holds pointwise; take expectations and the maximum. (ii) $|\sqrt{(\hat{p})} - \sqrt{(p)}| = |\hat{p} - p|/(\sqrt{(\hat{p})} + \sqrt{(p)}) \le |\hat{p} - p|/\sqrt{(p)}$ for $p > 0$, and $\mathbb{E}|\hat{p} - p| \le \sqrt{(p(1 - p)/n)}$, so $\mathbb{E}|\sqrt{(\hat{p})} - \sqrt{(p)}| \le \sqrt{((1 - p)/n)} \le 1/\sqrt{(n)}$; at $p = 0$, $\hat{p} = 0$. The rod witness is $(\lambda_1 - \lambda_0)p$ by Theorem , and $\mathbb{E}|\hat{p} - p| \le 1/(2\sqrt{(n)})$. (iii) The error of the likelihood-ratio test with equal priors is $1/2 \sum_x min\ (P_0^n(x), P_1^n(x)) \le 1/2 \sum_x \sqrt{(P_0^n P_1^n)} = 1/2 BC^n$; $BC < 1$ by the equality case of Cauchy–Schwarz (check Y05: exact binomial sums for $n \le 10^4$).

par *Non-claim.* This is not a cosmological prediction and refers to no survey. The separating datum is coupling sensitive by construction, so it is not admitted data of Theorem ; the theorem identifies what must be added, not that it is available. par

Classical records and a small register
Theorem.

• In the access model of Definition , a model that claims $F_e \ge f$ must have $k \ge \lceil fd \rceil$ (Theorem).

• *Pre-shared systems.* Suppose the encoder instrument is $\mathcal{N}_x: \mathcal{B}(C \otimes A) \to \mathcal{B}(K)$, $dim\ K = k$, applied to $\rho \otimes \beta_{AB}$ for a fixed state β_{AB}, and the decoder acts on the record, K and B, $dim\ B = d_B$. Then $F_e \le min\ \{1, kd_B/d\}$. The bound is attained by Λ_k ($d_B = 1$) and by teleportation ($k = 1$, $d_B = d$, Proposition).

• *Converse: classical-looking records with full recovery.* Let X_d, Z_d be the shift and clock operators and $T_{ab} = X_d^a Z_d^b$. The instrument $\mathcal{N}_{ab}(\rho) = d^{-2} T_{ab} \rho T_{ab}^{\dagger}$ ($a, b \in \mathbb{Z}_d$, $K = \mathbb{C}^d$) has a record distributed uniformly for every input and register marginal $\sum_{a,b} \mathcal{N}_{ab}(\rho) = Tr\ (\rho) I/d$ for every input, yet the record-dependent decoder $\mathcal{D}_{ab} = Ad_{T_{ab}^{\dagger}}$ gives the identity channel and $F_e = 1$.

Proof. (i) is the contrapositive of $F_e \le k/d$. (ii) The map $\mathcal{M}_x(\rho) = \mathcal{N}_x(\rho \otimes \beta_{AB})$ (with B untouched) is completely positive from $\mathcal{B}(C)$ to $\mathcal{B}(K \otimes B)$: if $\beta = \sum_i q_i |\beta_i\rangle\langle\beta_i|$ and $\mathcal{N}_x$ has Kraus operators $A_{x,a}$, its Kraus operators are $\sqrt{(q_i)}(A_{x,a} \otimes I_B)(I_C \otimes |\beta_i\rangle)$, maps $C \to K \otimes B$. Every Kraus operator of $\sum_x \mathcal{D}_x \mathcal{M}_x$ therefore factors through $K \otimes B$ and has rank at most kd_B; the Cauchy–Schwarz step of Theorem gives $F_e \le kd_B/d$. (iii) $\sum_b Z_d^b \rho Z_d^{-b} = d\,diag\ (\rho)$ and $\sum_a X_d^a diag\ (\rho) X_d^{-a} = Tr\ (\rho) I$, so the register marginal is $Tr\ (\rho) I/d$; $Tr\ \mathcal{N}_{ab}(\rho) = d^{-2} Tr\ \rho$. The composite Kraus operators are $d^{-1} T_{ab}^{\dagger} T_{ab} = I/d$, and $F_e = d^{-2} \sum_{a,b} |Tr\ (I/d)|^2 = 1$ (check Y06).

par *Non-claim.* This is not a cosmological prediction. Each of the record and the register alone is input independent, so no marginal test sees the input, while the complete output recovers it: classical-looking records do not establish that the complete output is classical. No radiation process is modelled. par

The primordial coherence–environment programme

Proposition. Let a model supply W, sectors $S_1, \ldots, S_n$, a joint observable O_J, and a weak-coupling class $\mathscr{W}_{\varepsilon} = \{W: \exists\, g \text{ pure on } X,\ D(\mathscr{C}_X(\rho), g) \le \varepsilon\ \forall \rho\}$. The criteria are declared requirements: (C1) every observable acting on at most $n - 1$ sectors has zero witness; (C2) $\gamma_{O_J}^{\text{joint}} > 0$; (C3) the retained coherence and the leakage are computed, with $c^2 + 4\delta_{\text{leak}}^2$ stated; (C4) a robustness bound $\gamma_{O_J}^{\text{joint}}(W) \le b(\varepsilon)$ on $\mathscr{W}_{\varepsilon}$ is stated.

• For every model, (C3) satisfies $c^2 + 4\delta_{\text{leak}}^2 \le 1$ (Theorem) and (C4) holds with the envelope b, so a joint response γ excludes $\mathscr{W}_{\varepsilon}$ for $\varepsilon < \varepsilon_*(\gamma)$ (Lemma and Theorem , applied on X). (C1) and (C2) together imply a nonconstant complete complement with $\delta_{\text{leak}} \ge \gamma_{O_J}^{\text{joint}}/2 > 0$ that no observable on fewer than n sectors detects.

• The model $W_{4,t}$ of Theorem (iii), $0 < t \le \pi/2$, meets (C1)–(C4) simultaneously: (C1) all one-, two- and three-sector statistics are input independent; (C2) O_t has $\gamma^{\text{joint}} = \sin t$; (C3) $c(W_{4,t}) = \cos t$, $\delta_{\text{leak}} = \tfrac{1}{2}\sin t$ and $c^2 + 4\delta_{\text{leak}}^2 = 1$; (C4) $W_{4,t} \in \mathscr{W}_{\sin(t/2)}$, $W_{4,t} \notin \mathscr{W}_{\varepsilon}$ for $\varepsilon < \sin(t/2)$, and $\sin(t/2) = \varepsilon_*(\sin t)$, so the exclusion threshold is attained.

Proof. (i) Theorem (ii). The proof of Theorem (i) uses only that the outputs lie in an ε-ball about a pure state, so it applies to $\mathscr{C}_X$; Theorem inverts b. The last statement is Theorem (i)–(ii). (ii) (C1)–(C3) are Theorem (iii) and Theorem (i) (the carrier is a controlled probe with $G = X$ and $\langle \Gamma_0 | \Gamma_t \rangle = \cos t$). (C4): the Fubini–Study angle $\arccos |\langle \psi | \varphi \rangle|$ is a metric on pure states and $D = \sin(\text{angle})$ for pure pairs; the angle between Γ_0 and Γ_t is t, so every pure g is at angle at least $t/2$ from one of them, and the normalized bisector $g \propto \Gamma_0 + \Gamma_t$ is at angle exactly $t/2$ from both. Finally $\arcsin(\sin t) = t$ for $t \le \pi/2$ (check Y07).

par *Non-claim.* This is not a cosmological prediction, and no cosmological claim is made. The criteria are declared requirements on finite data; the toy model meets them on declared data only and is not an inflationary model, a decoherence mechanism or a prediction. Whether an open-system primordial model meets (C1)–(C4) is not addressed here (Appendix). par

Limitations, standing boundaries, and open problems

Limitations

• Every host is prescribed. Nothing in this paper computes a metric, solves a field equation, selects a source law, or derives backreaction; a probe witness is a sampling response of a declared finite register.

• The probe register, its modes and the coupling are declared data. Theorem shows that coupling-blind data cannot replace that declaration; it does not exclude a different account in which a law fixes the coupling slot.

• The central inequalities are finite-dimensional. Several are standard facts (trace-norm duality, the triangle inequality, two-point minimax, Kraus-rank bounds, measure-and-prepare floors); what is specific to this paper is the typed interface in which they are applied and the sharp constants.

• The echo statement is local (Theorem (i)); the hidden-response bound $h(\sigma)$ is a pure-output statement (Theorem , Proposition); the side-register floor holds in the access model of Definition and fails outside it (Proposition).

• The conditional results of Section are finite-dimensional statements about supplied data. Their sectors, couplings and observables are declared, not derived from a primordial model; translating a constant reduced state into an unchanged angular power spectrum, or a half-diamond distance into a data uncertainty, requires a derivation that is not supplied.

• Numerical values marked as such (semidefinite maxima, the echo constants, grid evaluations) are records of computations, not theorems; exact rational certificates are identified where they exist.

Standing refusals (plan t322u, carried verbatim)

• No quantum coefficient. The coefficient slot stays unfilled.

• No Einstein dynamics, derived metric, spacetime emergence, de Sitter state, Page curve, or gravitational endpoint.

• Host A and Host B stay separate. Host C is not created.

• O.1 stays NOT_CLOSED. Gate 0 and ST4b stay NOT_SUPPLIED. XV-B is not opened. XVI-N is not discharged. H2, I3, J2, T3 stay unresolved. U6-sel is not moved.

• Magic is not leakage. Residual response is not geometric response. Readout-and-drop is not physical deletion.

• A finite probe witness is not an identification with a field or metric degree of freedom.

• Cited sheets, including OpenAI catalogue entries and Big05-A, are source records and are not premises.

• Parents are not revised. En05–En09 are not rewritten. This is a plan, not a registration. Wiring En04-B into the companion is a separate step; it is not taken here.

Standing boundary (v1, verbatim)

• No dimensional quantum coefficient is supplied to close the Big-series label slot, and no inherited characteristic quantum coefficient is admitted.

• No Einstein dynamics, derived metric, spacetime emergence, de Sitter quantum state, physical evaporation endpoint, or Page curve is constructed.

• Host A and Host B remain separate. Host C is not created. No Host-B field transfer is supplied.

• O.1 stays in the inherited prescription. Gate 0 and ST4b stay NOT_SUPPLIED. XV-B is not opened as a downstream quantum-admission exit. XVI-N and its unresolved Route-B obligations are not discharged. T3 stays unresolved, and U6-sel is not moved.

• The historical H2 ending is version-qualified to XIV-H. XIV-I's constructed internal I2 amplitude is not withdrawn. The full I3/J2 characteristic-map and later admission obligations are not supplied here [AnalyticRecords].

• Magic is not leakage. Residual response is not geometric response. Readout-and-drop is not physical deletion. A restore map with joint access does not relocate the diary.

Open problems

• *Mixed hidden response.* Determine *sup D(ω_0, ω_1)* over mixed outputs with equal *E*-marginals and *G*-marginal *σ*, as a function of *σ* and *dim E*. It exceeds *h(σ)* (Proposition); whether it is below *1* for *λ_max > 1/2* is open (numerically it is).

• *Robust no-hiding for leakage.* The distance constant *φ(δ)* is sharp (Theorem (ii)); the sharp constant in *δ_leak(W) ≤ δ_leak(𝒞_E) + c(δ)* is open.

• *A certified uniform echo constant.* An interval-arithmetic bound for *C_J(u_{*})* on a stated window, and a characterization of the windows on which *s* is monotone, are not supplied.

• *Conditional programme.* Whether an open-system primordial model with declared finite mode subspaces meets criteria (C1)–(C4) of Proposition is open; it is recorded as a conjecture, not asserted.

• *Coherence for several alternatives.* The exact relation between pairwise retained coherences and leakage for *d ≥ 3* lies between the two bounds of Theorem (iv); its sharp form is open.

• The standing items stay as recorded: no numerical *κ*; Gate 0 and ST4b NOT_SUPPLIED; O.1 NOT_CLOSED; T3, H2, I3, J2 unresolved. The version-2 open item ``optimality of *2√(δ)*" is closed: *2√(δ)* is not optimal and *φ(δ)* is (Theorem (ii), DC-20).

appendix

The framework of version 1 (archived)

The following appendices reproduce the hosting construction, the same-host blindness and supplied-probe certificates, the shredder cut, the operator-domain and apex certificates, dynamical hosting, the host fibres and the endpoint discussion of version 1, unchanged except for one subsection title (DC-24). They are cited from the main text where needed. Their proofs use only definitions printed in this paper.

The prescribed cone and ideal hosting

Geometric input and finite mode data

Fix

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

The regular conical product is

$$M_\mu = \mathbb{R}_T \times (0,\infty)_r \times (\mathbb{R}/2\pi\mathbb{Z})_\varphi \times \mathbb{R}_z, \qquad g_\mu = -c^2\,\mathrm{d}T^2 + \mathrm{d}r^2 + \alpha^2 r^2\,\mathrm{d}\varphi^2 + \mathrm{d}z^2.$$

This is the prescribed I-B host [IB]. The excluded axis becomes a worldsheet after adjoining z. In a developing chart, local spatial rods are

$$x = r\cos(\alpha\varphi), \qquad y = r\sin(\alpha\varphi), \qquad z = z.$$

The regular metric is locally flat. Its nontrivial global gluing is encoded by the deficit μ, with oriented holonomy convention fixed as in [IB].

Choose a relatively compact regular spatial laboratory U. Let

$$f_0, \ldots, f_{n-1} \in C_c^\infty(U)$$

be orthonormal for the prescribed spatial volume, and put

$$H_{\mathrm{mode}} = \mathrm{span}\,\{f_0, \ldots, f_{n-1}\}, \qquad G = H_{\mathrm{mode}} \otimes \mathbb{C}^2.$$

The choice of modes and internal two-dimensional frame is additional calibration data, not a canonical quantization.

For a real rod function q bounded on U, define

$$O_q = \Big[\int_U \overline{f_a}\, q f_b\,\mathrm{dvol}\Big]_{a,b} \otimes I_2.$$

Represent the supplied transverse holonomy by

$$H_\mu = I_{\mathrm{mode}} \otimes R_\mu,$$

where R_{μ} is the declared two-dimensional rotation. Its Hermitian parts

$$\frac{H_\mu + H_\mu^\dagger}{2}, \qquad \frac{H_\mu - H_\mu^\dagger}{2i}$$

are permissible probe observables. The deficit label can also be represented by μI_G. Regular curvature labels are zero on this laboratory.

These constructions use I-B data but do not turn G into the metric. In particular, changing the state of G does not change .

The separate destructive clock instrument

Let $K \cong \mathbb{C}^D$, $D = 2^q$, have an orthonormal reading basis $\{|\tau_k\rangle\}_{k=0}^{D-1}$. Write X for the classical record, so that X is not confused with radiation R. For any surviving register S, put

$$D_k = \langle \tau_k|_K \otimes I_S, \qquad \mathscr{M}_K(Z) = \sum_{k=0}^{D-1} |k\rangle\langle k|_X \otimes D_k Z D_k^\dagger.$$

The quantum name K is absent from the output interface. This is the finite instrument recorded by [IB]; we include the verification needed here.

Lemma. The map $\mathscr{M}_K$ is CPTP and

$$\mathrm{Tr}_X\, \mathscr{M}_K(Z) = \mathrm{Tr}_K\, Z.$$

Both identities hold after every untouched reference extension.

Proof. Its Kraus operators are $L_k = |k\rangle_X \otimes D_k$, and

$$\sum_k L_k^\dagger L_k = \sum_k |\tau_k\rangle\langle\tau_k|_K \otimes I_S = I_{KS}.$$

Expanding Z in the reading basis shows that both partial traces are the sum of its diagonal K-blocks. Tensoring these operator identities with an identity proves the reference statement.

par *Non-claim.* The clock record is not an event-time reconstruction and returns no quantum clock. par

Theorem. Fix the cone , a regular laboratory, a finite carrier $V\colon C \to R \otimes E$, and a clock basis and calibration. Under the declared ideal control contract that a finite unitary on laboratory registers is an allowed local primitive:

• V admits a finite hosted realization, after finite register padding if necessary;

• a clock initialized independently of the code can be read by without changing the carrier channel;

• a finite sequence of such local primitives can be assigned successive events on one regular timelike laboratory curve. The metric, deficit, time coordinate, calibration, and primitive control permissions are inputs. No metric is output, and no compilation into a fixed gate library or physical detector construction is asserted.

Proof. Embed the input and output registers into sufficiently large finite qubit registers. On the initialized input subspace, the columns prescribed by V are orthonormal. Complete them to an orthonormal basis of the padded output space. The resulting unitary realizes the isometry on the declared code subspace. Unused outputs are retained in the complete output ledger.

The static curve

$$T\text{longmapsto}\,(T, r_0, \varphi_0, z_0), \qquad r_0 > 0,$$

is timelike for . Assign the finitely many local primitives to increasing values of T. This is an ideal semantic placement; no interaction Hamiltonian or implementation accuracy follows from it.

For an independent clock state η_K, the joint channel is

$$\rho\text{longmapsto}\,\mathscr{M}_K(\eta_K) \otimes V\rho V^\dagger.$$

The clock factor is code-independent. Lemma gives the stated complete readout identity. None of the operations alters any coefficient of .

par *Non-claim.* Ideal semantic placement only; no gate compilation, detector construction, or metric output. par

Remark. A nontrivial distribution of calibrated clock readings at a fixed laboratory event is not an exact reconstruction of that event's time coordinate. Exact agreement with one fixed event time would force a deterministic reading when calibrated labels are distinct. This is the distinction recorded by [IB]. The clock consumes finite names, not the geometric time axis. Finite clock matrices also cannot satisfy an exact canonical commutator $[T, H] = iI$, since the traces of the two sides differ [IB].

Same-host blindness and a supplied probe witness

The explicit uncoupled extension

Definition. For host data h, choose a normalized vector $|g_h\rangle \in G$ independently of the code. The spectator extension of V is

$$W_h^{(0)}|\psi\rangle = V|\psi\rangle \otimes |g_h\rangle.$$

``Uncoupled'' means precisely this extension, or an explicitly specified equivalent channel factorization. It does not mean merely that a coupling has not been written down.

Theorem. For ,

$$\mathscr{C}_G^{(0)}(X) = \mathrm{Tr}\,(X)|g_h\rangle\langle g_h|, \qquad \mathscr{C}_{EG}^{(0)}(X) = \mathscr{C}_V(X) \otimes |g_h\rangle\langle g_h|.$$

Every observable constructed in Section , and every other fixed Hermitian matrix on G, is input-independent. Furthermore,

$$\delta_{\mathrm{leak}}(W_h^{(0)}) = \delta_{\mathrm{leak}}(V).$$

There are hosted carriers for which the entire code is recoverable from E, while $\mathscr{C}_G\^{(0)}$ is constant.

Proof. Partial traces give . Every probe expectation is therefore *Tr (O|g_h⟩⟨g_h|)Tr (X)*.

Appending a fixed state and tracing it out are channels. For any state *σ_E*,

$$d_\diamond(\mathscr{C}_V \otimes |g_h\rangle\langle g_h|, \mathscr{T}_{\sigma_E \otimes |g_h\rangle\langle g_h|}) = d_\diamond(\mathscr{C}_V, \mathscr{T}_{\sigma_E}).$$

This gives the upper bound in . Conversely, trace *G* from any candidate replacement on *EG*; contractivity gives the reverse bound after minimization.

For the final assertion, take $E \cong C$ and

$$V_{\text{diary}}|\psi\rangle = |0\rangle_R \otimes |\psi\rangle_E.$$

The *E*-channel is the identity, whereas *G* remains in *|g_h⟩⟨g_h|*. The metric is unchanged.

par *Non-claim.* A printed zero-coupling model is blind; silence about a coupling is not a zero coupling. par

This realizes the negative same-host certificate sought in the plan. Residual response need not be a response of any declared rod, holonomy, or curvature-label observable.

Remark. Without a declared *W*, no *𝒞_G* has been specified. One cannot infer its constancy from silence. Theorem proves constancy for a printed zero-coupling model. It also provides a counterexample to a universal implication from residual response to geometric-probe response.

Green-sector blindness

A field-derived quantity may enter the finite probe interface only after the relevant extension, state, smearing, and finite representation have been specified.

Definition. Fix host data *h*, including a named apex realization and any state or renormalization data used. An admissible representative is either:

• a finite host-dependent scalar *o(h)*, represented by *o(h)I_G*; or

• a declared Hermitian matrix *O(h)* obtained from well-defined smeared quantities and finite matrix elements. For case (ii), existence of all matrix elements and the required domains is part of the representative's declaration.

Corollary. Every representative of Definition is code-blind under spectator hosting.

Proof. The scalar case is immediate. The matrix case is Theorem applied to the fixed matrix *O(h)*.

par *Non-claim.* No field representation is constructed; Theorem names a printed observable. par

The source records supply scalar Green operators after a declared extension, local renormalized quantities, a charged current, and Krein product-extension constructions [IBG] [IBVP]. They do not supply the code-to-probe map. Corollary does not construct a new field representation or promote a local field result to a global state theorem. In particular, I-B-G's non-global-hyperbolicity record remains separate [IBG].

A positive certificate, explicitly supplied

Choose two disjointly supported normalized modes *f_0*, *f_1* in the same laboratory with distinct radial expectations. The compressed radial rod matrix has corresponding eigenvectors *|g_0⟩*, *|g_1⟩* and eigenvalues *λ_0 ≠ λ_1*, after fixing the internal frame.

Theorem. Let $C \cong R \cong \mathbb{C}\text{^}2$, let *E* be in a fixed pure state, and supply the controlled probe rotation

$$W_\eta|0\rangle = |0\rangle_R|e_0\rangle_E|g_0\rangle_G, \qquad W_\eta|1\rangle = |1\rangle_R|e_0\rangle_E(\cos\eta|g_0\rangle + \sin\eta|g_1\rangle)_G, \quad 0 \le \eta \le \frac{\pi}{2}.$$

For the radial rod observable *O_r*,

$$w_{O_r}(\text{proj } 1, \text{proj } 0) = (\lambda_1 - \lambda_0)\sin^2\eta.$$

For *0 < η ≤ π/2*, the complete residual responds. Nevertheless the metric , the deficit label *μI_G*, and the regular curvature labels are unchanged.

Proof. The two displayed columns are normalized and orthogonal because their *R*-labels are orthogonal. Thus *W_{η}* is an isometry. A unitary rotating *|g_0⟩* to *cos η|g_0⟩ + sin η|g_1⟩*, controlled by *R*, implements it on the initialized subspace.

The two *G*-outputs are the projectors onto the displayed probe vectors. Their rod expectations are

$$\lambda_0, \qquad \lambda_0 \cos^2\eta + \lambda_1 \sin^2\eta,$$

giving . Lemma proves residual response.

Only the state of the finite probe has changed. No rule in the construction changes *g_{μ}* or *μ*. A scalar observable *μI_G*, and the zero regular-curvature labels, have zero witness for every input.

par *Non-claim.* A supplied finite coupling, not an interaction law for a dynamical metric. par

Remark. This is a supplied finite carrier-to-probe coupling, hosted using the cone's own rod calibration. It is not an interaction law for a dynamical metric, a stress-to-curvature equation, or a physical field implementation. The finite controlled-rotation mechanism is already present in En04-A [En04A]; its role here is the additional host-calibrated observation interface. No novelty is claimed for the rotation family itself.

A necessary correlation correction

Proposition. Constancy of $\mathscr{C}_G$ does not imply that all residual response appears in the *E*-marginal. Both *E* and *G* marginals can be constant while the complete *EG*-channel responds.

Proof. Take qubits *E*, *G* and

$$|\Phi_\pm\rangle = \frac{|00\rangle \pm |11\rangle}{\sqrt{2}}, \qquad W|0\rangle = |0\rangle_R|\Phi_+\rangle_{EG}, \qquad W|1\rangle = |1\rangle_R|\Phi_-\rangle_{EG}.$$

Then

$$\mathscr{C}_{EG}(\rho) = \rho_{00}|\Phi_+\rangle\langle\Phi_+| + \rho_{11}|\Phi_-\rangle\langle\Phi_-|.$$

Its two basis outputs are orthogonal, hence different. Each marginal is *I_2/2* on every code state.

par *Non-claim.* No-hiding is not contradicted; the complete complement responds. par

Thus the statement that response ``lives in *E*'' is justified by the product factorization , not by geometric marginal blindness alone. This example does not contradict no-hiding: the complete complement *EG* is not constant, and it does not recover an arbitrary unknown qubit from the populations alone [NoHiding].

Proposition. Suppose a complete implemented channel $\mathscr{W}$ on $C \to REG$ is within half-diamond distance ε of the spectator channel $\mathscr{W}^{(0)}$. Then

$$\left|\widehat{w}_O(\rho_1, \rho_0)\right| \le 4\|O\|_\infty \varepsilon, \qquad \gamma_{\mathscr{O}_G}(\widehat{\mathscr{W}}) \le 2\varepsilon.$$

For any two complete complementary channels $\mathscr{C}_1$, $\mathscr{C}_2$,

$$|\delta_{\mathrm{leak}}(\mathscr{C}_1) - \delta_{\mathrm{leak}}(\mathscr{C}_2)| \mathrm{led}_\diamond(\mathscr{C}_1, \mathscr{C}_2).$$

Here leakage of a channel means its distance to the set of replacement channels.

Proof. Each implemented probe output is within trace distance ε of the same spectator state. Apply the triangle inequality to the two inputs and trace duality. For the second assertion, apply the triangle inequality through an arbitrary replacement channel, minimize, and interchange the two channels.

par *Non-claim.* The constant 2ε is not sharp (DC-8; Theorem). par

The radiation–shredder cut

Definition. A shredder on *R* is a finite classical-output channel

$$\mathscr{S}(Y) = \sum_x \mathrm{Tr}\,(M_x Y)|x\rangle\langle x|_X, \qquad M_x \ge 0, \quad \sum_x M_x = I_R.$$

At the shredder cut, the *complete decoder-accessible message-bearing output* is *X*. Every retained quantum side register must be included in the access description; it cannot be omitted because its marginal happens to be input-independent.

Theorem. Let $V\colon C \to R \otimes B$ be any finite isometry and suppose an exact deterministic radiation decoder $\mathscr{D}_0$ is supplied:

$$\mathscr{D}_0 \mathscr{N}_V = \mathrm{id}_C.$$

For every shredder $\mathscr{S}$ and every deterministic decoder $\mathscr{D}\colon X \to C$,

$$F_e(\mathcal{D}\mathcal{S}\mathcal{N}_V) \le \frac{1}{d}, \qquad d_\diamond(\mathcal{D}\mathcal{S}\mathcal{N}_V, \mathrm{id}_C) \ge 1 - \frac{1}{d},$$

where *F_e* is fidelity on the normalized maximally entangled input. The constants are sharp over this class.

Before shredding the recovery error is zero; after complete classical shredding it obeys . These are different access tasks.

Proof. The composed channel $\mathcal{S}\mathcal{N}_V$ is classical:

$$\mathcal{S}\mathcal{N}_V(\rho) = \sum_x \mathrm{Tr}\,(E_x\rho)|x\rangle\langle x|, \qquad E_x = \mathcal{N}_V^*(M_x).$$

A decoder acting on a classical record prepares states $\sigma_x = \mathcal{D}(|x\rangle\langle x|)$, so

$$\mathcal{D}\mathcal{S}\mathcal{N}_V(\rho) = \sum_x \mathrm{Tr}\,(E_x\rho)\sigma_x.$$

This measure-and-prepare form is the relevant entanglement-breaking structure [HSR].

Let

$$|\Phi_d\rangle = d^{-1/2}\sum_{j=0}^{d-1} |j\rangle_Q|j\rangle_C, \qquad \Phi_d = |\Phi_d\rangle\langle\Phi_d|.$$

Its decoded output is the separable state

$$\frac{1}{d}\sum_x E_x^{\mathrm{T}} \otimes \sigma_x.$$

For density operators *a*, *b* on ℂ^*d*,

$$\mathrm{Tr}\,(\Phi_d(a \otimes b)) = \frac{1}{d}\mathrm{Tr}\,(a^{\mathrm{T}}b) \le \frac{1}{d}.$$

Convexity gives *F_e ≤ 1/d*. Testing the difference from *Φ_d* with the effect *Φ_d* gives trace distance at least *1 − F_e*, hence the half-diamond lower bound.

For sharpness, use the identity radiation channel and measure and reprepare one orthonormal basis. The decoded channel is

$$\Delta(\rho) = \sum_j \mathrm{proj}\, j\rho\mathrm{proj}\, j.$$

For *Z = ∑_j e^{2πij/d}proj j*,

$$\Delta = \frac{1}{d}\sum_{k=0}^{d-1} \mathrm{Ad}_{Z^k}.$$

Thus

$$d_\diamond(\Delta, \mathrm{id}) \le \frac{1}{d}\sum_{k=1}^{d-1} d_\diamond(\mathrm{Ad}_{Z^k}, \mathrm{id}) \le \frac{d-1}{d}.$$

The lower bound proves equality, and directly *F_e(Δ) = 1/d*.

par *Non-claim.* No new bound; the constant is that of I-C [IC]. par

Theorem re-establishes the constant recorded by I-C [IC]. It claims no new bound. An exact radiation decoder cannot already be a complete classical-output recovery channel for *d ≥ 2*, since the proof would then apply before shredding and contradict zero error.

Example. Let *R = C ⊗ A*, let *{p_a}* be a probability vector, and define

$$V_{\mathrm{rec}}|i\rangle = \sum_a \sqrt{p_a}|i, a\rangle_R|a\rangle_B.$$

Then

$$\mathcal{N}_{\mathrm{rec}}(X) = X \otimes \sum_a p_a \mathrm{proj}\, a_A, \qquad \mathcal{C}_{\mathrm{rec}}(X) = \mathrm{Tr}\,(X)\sum_a p_a \mathrm{proj}\, a_B.$$

Tracing *A* is an exact decoder. Theorem therefore applies after any complete classical shredding of this same *R*. This explicit construction supplies all data required by the theorem without importing the general exact-recovery

criterion.

par *Non-claim.* A printed test case, not a general exact-recovery criterion. par

Corollary. If a complete accessible channel $\mathscr{K}$ is within half-diamond distance ε of a classical-output channel $\mathscr{K}$, embedded in the same output interface, then every deterministic decoder satisfies

$$d_{\diamond}(\widehat{\mathscr{D}\mathscr{K}}, \mathrm{id}_C) \geq \max\left\{0, 1 - \frac{1}{d} - \varepsilon\right\}.$$

Proof. Use post-composition contractivity, the triangle inequality, and the proof of Theorem .

par *Non-claim.* Finite channel statement; optimality is Theorem . par

Remark. The separate clock record of Theorem does not shred the unmeasured radiation register. Conversely, a classical message accompanied by a retained quantum system is not a complete classical output. Classical communication assisted by a quantum side system falls outside Definition , even if that system's marginal is fixed.

Remark. A non-Clifford logical unitary, a fixed magic-bearing syndrome, constancy of a complement, and classical shredding are different declarations. The first does not determine any of the others [En04A]. Theorems and do not reclassify magic or supply a new magic theorem.

Operator domains and apex choices are separate data

A local spin-2 domain calculation

For *0 < ν < 1*, consider the Bessel expression

$$\ell_\nu f = -f'' - \frac{1}{r} f' + \frac{\nu^2}{r^2} f$$

on *L^2((0, ∞), r dr)*. Its Friedrichs quadratic form is the closure of

$$q_\nu(f) = \int_0^\infty \left(|f'|^2 + \frac{\nu^2}{r^2} |f|^2 \right) r \, \mathrm{d}r$$

from compactly supported smooth functions away from the origin. The regular branch *r^{ν}* has finite local form energy; the branch *r^{−ν}* does not.

Theorem. Fix *1/2 < α < 1*, and put

$$\nu_2 = 2 - \alpha^{-1} \in (0, 1), \qquad \nu_1 = \alpha^{-1} - 1 = 1 - \nu_2.$$

The radial lowering operation

$$L_{\nu_2} = \partial_r + \frac{\nu_2}{r}$$

takes a cutoff regular *ν_2*-branch to a vector with a non-Friedrichs *ν_1*-branch:

$$L_{\nu_2} r^{\nu_2} = 2\nu_2 r^{-\nu_1}.$$

This domain mismatch can coexist, on the same prescribed host, with either zero or positive finite residual leakage, and with Clifford-only finite carrier implementations. It is therefore not, by itself, a residual-response or magic certificate.

Proof. Let *χ* be smooth, equal to one near zero, and compactly supported at large *r*. The function *f = χr^{ν_2}* lies in the Friedrichs operator domain: its regular branch has finite form energy, and *ℓ_{ν_2}f* is square-integrable because the expression vanishes near zero and the remaining terms are supported away from zero. Approximation by cutoffs at the origin verifies the Friedrichs form condition directly.

Equation holds where *χ = 1*. The target branch is locally square-integrable but has divergent Friedrichs form energy:

$$\int_0^\varepsilon \left(\left| \partial_r r^{-\nu_1} \right|^2 + \frac{\nu_1^2}{r^2} r^{-2\nu_1} \right) r \, \mathrm{d}r = 2\nu_1^2 \int_0^\varepsilon r^{-2\nu_1 - 1} \, \mathrm{d}r = \infty.$$

Thus the lowering operation does not preserve the named Friedrichs domains.

The domain data do not occur in the finite channel formulas. Attach independently either

$$V_{\mathrm{tr}}|i\rangle = |i\rangle_R|0\rangle_E, \qquad V_{\mathrm{cp}}|i\rangle = |i\rangle_R|i\rangle_E, \quad i = 0, 1.$$

The first has constant complement; the second has distinct complementary basis outputs. They are implemented by identity and CNOT with a blank qubit, respectively, hence require no non-Clifford gate. Spectator hosting preserves both conclusions and the domain mismatch.

par *Non-claim.* Not the full I-B-G-S Green theorem; no leakage or magic certificate. par

The local mechanism in is the one recorded in the exceptional spin-2 channels of I-B-G-S. That source proves the full source-tested de Donder failure for componentwise Friedrichs spin-2 when $1/2 < \alpha < 1$, equivalently when the deficit is less than π, and treats the threshold separately [IBGS]. Theorem does not reproduce that full Green theorem. The source's curvature-regular or core-based mathematical selection also remains a separate domain question [IBGS].

An explicit apex non-selection certificate

Theorem. There is one Bessel differential expression with two distinct nonnegative self-adjoint apex realizations, either of which can be attached to the same finite carrier and all of its finite reference-extended channel statistics. Consequently those statistics do not select the apex realization in the uncoupled interface.

Proof. Take $\nu = 1/2$. The unitary

$$Uf(r) = r^{1/2} f(r) : L^2(r\,\mathrm{d}r) \to L^2(\mathrm{d}r)$$

satisfies, on compactly supported smooth functions,

$$U\ell_{1/2}U^{-1} = -\partial_r^2.$$

The closed nonnegative forms

$$\int_0^\infty |u'|^2\,\mathrm{d}r$$

with domains $H_0^1(0, \infty)$ and $H^1(0, \infty)$ give the Dirichlet and Neumann self-adjoint half-line Laplacians. Pulling back gives two nonnegative realizations of the same Bessel expression. Their boundary branches are, respectively, regular $r^{1/2}$ and singular $r^{-1/2}$.

They are distinct. For $p > 0$, the resolvent kernels of $-\partial_r^2 + p^2$ are

$$K_D(r, s) = \frac{e^{-p|r-s|} - e^{-p(r+s)}}{2p}, \qquad K_N(r, s) = \frac{e^{-p|r-s|} + e^{-p(r+s)}}{2p}.$$

Their difference is the nonzero kernel $p^{-1}e^{-p(r+s)}$. These formulas follow by solving the homogeneous equation on either side of $r = s$, imposing the boundary condition and the derivative jump.

The channel V, its independent clock instrument, and its spectator extension contain neither boundary condition. Choosing either realization as continuum metadata therefore leaves every printed finite channel unchanged.

par *Non-claim.* Channel-blind comparison only; resolvent or echo data can distinguish extensions when included. par

A channel-blind comparison is not a claim that all continuum experiments are extension-blind. Resolvent or echo measurements can distinguish extensions when they are actually included in the data.

The I-B-VP-CR source record adds a different datum: a Ward demand in one fixed scalar channel selects its singular nonnegative realization; the stated positive local-core class instead converges to Friedrichs and fails that demand [IBVPCR]. That result is not selection by residual response. Its positive-core obstruction is not a theorem excluding every smooth or attractive resonant core.

Dynamical hosting and the source-selection slot

I-D keeps an axis-filled dynamical Host A and a topologically different bridge Host B distinct [ID]. We do not identify either with , or create a third Host C.

Definition. A dynamical-host interface consists of:

• a prescribed smooth time-oriented Lorentzian host *h_B = (M_B, g_B)*;

• a regular timelike laboratory tube, with a finite ordered set of local control events and the ideal register-control contract of Theorem ;

• a finite carrier, an independent clock preparation, and a declared accessible output;

• any optional continuum operator, state, source-completion, or interface-moment data, named separately. A resonance datum $\mathscr{R}(h_B)$, when supplied, belongs to the prescribed host/operator package. It is not defined as a function of the finite carrier.

Theorem. For Definition :

• Every declared finite carrier admits the same ideal local hosting construction on the laboratory tube. Its logical channel and clock identities are unchanged.

• Changing the finite carrier while fixing the host/operator package does not change its supplied resonance datum.

• Suppose an optional source-completion class $\mathscr{Q}_B(h_B)$ is supplied, together with interface moments

$$m : \mathscr{Q}_B(h_B) \to \mathbb{R}^k.$$

If two admitted completions *q_0, q_1* have different moments and the finite channel is independent of *q*, then no rule of the finite channel data alone returns *m(q)* on both. Its two-point worst-case error, in any norm on $\mathbb{R}^k$, is at least

$$\frac{1}{2}\|m(q_1) - m(q_0)\|.$$

No physical source completion or code-to-moment law is constructed by these assertions.

Proof. A finite isometry extends to a finite unitary by the orthonormal-completion argument in Theorem . Assign the allowed local operations to the declared ordered events. This proves (i); the proof uses no stationarity or global field theory.

Part (ii) follows because the supplied function $\mathscr{R}$ takes the host/operator package, not the carrier, as its argument.

For (iii), the two completions give equal finite data. A rule of those data takes one common value *a*. The triangle inequality gives

$$\|m(q_1) - m(q_0)\| \le \|m(q_1) - a\| + \|a - m(q_0)\|,$$

which proves the bound.

par *Non-claim.* No physical source completion or code-to-moment law; U6-sel is not moved. par

Remark. The theorem is a finite local-hosting result and a conditional non-selection certificate. It does not assert that an arbitrary pair of formal moment values is realizable by I-D matter fields. A theorem about such realizability would require the actual source class and its equations.

The source record [ID] concerns resonances of settled Host B. We neither rerun its computer-assisted census nor turn it into a damping theorem. I-D's U6 source-selection line does not supply a map from an En04 carrier to the interface moments. U6-sel is not moved.

Remark. If a metric and normalization are supplied, an Einstein-effective tensor computed from that metric may already have fixed moments. Such moments are host-derived quantities; it would be wrong to call them freely varying while holding their defining metric and normalization fixed.

The unfilled slot is instead an independently justified matter completion, or a law coupling the code to that completion. The identity

$$G[g] + \Lambda g = \chi T, \qquad T := \chi^{-1}(G[g] + \Lambda g),$$

for supplied $\chi \neq 0$, defines an inverse source; it does not select an independent matter theory. This is the distinction recorded by [Big01]. No Host-B field transfer, neck-crossing detector model, selected dynamical state, or evaluated Host-B echo is supplied here.

Host fibres, magic labels, and coefficient blindness

Definition. An account is a tuple

$$a = (h, \Delta),$$

where h is prescribed host data and Δ contains the declared finite carrier, preparations, observation set, access cut, coupling, and any separately named metadata.

The host data map is

$$D_H(h, \Delta) = h.$$

A host functional is a function that factors through D_H. A complete host-preserving reorganization relation identifies exactly the accounts with the same h.

Lemma. For maps $D: \mathscr{A} \to \mathscr{Y}$ and $t: \mathscr{A} \to \mathscr{Z}$, a map $F: D(\mathscr{A}) \to \mathscr{Z}$ satisfying $t = F \circ D$ exists exactly when t is constant on every fibre of D. If $\mathscr{Z}$ is metric and

$$D(a_0) = D(a_1), \qquad d(t(a_0), t(a_1)) = \Delta,$$

every rule of the admitted data has two-point worst-case error at least $\Delta/2$.

Proof. A factorization has equal values on equal data. Conversely, define $F(y)$ to be the common target value on $D^{-1}(y)$; fibre constancy makes it well defined. The bound is the triangle inequality through the rule's common output.

par *Non-claim.* Elementary; recorded in [Big01], re-proved here. par

This elementary lemma is the criterion recorded by [Big01]. We prove it locally to avoid any proof transfer.

Theorem. On the account class permitting arbitrary declared finite carriers:

• Complete residual leakage is not a host functional. Already on one fixed host, a qubit pair of carriers has leakage 0 and $1/2$. Every host-only leakage estimate has two-point worst-case error at least $1/4$.

• The conclusion persists after adjoining either the Clifford/non-Clifford implementation flag or the declared count of T-gates.

• For a fixed nonconstant rod observable, the signal is not determined by the host and that observable alone. The coupling and preparation matter.

• Invariance under the complete host-preserving reorganization relation is equivalent to being a host functional.

Proof. Use the two qubit carriers in on the same host with the same spectator probe. The transmitting complement is constant, so its leakage is zero. The copying complement is qubit dephasing:

$$\mathscr{C}_{\mathrm{cp}}(\rho) = \rho_{00}\mathrm{proj}\,0 + \rho_{11}\mathrm{proj}\,1.$$

Its two basis outputs have trace distance one. For any replacement state, the triangle inequality gives leakage at least $1/2$.

For the matching upper bound choose $I_{2/2}$. For any referenced input ω, let X_0, X_1 be its positive diagonal code blocks. Then

$$(\mathrm{id} \otimes (\mathscr{C}_{\mathrm{cp}} - \mathscr{T}_{I_2/2}))(\omega) = X_0 \otimes (\mathrm{proj}\,0 - I_2/2) + X_1 \otimes (\mathrm{proj}\,1 - I_2/2).$$

Each parenthesized matrix has trace norm one and $\mathrm{Tr}\, X_0 + \mathrm{Tr}\, X_1 = 1$, so the output trace norm is at most one. The leakage is therefore $1/2$. Spectator extension preserves it by Theorem . Lemma gives the $1/4$ estimation floor.

Both implementations can be Clifford, with zero T-gates. Alternatively precompose both by

$$T = \mathrm{diag}\,(1, e^{i\pi/4}).$$

Input-unitary precomposition preserves the distance to the replacement-channel set. Both implementations then have one declared T-gate and are non-Clifford: $TXT^{\dagger}$ is not a Pauli matrix, and multiplication by the Clifford CNOT cannot turn T into a Clifford unitary. Their leakage values remain different. This proves (ii) for the stated flags, not for every imaginable numerical magic measure.

For (iii), compare the spectator coupling with , keeping h, O_r, and the two code input states fixed. Their signals

are *0* and *(λ_1 − λ_0)sin^2 η*. The same fibre lemma applies.

Finally, the equivalence classes of the complete reorganization relation are precisely the fibres of *D_H*. Apply the first assertion of Lemma .

par *Non-claim.* The *1/4* floor is not optimal (DC-9; Theorem). Not a theorem that every backreaction quantity fails a fibre test. par

Remark. A zero response in every account of a class *is* a host functional. There is no blanket theorem that every quantity called ``backreaction'' fails a fibre test.

Nor is adding $\mathscr{O}_G$ alone sufficient to determine a response. For a specified finite observation task, sufficient data include the input pair and the relevant pullbacks

$$W^{\dagger}(I_{RE} \otimes O)W, \qquad O \in \mathscr{O}_G,$$

or a complete channel/coupling package that determines them. A restricted reorganization monoid also need not connect an entire host fibre; invariance under only that monoid is not, without further hypotheses, the converse in Theorem (iv).

The external coefficient slot remains external

The following statement applies equally to a prescribed *DSS_H* host or a prescribed Big04 comparison host; it makes no state identification.

Proposition. Let κ range over a set containing two values. Suppose all admitted host, carrier, coupling, magic-label, and experimental data are independent of κ. If a target label *L(κ)* takes different values at those two coefficients, it does not factor through the admitted data.

The same conclusion holds for a finite adaptive experiment whose initial law, decision kernels, and conditional report laws are all coefficient-independent.

Proof. The two coefficients give the same admitted datum but different targets, so Lemma applies. For an adaptive experiment, induction on the number of rounds shows that its joint transcript law is coefficient-independent. Coefficient-blind randomized postprocessing preserves that law.

par *Non-claim.* No value of κ and no numerical κ. par

This is the local form of the negative certificates in [Big01] and [Big04Coeff]. It applies to a magic label only when that label is genuinely coefficient-blind; a coefficient-sensitive supplied experiment is a different data contract.

The radiation-label orbit also needs its source qualification. Big04-A-coeff records invariants *U* and *κ^3/α* under

$$(U, \kappa, \alpha)\text{longmapsto}\,(U, r\kappa, r^3\alpha).$$

This is confounding only when α is omitted from the data. The admitted datum of that sheet supplies α; an absolute coefficient-sensitive label is an additional supply, not an output of the coefficient-blind carrier [Big04Coeff]. We do not adopt the unqualified slogan that ``the coefficient is only an orbit''.

Remark. A dimensionless finite gate angle is not the dimensional coefficient slot of an external horizon or radiation label. Neither is that slot the inherited analytic characteristic coefficient whose quantum admission remains unconstructed. No identification between these slots is made.

Big02-A's dark capacity is also not canonically the residual register *E*, and a proposed split of a prescribed total source is not the complementary channel $\mathscr{C}_V$ [Big02,Big05Plan]. These objects require different data.

Endpoint continuity, archive entropy, and physical interpretation

Proposition. For finite classical records *X_1*, …, *X_n*, with the entire prefix retained,

$$H(X_1, \ldots, X_{n+1}) = H(X_1, \ldots, X_n) + H(X_{n+1} \mid X_1, \ldots, X_n) \geq H(X_1, \ldots, X_n).$$

A condition *δ_leak(V_t) → 0* does not imply an entropy turnover of that archive, or a radiation Page curve.

Proof. The entropy identity follows by expanding the joint probability as a marginal times a conditional probability. Conditional Shannon entropy is nonnegative.

For a direct independence example, use the transmitting carrier at every time, so that leakage is identically zero, and append one independent fair classical bit at each step. The archive entropy is *nlog 2*, strictly increasing. The leakage condition therefore implies no turnover even in this finite setting.

par *Non-claim.* Not a Page curve and not an evaporation endpoint. par

This is the separation between En04-A's finite endpoint statement and I-C's append-only theorem [En04A] [IC]. The Page problem concerns a specified quantum radiation history with its state, access rule, and dynamics, not the entropy of a retained classical transcript [Page]. Likewise, the arbitrarily late recurrence obstruction in En04-A has the hypothesis of a fixed finite autonomous Hamiltonian; it is not a theorem about an unspecified gravitational endpoint [En04A].

Physical reading and the exact emergence boundary

The practical use of the results is a sequence of tests.

• Is the complete complement specified, including omitted apparatus and failure registers?

• Is the proposed geometric quantity a declared observable of a finite probe, a continuum field observable, or a metric coefficient?

• Is the code-to-observable coupling supplied?

• Is the response target constant on the fibres of the data actually admitted?

• Does a later classical readout change the recovery task? A failure at any of these steps prevents the corresponding interpretation, even when the finite computation is correct.

A proposed geometric witness must satisfy two different requirements. First, it needs a channel that changes a declared geometric observable. Second, a gravitational interpretation needs a separately justified identification of that observable with the relevant field or metric degree of freedom, together with its dynamics and domains. Theorem supplies only the first, finite requirement for a calibrated probe. It does not supply the second.

Thus the new negative certificate is constructive, not a claim that geometric response is impossible. A coupled theory could impose relations absent from this paper. Its relations would have to be printed and proved in the same model.

Further certificates of version 2 on named source-record data

This appendix holds the remaining certificates of the binding v2 plan (Appendix); the instantiated examples now in Section were part of it. Every cited formula is a source record, quoted after a read-only retrieval of the registered source (Appendix); none is a premise of a proof below. All proofs use only the definitions printed in this paper.

The supplied coupling in arbitrary dimension, and the exact arc

Theorem. *W_U* is an isometry, and for all code states

$$A_O = \operatorname{diag}(o_0, \dots, o_{d-1}), \qquad w_O(\rho_1, \rho_0) = \sum_j (\rho_1 - \rho_0)_{jj}\, o_j, \qquad \gamma_{\{O\}}(W_U) = \frac{\max_j o_j - \min_j o_j}{2\|O\|_\infty}.$$

For a rod-plane coupling $|\varphi_j\rangle = \cos \eta_j |g_0\rangle + \sin \eta_j |g_1\rangle$, with $|g_0\rangle$, $|g_1\rangle$ eigenvectors of O_r for λ_0, λ_1,

$$w_{O_r}(\operatorname{proj} j, \operatorname{proj} k) = (\lambda_1 - \lambda_0)(\sin^2 \eta_j - \sin^2 \eta_k).$$

For $d = 2$, $\eta_0 = 0$, $\eta_1 = \eta$ this is . The metric and all host labels are unchanged.

Proof. The columns have orthogonal *R*-labels. $\langle j|A_O|k\rangle = \langle j|k\rangle\langle \varphi_j rvert O\, |\varphi_k\rangle = \delta_{jk} o_j$. The witness is *Tr (A_O(ρ_1 − ρ_0))*, whose supremum over states is *max o − min o*. For the rod-plane coupling, $o_j = \lambda_0 \cos^2 \eta_j + \lambda_1 \sin^2 \eta_j$.

par *Non-claim.* The coupling *U_j* is supplied, not derived; it is not an interaction law for a dynamical metric. A rod witness is a finite probe witness, not an identification with a field or metric degree of freedom. par

Theorem. Let $|b_\theta\rangle = \cos\theta |g_0\rangle + \sin\theta |g_1\rangle$, and let the controlled-probe carrier of Definition (any $d \geq 2$) have probe states $|\varphi_j\rangle = |b_{\theta_j}\rangle$ with $\theta_j \in [0, \pi/2]$. Put $\theta_- = \min_j \theta_j$, $\theta_+ = \max_j \theta_j$ (both endpoints belong to the family), $\Delta = \theta_+ - \theta_- \leq \pi/2$, and $O = \operatorname{diag}(\lambda_0, \lambda_1) \neq 0$.

• $\delta_{leak}(W_{\theta}) = 1/2\sin\Delta$, attained by $\sigma_{*} = 1/2(P_{\theta_{-}} + P_{\theta_{+}})$; every state on the arc between the endpoints is within $1/2\sin\Delta$ of σ_{*}.

• $\gamma_O(W_{\theta}) = (|\lambda_1 - \lambda_0|)/(2\max\{|\lambda_0|, |\lambda_1|\})\sin(\theta_{-} + \theta_{+})\sin\Delta$.

• If $\Delta > 0$, $O_{*} = (P_{\theta_{+}} - P_{\theta_{-}})/\sin\Delta$ has $\|O_{*}\|_{\infty} = 1$ and $\gamma_{O_{*}} = \sin\Delta = 2\delta_{leak}$: the bound is saturated by an optimized observable.

• For $\Delta > 0$ the rod saturates, $\gamma_O = 2\delta_{leak}$, if and only if $\lambda_1 = -\lambda_0$ and $\theta_{-} + \theta_{+} = \pi/2$. For the family ($\theta_{-} = 0$, $\theta_{+} = \eta$): $\delta_{leak}(W_{\eta}) = 1/2\sin\eta$ and the full-set response is $\sin\eta = 2\delta_{leak}$.

Proof. (i) By Theorem , $\delta_{leak} = R_{probe}$. The endpoints have overlap $\cos\Delta$, so $D(P_{\theta_{-}}, P_{\theta_{+}}) = \sin\Delta$ and $R_{probe} \geq 1/2\sin\Delta$. Put $m = (\theta_{-} + \theta_{+})/2$. In the basis rotated by m, P_t has Bloch vector $(\sin 2(t - m), 0, \cos 2(t - m))$ and σ_{*} has $(0, 0, \cos\Delta)$, so $D(P_t, \sigma_{*})^2 = 1/4(1 + \cos^2\Delta - 2\cos\Delta\cos 2(t - m))$ (check N05). For $t \in [\theta_{-}, \theta_{+}]$, $\cos 2(t - m) \geq \cos\Delta \geq 0$, so the right side is at most $1/4\sin^2\Delta$. (ii) $o_j = \lambda_0 + (\lambda_1 - \lambda_0)\sin^2\theta_j$, increasing in θ_j, and $\sin^2\theta_{+} - \sin^2\theta_{-} = \sin(\theta_{-} + \theta_{+})\sin\Delta$; apply Theorem . (iii) $P_{\theta_{+}} - P_{\theta_{-}}$ has eigenvalues $\pm\sin\Delta$; $\mathrm{Tr}(O_{*}(P_{\theta_{+}} - P_{\theta_{-}})) = 2\sin\Delta$, and no pair is farther apart than the endpoints. (iv) By (ii), $\gamma_O/(2\delta_{leak}) = (|\lambda_1 - \lambda_0|)/(2\max|\lambda_i|)\sin(\theta_{-} + \theta_{+})$; the first factor equals 1 iff $\lambda_1 = -\lambda_0$ and the second iff $\theta_{-} + \theta_{+} = \pi/2$.

par *Non-claim.* If a family lies inside the arc but omits an endpoint, its leakage is $1/2\sin$ of its own span, not of the ambient arc (PC-6; check N04). Saturation concerns the finite bound of Lemma , not a continuum field. The binary value $\sin\theta/2$ is recorded in [En04A] for a different carrier; no proof is transferred. par

Corollary. For the v1 family, or any d-dimensional arc family with $\theta_{-} = 0$, $\theta_{+} = \eta$, the basis-input witness is $(\lambda_1 - \lambda_0)\sin^2\eta$. For the positive radial rod $0 < \lambda_0 < \lambda_1$,

$$\frac{\gamma_O}{2\delta_{\mathrm{leak}}} = \frac{\lambda_1 - \lambda_0}{2\lambda_1}\sin\eta < \frac{1}{2} \qquad (0 < \eta \leq \pi/2),$$

so the raw rod never saturates at nonzero coupling. The centred rod $O_c = \mathrm{diag}(-1, 1)$ has ratio $\sin\eta$: it saturates at $\eta = \pi/2$ and is strict for $0 < \eta < \pi/2$.

Proof. Substitute in Theorem (ii),(iv).

par *Non-claim.* Nonsaturation of the raw rod is a mismatch between the chosen observable and the Helstrom direction, not a defect of the leakage calculation. par

The fully printed correlation isometry

In the ordered basis $|r\,e\,g\rangle$, $r, e, g \in \{0, 1\}$, with index $4r + 2e + g$, the isometry of Proposition is

$$W_{\mathrm{corr}} = \frac{1}{\sqrt{2}}\begin{pmatrix} 1 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & -1 \end{pmatrix}^{\mathrm{T}} \in \mathbb{C}^{8\times 2}, \qquad W_{\mathrm{corr}}^{\dagger}W_{\mathrm{corr}} = I_2.$$

Its complete complement is $\rho_{00}|\Phi_{+}\rangle\langle\Phi_{+}| + \rho_{11}|\Phi_{-}\rangle\langle\Phi_{-}|$, both marginals are $I_{2/2}$, $\delta_{leak}(W_{corr}) = 1/2$, and the response is seen only by the correlation observable $X \otimes X$, with $\mathrm{Tr}((X \otimes X)(\Phi_{+} - \Phi_{-})) = 2$ (Appendix). Theorem gives the exact characterization of such hiding.

Clock phase and dynamical hosts

Theorem. Host an independent En09-A clock with the carrier, and let the reconstruction of [En09C] (source record; not a premise) be computed from the clock output blocks and the declared system generator.

• The spectator coupling and the supplied coupling , with the same clock preparation, give identical clock outputs and identical reconstruction sets, while their rod witnesses are 0 and $(\lambda_1 - \lambda_0)\sin^2\eta$. No rule of the reconstruction returns the witness; its two-point worst-case error is at least $1/2|\lambda_1 - \lambda_0|\sin^2\eta$.

• The reconstruction is a class modulo a probe stabilizer and presupposes the declared generator; it does not remove the external parameter.

• The recorded phases do not select a time unit: $(A, t_k) \mapsto (A/a, at_k)$, $a > 0$, leaves every sampled unitary e^{-iAt_k} unchanged, and the phase fibre of a fixed probe ρ is $t_k + \Lambda_{\rho}$, $\Lambda_{\rho} = \{s: e^{-iAs}\rho e^{iAs} = \rho\}$.

• A code-dependent clock is a confounding supply: with $W'|j\rangle = V_{tr}|j\rangle \otimes |\tau_j\rangle_K \otimes |g_h\rangle$, the complete complement becomes the dephasing channel into K, and $\delta_{leak}(W') = 1/2$ although $\delta_{leak}(V_{tr}) = 0$ and the

probe is a spectator.

Proof. (i) The joint channel factorizes as clock ⊗ carrier (proof of Theorem); the clock factor is the same in both accounts. Lemma . (ii) This is the scope of the source record; nothing here changes it. (iii) $e^{-i(A/a)(at_k)} = e^{-iAt_k}$; multiply by e^{iAt_k} for the fibre (check F08). (iv) Tracing R kills code off-diagonals, leaving $\sum_j \rho_{jj}|\tau_j\rangle\langle\tau_j| \otimes proj\ 0_E \otimes |g_h\rangle\langle g_h|$; its leakage is $1/2$ as in Theorem .

par *Non-claim.* No quantized relational time without an external parameter is claimed; the clock unit, winding and generator stay external. par

Proposition. Let a declared clock preparation and destructive readout produce record k with probability $Tr\,(F_k\rho)$ for a POVM $\{F_k\}$ on the code, followed by a record-controlled probe unitary U_k^G on σ_G: $\mathscr{F}_{clk}(\rho) = \sum_k Tr\,(F_k\rho)\, U_k^G \sigma_G (U_k^G)^\dagger$. With $m_k = Tr\,(O U_k^G \sigma_G (U_k^G)^\dagger)$, the O-witness vanishes on all code pairs if and only if $\sum_k m_k F_k$ is scalar. For $F_k = proj\ k$, $\sigma_G = |g_0\rangle\langle g_0|$, $U_0^G = I$, $U_1^G|g_0\rangle = |b_\eta\rangle$, the rod witness is $(\lambda_1 - \lambda_0)\sin^2\eta$.

Proof. $Tr\,(O\mathscr{F}_{clk}(\rho)) = Tr\,(\rho \sum_k m_k F_k)$; a Hermitian matrix has constant expectation iff it is scalar. Substitute for the example (check F08).

par *Non-claim.* The same rod signal can arise from a supplied clock record and feedback; this is an information path, not evidence that calibration selected the coupling or that the metric responded. Copying basis labels into a clock register dephases the radiation marginal and does not transmit quantum coherence through a classical record. par

Theorem. Let Host A and Host B be the prescribed metrics of [ID] and [ID] (source record; not a premise):

$$g_A = a(\eta)^2[-c^2\,\mathrm{d}\eta^2 + \mathrm{d}r^2 + F_A^2\,\mathrm{d}\varphi^2 + \mathrm{d}z^2], \qquad F_A = r - \varepsilon Q(r) s(\eta - r/c),$$

on $\mathbb{R}_\eta \times \mathbb{R}^2 \times \mathbb{R}_z$, and

$$g_B = a(\eta)^2[-c^2\,\mathrm{d}\eta^2 + \mathrm{d}\ell^2 + F_B^2\,\mathrm{d}\varphi^2 + \mathrm{d}z^2], \qquad F_B = P(|\ell|) - \varepsilon Q(|\ell|) s(\eta - |\ell|/c),$$

on $\mathbb{R}_\eta \times \mathbb{R}_\ell \times S_\varphi^1 \times (\mathbb{R}/L_z\mathbb{Z})_z$, with $a(\eta) = 1 + \lambda S(\eta/\tau_a)$, $s(u) = S(u/\tau_f)$, $Q(r) = \int_0^r S((s'-r_0)/(r_1-r_0))\,ds'$, and the neck profile $P(r) = b + \int_0^r v$, $v = (1-\chi)\, r/\sqrt{(r^2+b^2)} + \chi$, $\chi = S((r - L_0)/(L_1 - L_0))$, $0 < b < L_0 < L_1 < r_0 < r_1$, as displayed in [Hawk07CDyn], [Hawk07CDyn], [Hawk07D], [Hawk07D] and [Hawk07D] (source record; not a premise). The sources write the deformation amplitude as β and the neck profile as W; here they are ε and P, to avoid a clash with the charged holonomy β of Definition and the isometry W. One has $P(r) = \sqrt{(r^2 + b^2)}$ for $r \le L_0$ and $P(r) = r + d_0$ for $r \ge L_1$, $d_0 = P(L_1) - L_1 > 0$ (check F09); $F_B(\eta, 0) = b > 0$, so Host B has no axis.

• Each is an input. On each, the curve at fixed spatial point is timelike, and every finite carrier admits the hosting of Theorem (i).

• The resonance datum of Host B, recorded in [ID] as a computer-assisted census (44 simple zeros in the declared box for $|m| \le 2$), is a function of the host/operator package; changing the carrier does not change it.

• Every account has exactly one host; Host A and Host B are not identified, and no third host is formed.

• Varying the carrier W_θ with the metric and spectral package fixed changes the leakage as $1/2\sin\Delta$ (Theorem) and changes no metric coefficient, curvature function, determinant $D_{m,\pm}$, zero set, or census.

Proof. (i) Both metrics are smooth Lorentzian metrics (source record), so $a(\eta) \ne 0$ and $g(\partial_\eta, \partial_\eta) = -a^2c^2 < 0$. (ii) Theorem (ii) and Lemma . (iii) The account tuple of Definition has one host entry. (iv) The metric functions and the declared determinants have no carrier argument.

par *Non-claim.* The census is not rerun and is not turned into a damping theorem. No Host-B field transfer, neck-crossing detector, or code-to-moment law is supplied. U6-sel is not moved. par

The version-qualified census record. For the source's fixed parameter instance only, [ID] records in-box counts $(m, parity)$: $(0,e)\ 7$, $(0,o)\ 6$, $(1,e)\ 8$, $(1,o)\ 7$, $(2,e)\ 8$, $(2,o)\ 8$, 44 in total, in $\mathscr{K} = \{0.05 \le Re\ \omega \le 2.5,\ -0.75 \le Im\ \omega \le -0.005\}$, all simple, with $|Im\ \omega| \ge 0.12816$ in the box, by computer-assisted ball arithmetic (source record; not a premise). It is not re-executed here and is not assigned to other parameters.

Mouths and the Gate-0 sector

Proposition.

• The rod observable acts on the laboratory probe G; the Res01-C forms of [Res01C] and [Res01C] (source record; not a premise) are bookkeeping forms on the radiation block of a fixed finite Haar device. They have different domains.

• For $d = 2$ and orthonormal $|e_0\rangle$, $|e_1\rangle$, the couplings $W^{(0)}|j\rangle = |j\rangle|e_j\rangle|g_0\rangle$ and $W^{'}|j\rangle = |j\rangle|e_j\rangle|g_j\rangle$ have the same radiation channel (complete dephasing), while their rod witnesses are 0 and $\lambda_1 - \lambda_0$. Hence no functional of the radiation channel, including any form evaluated on radiation outputs, determines the rod witness; the two-point error is at least $1/2|\lambda_1 - \lambda_0|$.

• Local probe data do not determine the throat area: keeping a small laboratory metric germ, the rod, the carrier and any finite bookkeeping fixed, and varying only the period L_z of settled Host B (larger than the laboratory's axial extent), the central torus has area $A_{neck} = 2\pi a_{\infty}^2 bL_z$, so every area rule of that datum has two-point error at least $\pi a_{\infty}^2 b|L_z^{(1)} - L_z^{(0)}|$.

Proof. (i) By definition. (ii) Tr_{EG} of either column pair gives $\langle e_k|e_j\rangle = \delta_{jk}$. The rod values are λ_0, λ_0 and λ_0, λ_1. Lemma . (iii) The induced metric at $\ell = 0$ is $a_{\infty}^2(b^2\, d\varphi^2 + dz^2)$; integrate (check F05) and apply Theorem .

par *Non-claim.* A fully supplied global host determines its own area; the statement is that local operational data are not that host. Res01-C ([Res01C]) remains a separate negative certificate; its own non-claim states that its forms are not a gravitational metric, and the Res-series item ``a metric identifying the mouths'' is not discharged here (PC-4). par

Proposition. The kernel κ_n of [G0] (source record; not a premise) is defined on the declared class $\mathscr{S}_{G(\alpha, n)}$ of that sheet. No object of En04-B (finite carriers, probe matrices, channels, leakage) is an element of that class, and no map between them is declared in either sheet. Consequently no result of En04-B is a Gate-0 test value. Moreover, a factorization through a projection on a stated sector does not by itself imply factorization on a larger domain, so a passed sector kernel is not full Gate 0.

Proof. The En04-B objects are finite-dimensional matrices and channels; the class of the source record is a declared class of that sheet's transverse-sector data. Without a declared map, no evaluation of one on the other is defined. For the second statement take $\mathbb{C}^2$, $\mathscr{S} = \{(x, 0)\}$, $r(x, y) = x$, $I_0 = kx$, $I_1 = kx + y$: both factor through r on $\mathscr{S}$, but $I_1(0, 1) = 1$ while $r(0, 1) = 0$ (check F10). This shows insufficiency of the inference, not failure of every full Gate-0 construction.

par *Non-claim.* Gate 0 stays outside the source's sector; O.1 stays NOT_CLOSED. Prob02-B's Ward-conserved product [Prob02B] is a parallel to the apex non-selection of Theorem , not a premise, and does not construct T3. par

Parallel records and catalogue separations

Proposition. Fix a metric g and a total symmetric tensor T_{tot}. In a declared class admitting conserved transfers proportional to g, the split $T_{tot} = T_{ord} + T_{dark} + T_{vac}$ is not determined by the host and the total tensor.

Proof. Replace $T_{ord} \mapsto T_{ord} + sg$ and $T_{vac} \mapsto T_{vac} - sg$ for an admitted constant s; the sum and metric are unchanged and $\nabla(sg) = 0$.

par *Non-claim.* If a physical class forbids these transfers, its remaining split freedom must be tested separately. A tensor decomposition is not a complementary quantum channel. No crossover radius or number is imported. par

Big05-A, as a parallel only. Big05-A v1 [Big05A] proves that the ordinary/dark/vacuum split of a prescribed total source is not a host functional (thm:Big05-fibre). This is the cosmological twin of Theorem . It is cited as a parallel source record; none of its crossover radii or documentary numbers is imported, and Big05-A is not registered (its API route returned 404 on retrieval).

Theorem. Let the enriched datum $D_{enr} = (h, \mathscr{L}_h, \mathscr{J}_{A(\rho)}, \text{fixed calibration})$ contain only named readings defined on the fixed host h (current, Wick square, echo, curvature label, resonance record) with their continuum inputs fixed, and an independent phase experiment; it omits the controls U_j. For $O = \mathrm{diag}(\lambda_0, \lambda_1)$, $\lambda_0 \neq \lambda_1$,

and the arc pair of widths *0* and $\eta \in (0, \pi/2]$ with $\theta_{-} = 0$, every rule of *D_enr* has two-point worst-case error at least $1/4 \sin \eta$ for leakage and $1/2|\lambda_1 - \lambda_0| \sin^2 \eta$ for the absolute basis-input witness; the same holds for the current and curvature samplers.

Proof. No entry of *D_enr* depends on the arc; the targets are $0, 1/2 \sin \eta$ and $0, |\lambda_1 - \lambda_0| \sin^2 \eta$. Apply Theorem (check F11).

par *Non-claim.* No cone formula is transferred to *DSS_H* or Host B. A law fixing the coupling slot is not excluded. par

Spin-2 threshold, as a source-record comparison. For componentwise Friedrichs tensors with the compatible vector ghost, [IBGS] records: for $0 < \alpha \le 1/2$ the source-test de Donder intertwining identity holds; for $1/2 < \alpha < 1$ it fails in precisely two mirror weight-2 channels, with $v_2 = 2 - \alpha^{-1}$ and $v_1 = \alpha^{-1} - 1 = 1 - v_2$ (source record; not a premise). No θ occurs in this threshold and no spin-2 domain occurs in Theorem ; branch selection remains the separate record [IBGS].

Hawk07-C and En08-A. Hawk07-C hosts a different finite certificate on the same form of prescribed cone [Hawk07C]; it is not this carrier, not a wormhole, and not a geometric identification. The curve assignment of Theorem is a schedule; by the En08-A separation, schedule consistency does not select a Lorentz cone [En08A].

OpenAI catalogue. Family 265 (two-dimensional gapped area law) is not this complement. Families 272 (entanglement without secret key; PPT-square) and 276 (classical capacity of qubit generalized amplitude damping) are not this leakage. Family 280 (strong locality for strongly rational unitary vertex operator algebras) is not this isometry. Family 003 (zero-free half-plane for Dirichlet *L*-functions) is not a coefficient. Family 282 (scale-to-conformal enhancement in four-dimensional QFT) is not this apex certificate. No family supplies backreaction [OAICatalogue].

Self-derived results (retained; stronger forms)

These results were derived from the open gaps of v1 before the binding plan arrived (Appendix). They are proved from the definitions of this paper and are kept where they are stronger than, or not covered by, the plan items. For a set of states write *diam* for its trace-distance diameter, and for a Hermitian matrix $\mathrm{spr}(A) = \lambda_{\max}(A) - \lambda_{\min}(A)$.

Proposition. For every hosted probe extension W and observation set $\mathscr{O}_G$,

$$\gamma_{\mathscr{O}_G}(W) = \max_{O \in \mathscr{O}_G} \frac{\mathrm{spr}\,(A_O)}{2\|O\|_\infty}, \qquad A_O = W^\dagger (I_{RE} \otimes O) W.$$

For the full set $\mathscr{B}(G)_{sa}$, $\gamma(W) = \mathrm{diam}\ \mathscr{C}_G(\mathscr{D}(C))$, and

$$\gamma_{\mathscr{O}_G}(W) \le \mathrm{diam}\ \mathscr{C}_G(\mathscr{D}(C)) \le \mathrm{diam}\ \mathscr{C}_{EG}(\mathscr{D}(C)) \le 2\delta_{\mathrm{leak}}(W).$$

Proof. $w_O = \mathrm{Tr}\,(A_O(\rho_1 - \rho_0))$ has supremum $\mathrm{spr}\,(A_O)$ over pairs of states. For the full set, $\sup_{\|O\| \le 1} 1/2 \mathrm{Tr}\,(O(\sigma_1 - \sigma_0)) = D(\sigma_1, \sigma_0)$. Partial trace contracts, and $\mathrm{diam} \le 2\delta_{leak}$ by the triangle inequality through the optimal replacement state.

par *Non-claim.* An exact formula for a declared finite witness; no continuum observable is constructed. par

Theorem. For every $\lambda \in [0, 1/2]$ there is a hosted probe extension with $\delta_{leak} = \lambda$ and full-set response $\gamma = 2\lambda$; the value $\gamma = 1$ occurs at $\delta_{leak} = 1/2$ and at the maximal leakage $1 - 1/d^2$. Hence $\min\{1, 2\delta_{leak}\}$ in cannot be improved as a function of leakage on $[0, 1/2]$.

Proof. Theorem with $\sin \eta = 2\lambda$. For maximal leakage use $W|\psi\rangle = |0\rangle_R |\psi\rangle_G$; its complement is the identity channel, with leakage $1 - 1/d^2$ by Theorem , and $\gamma = 1$.

par *Non-claim.* Sharpness of a finite inequality only. par

Theorem. For every V with an exact decoder $\mathscr{D}_0$, the shredder $M_x = \mathscr{D}_0^{*}(\mathrm{proj}\ x)$ and the decoder $x \mapsto \mathrm{proj}\ x$ give $\mathscr{D}\mathscr{S}\mathscr{N}_V = \Delta$, so $\min_{\mathscr{S}, \mathscr{D}} d_{\diamond} = 1 - 1/d$ and $\max F_e = 1/d$ for each such V, not only for the identity radiation channel.

Proof. $\mathscr{D}_0^{*}$ is unital and positive, so $\{M_x\}$ is a POVM, and $\mathrm{Tr}\,(M_x \mathscr{N}_V(\rho)) = \langle x | \mathscr{D}_0 \mathscr{N}_V(\rho) | x \rangle = \rho_{xx}$. Theorem .

par *Non-claim.* No new error-correction theorem; the constant is that of I-C [IC]. par

Theorem. For every $\varepsilon \geq 0$,

$$\inf\{d_\diamond(\widehat{\mathscr{D}\mathscr{K}}, \mathrm{id}_C) : d_\diamond(\widehat{\mathscr{K}}, \mathscr{K}) \leq \varepsilon,\ \mathscr{K}\text{classical-output}\} = \max\{0, 1 - \frac{1}{d} - \varepsilon\},$$

and *sup F_e = min {1, 1/d + ε}*. Corollary is therefore exactly optimal.

Proof. Lower bound: Corollary and *|F_e(A) − F_e(B)|led_{◇} (A, B)*. Attainment: *𝒦_p = (1 − p)Δ + p id* with *𝒦 = Δ, 𝒟 = id*: *d_{◇}(𝒦_p, Δ) = p(1 − 1/d)* and *d_{◇}(𝒦_p, id) = (1 − p)(1 − 1/d)*; take *p = min {1, ε/(1 − 1/d)}*.

par *Non-claim.* Finite channel statement only. par

Theorem. On one fixed host and code dimension *d*, the leakage values of admitted carriers fill exactly *[0, 1 − 1/d^2]*. Every host-only rule, deterministic or randomized, has worst-case absolute error at least *1/2(1 − 1/d^2)*, and the constant rule attains it. For qubit codes the exact minimax error is *3/8*, improving the floor *1/4* of Theorem . For qubit codes the same holds within each class of a declared *T*-count.

Proof. Upper: *𝒞 = 𝒞 ∘ id* and *𝒯_{𝒞(I/d)} = 𝒞 ∘ 𝒯_{I/d}*, so contractivity gives *δ_leak(𝒞)led_{◇} (id, 𝒯_{I/d}) = 1 − 1/d^2* (proof of Theorem). The diary carrier attains it. The path *V_s|ψ⟩ = (cos s I − isin s SWAP)(|ψ⟩_R|0⟩_E)* is continuous, and leakage is *1*-Lipschitz (Proposition), so all intermediate values occur. Two-point argument at the ends; input-unitary precomposition preserves leakage.

par *Non-claim.* Host-only rules only; a separately imposed host-dependent carrier law is a different account class. par

Theorem. For the family and a declared set *𝒪_G*, put *A_O = ⟨g_1rvertO |g_1⟩ − ⟨g_0rvertO |g_0⟩*, *B_O = Re ⟨g_0rvertO |g_1⟩*. Then *w_O(η) = A_Osin^2 η + B_Osin 2η*, and *η ∈ [0, π/2]* is determined by *(w_O(η))_{O ∈ 𝒪_G}* iff the vectors *(−A_O/2, B_O)* span $\mathbb{R}^2$, or span a line containing a vector with *B = 0*. In the remaining line case with direction angle *φ ∈ (0, π)*, the minimax error is *1/2min {φ, π − φ}*; with no observable it is *π/4*. A pure-coherence observable (*A_O = 0*) thus has the same worst case *π/4* as no data.

Proof. *⟨b_{η}rvertO |b_{η}⟩ = cos^2 η O_00 + sin^2 η O_11 + sin 2ηRe O_01*. With *u = (cos 2η, sin 2η)* on the upper semicircle, the data are affine functionals of *u*; a single functional *Rcos (x − φ), x = 2η ∈ [0, π]*, is injective iff *φ ∈ {0, π}*, and otherwise has fibres *{x, 2φ − x}* of maximal width *2min {φ, π − φ}*. Lemma .

par *Non-claim.* A dimensionless gate angle, not the coefficient slot; cf.?the source-record parallels [Big04Coeff] and [Big04Coeff], which concern a different readout. par

Proposition. Under the hypotheses of Proposition , with *κ* in a set $\mathscr{K} \subset \mathbb{R}$, the deterministic and randomized minimax absolute error of *κ* from the admitted data, including finite adaptive experiments, is exactly *1/2(sup 𝒦 − inf 𝒦)*, infinite if *𝒦* is unbounded.

Proof. The transcript law is *κ*-independent, so every estimate has one law *v*; *max_i 𝔼_{v}|κ̂ − κ_i| ≥ 1/2|κ_1 − κ_0|* for any two points; the midpoint attains.

par *Non-claim.* No value of *κ*; no numerical *κ*. The record [Big04Coeff] has its own readout and hypotheses. par

Consolidated release statements of versions 1 and 2

Theorem. For the finite interfaces and prescribed-host contracts printed in this manuscript:

• Ideal finite hosting and destructive clock readout are constructed without making the metric an output.

• The spectator extension is exactly probe-blind and preserves complete residual leakage. It permits the entire unknown diary to remain in a nongeometric residual factor.

• A supplied controlled coupling has the same-host rod-observable witness , without changing the prescribed metric.

• Blind marginal channels need not imply a blind joint complement; the correlation counterexample is explicit.

• Complete classical shredding has the sharp whole-code floor *1 − 1/d*, including the stated robust version.

• Spin-domain mismatch, apex choice, dynamical-source selection, residual leakage, magic implementation flags, and external coefficient calibration are distinct questions under the printed independence contracts.

• The host-fibre criterion gives explicit non-identifiability certificates for leakage and for an unsupplied probe coupling. No gravitational backreaction law or spacetime-emergence theorem is asserted.

Proof. Theorem and Lemma prove (i). Theorem proves (ii). Theorem proves (iii). Proposition proves (iv). Theorem and Corollary prove (v). Theorems , , and , together with Proposition , give the precisely scoped separations in (vi). Theorem proves (vii). None of those constructions changes a metric or supplies the additional gravitational identifications.

par *Non-claim.* No gravitational backreaction law or spacetime-emergence theorem. par

Theorem. In addition to Theorem :

• finite probe response is controlled distinguishability: the optimal response is the probe diameter and leakage is the probe radius (Theorems ,); a finite sample of a fixed field responds only through the coupling, and a constant field never does (Theorem , Corollary); coupling-blind data, including named readings, cannot determine leakage or a witness (Theorems ,);

• the printed I-B-VP-0 current and I-B-VP Wick square are code-blind host scalars; a code-dependent reading needs a separate source supply and still does not identify β (Theorem);

• blindness and the leakage fibre certificate hold on the curved *DSS_H* host, and scalar curvature labels have zero witness under every coupling (Theorem);

• the supplied coupling has an exact d-dimensional witness and exact arc leakage $1/2\sin\Delta$; $\gamma \le 2\delta_{leak}$ is saturated by O_{*}, and by a rod exactly when it is centred and the arc is symmetric about $\pi/4$ (Theorems ,);

• echo readings, phase reconstruction, the printed dynamical hosts, mouth forms and the Gate-0 sector are separated from residual and probe response (Theorems , , , Propositions ,);

• the robust-blindness, host-only leakage, robust shredder and side-register shredder constants are exact (Theorems , , ,), and correlation hiding is characterized exactly (Theorem).

Proof. The cited theorems.

par *Non-claim.* No gravitational backreaction law, spacetime-emergence theorem, metric reconstruction, or quantum coefficient is asserted. par

Version 3: the technical cautions, verdicts and draft corrections

Version 3 restructures the paper (main text: definitions, six central results, three examples, limitations; appendices: the audit trail) and re-proves four results flagged for careful checking in an external assessment of version 2. The assessment is a source record supplied by the user; it is not a premise. No evaluation figure from it is reproduced. The draft corrections continue the numbering of Appendix and Appendix .

Caution 1: robust attainment. *Verdict: confirmed and made precise.* The holonomy observable is $O_{\mu} = -\sin\mu\,(I_{mode}\otimes\sigma_y)$. The unnormalized witness of the attaining family is $2\sin\mu\sin 2t$, which depends on μ; the normalized response $\gamma_{O_{\mu}} = \sin 2t = b(\varepsilon)$ holds for every μ with $\sin\mu \neq 0$; at $\mu \in \{0, \pi\}$ the observable vanishes, and the probe observable $I\otimes\sigma_y$ attains $b(\varepsilon)$ for every μ (Theorem (iii); checks X01, MX1).

Caution 2: correlation-hidden response. *Verdict: the pure-output formula is correct with the stated hypotheses; it fails for mixed outputs.* Exact statement: for pure complete-complement outputs with equal E-marginals and equal G-marginal σ, $|\langle\Psi_0|\Psi_1\rangle| \ge \max\{0, 2\lambda_{max} - 1\}$ and $D \le h(\sigma)$, attained in every dimension with $\dim E \ge \operatorname{rank}\sigma$ (Theorem (iii); check X02 over nine spectra, including degenerate ones). For mixed outputs an exact rational certificate gives $D \ge 0.9479 > h = 0.91652$ at $\sigma = \operatorname{diag}(7/10, 3/10)$, $\dim E = 3$ (Proposition ; checks X03, X04).

Caution 3: side-register floor. *Verdict: survives under an explicit access model.* The record is classical, the k-dimensional register is the only retained quantum system (no pre-shared entanglement), and the decoder is an arbitrary channel on record and register, i.e. arbitrary record-dependent quantum operations with fresh ancillas; randomized decoders are included as convex combinations. Then $F_e \le k/d$ and $d_{\diamond} \ge 1 - k/d$, attained by Λ_k (Definition , Theorem). Loosening the model breaks the bound: teleportation with a pre-shared maximally entangled pair gives $F_e = 1$ at $k = 1$ (Proposition ; check X06).

Caution 4: echo. *Verdict: confirmed; stated as local only*. Theorem (i) is a local short-window statement on a compact $J \subset (1/2, 1]$, with the explicit lower bound $C_J(u_{*}) \geq C_J^{lead}$; no global deficit identifiability is claimed, and $\partial_{\alpha} q$ changes sign at long gates (check X07).

Tractable open items attempted. (a) Optimality of $2\sqrt{(\delta)}$: *resolved*; the sharp distance is $\varphi(\delta)$ (Theorem (ii)). (b) Hidden distinguishability for mixed outputs: *partially resolved*; the pure formula fails, classical outputs obey $\min\{1, 2(1 - \lambda_{max})\} \leq h$, the exact maximum is open. (c) C_J: *partially resolved*; the leading constant is exact, numerical values agree, a certified uniform constant is open.

Draft corrections (version 3).

DC-19 (thm:robust-spectator / thm:B-robustconst.) Version 2 wrote ``$\pm \sin \mu\, (I \otimes \sigma_y)$, $\mu \neq \pi$, has response exactly $b(\varepsilon)$" without stating that the response is normalized by $2\|O\|_{\infty}$ and without excluding $\mu = 0$, where the observable also vanishes. Corrected: the normalized response equals $b(\varepsilon)$ iff $\sin \mu \neq 0$; the unnormalized witness is $2|\sin \mu| \sin 2t$; the sign is $-\sin \mu$; $I \otimes \sigma_y$ is an alternative witness for every μ. The two v2 theorems are merged (both labels resolve to Theorem), and the hypothesis is weakened to $D(\mathscr{C}_G(\rho), g_h) \leq \varepsilon$.

DC-20 (thm:B-hidden(i).) The robust constant $2\sqrt{(\delta)}$ of version 2 is valid but not sharp. Replaced by the sharp $\varphi(\delta) = 1/2(\delta + \sqrt{(4\delta - 3\delta^2)})$, with proof and an attaining extension. The v2 proof's intermediate estimate $\|\omega^{'} - \omega_{QE}^{'} \otimes g\|_1 \leq 4\sqrt{(\delta)}$ is superseded.

DC-21 (thm:B-hidden(ii).) The hypotheses are now explicit (pure complete-complement outputs; equal E -marginals; equal G-marginal; $\dim E \geq \operatorname{rank} \sigma$ for attainment). The v2 sentence ``it is maximal ($h = 1$) iff $\lambda_{max} \leq 1/2$" is restricted to pure outputs; for mixed outputs $h(\sigma)$ is not an upper bound (Proposition).

DC-22 (thm:B-sideshred.) Version 2 did not state the decoder class or exclude pre-shared entanglement. The access model is now Definition ; the bound fails without it (Proposition).

DC-23 (thm:echo(i), cor:echo-error.) Version 2 stated (i) for ``sufficiently small u_{*}" and did not compute C_J. Version 3 defines $C_J(u_{*})$, proves $C_J(u_{*}) \geq C_J^{lead}$, records its numerical values and states locality explicitly. Check F07 of version 2 tested the $O(u_{*}^2)$ scaling on $J = [0.6, 1]$ at $u_{*} \in \{0.1, 0.2\}$, where $\pi/2 - C_J u_{*}^2 < 0$; it verified the scaling, not the positivity of c_J (check MX3).

DC-24 (structure.) The paper is restructured; v1 and v2 material moves to the appendices with every label kept (Appendix); the standing refusals and the v1 standing boundary are carried once, in Section ; the ledger stays verbatim in the abstract and at the end. One v1 subsection title is renamed ``Physical reading and the exact emergence boundary", and the declarations paragraph on the contribution is retitled; no evaluation figure of the paper appears in the sheet (check T16).

Plan corrections. None of the four cautions is incorrect; each is confirmed, and no new PC is recorded.

Version 4: verdicts on the conditional extrapolations, corrections and citation record

Version 4 adds Section in response to plan t330u, which proposes six extrapolations of the central theorems and a programme with four criteria. The plan text (file PLAN_t330u.md, sha256 60deb972a4dcffba53dea25bdfdd4e770005df80c7fe0839aeef814192f89f3c) is a source record supplied by the user; it is not a premise. Each item was rewritten as a conditional statement on declared finite data, proved, given an attaining witness, and followed by a non-claim. Plan corrections continue the PC numbering of Appendix ; draft corrections continue the DC numbering of Appendix .

Verdicts

toprule Plan item Verdict Exact statement in this paper

midrule endfirsthead toprule Plan item Verdict Exact statement in this paper

midrule endhead bottomrule endfoot 1. Information in correlations, individual sectors ordinary held as a conditional theorem; corrected in scope (PC-12–PC-14) Theorem : $\gamma_O^{joint} \leq \operatorname{diam} \leq 2\delta_{leak}$ for every joint observable, with $\sup_O \gamma^{joint} = 2\delta_{leak}$ for binary classical–quantum complements; constant marginals on $\leq k$ sectors kill every observable on $\leq k$ sectors; the family $W_{n,t}$ fixes every marginal on $n - 1$ sectors and attains $\gamma^{joint} = \sin t = 2\delta_{leak}$ with a product (n-point) observable. The plan's request for ``a specific relation between the strength of a joint-correlation signature and the information leaked" is answered by $\gamma^{joint} \leq 2\delta_{leak}$, sharp.

The cosmological reading (two-point statistics nearly unchanged, four-point statistics responding) is not derived; it is recorded as part of the open programme.

2. Coherence tied to environmental distinguishability held exactly in the stated model; extended to an inequality (PC-15) Theorem : $v^2 + 4\delta_{leak}^2 = 1$ for pure binary controlled probes; for every carrier and every label-preserving decoder $c^2 + 4\delta_{leak}^2 \le 1$; equality for mixed records iff $D^2 = 1 - F^2$; strict example $c^2 + 4\delta_{leak}^2 = 3/4$; for $d \ge 3$ only two-sided bounds hold.

3. Curvature-gradient sampler corrected (PC-16) Theorem : $w = (\mathcal{R}_1 - \mathcal{R}_0)\sin(\theta_{-} + \theta_{+})\sin\Delta$; exact sign reversal; zero for constant curvature of any size; $|\mathcal{R}_1 - \mathcal{R}_0| \le |\Delta x$rvertG_K; $|\mathcal{R}_1 - \mathcal{R}_0 - \Delta x \cdot \nabla\mathcal{R}(\bar{x})| \le M_3|\Delta x|^3/6$; $w = \eta^2\Delta x \cdot \nabla\mathcal{R}(\bar{x}) + E$ with explicit E; the ordering claim holds when $g_B - M_{3,B}s^2/6 > G_A$. Proposition gives the exact Host-B neck values.

4. Exclusion of nearly spectator couplings held (PC-17, presentation only) Theorem : $\gamma_O \ge \gamma \Rightarrow \varepsilon \ge \varepsilon_{*}(\gamma) = \sin(1/2\arcsin\gamma)$, sharp; $\varepsilon_{*}(3/5) = \sqrt{(1/10)}$; nothing is excluded for $\varepsilon \ge 1/\sqrt{(2)}$.

5. Precision does not resolve a degeneracy held (PC-18) Theorem : every precision index and every adaptive design factoring through D_{adm} keeps the floor $\Delta/2$; one coupling-sensitive datum estimates δ_{leak} with $\sup_{\eta}\mathbb{E}|\mathcal{L}_n - \delta_{leak}| \le 1/(2\sqrt{(n)})$; two accounts are separated with error $\le 1/2BC^n$.

6. Classical records and retained quantum access held; extended (PC-19) Theorem : $F_e \ge f \Rightarrow k \ge \lceil fd \rceil$; with a pre-shared system of dimension d_B retained by the decoder $F_e \le \min\{1, kd_B/d\}$, sharp; a one-time pad has uniform records and maximally mixed register marginals for every input yet $F_e = 1$.

Programme (four criteria) criteria formalized (PC-20); finite model held; cosmological realization a conjecture Proposition : (C1)–(C4) as declared requirements; $W_{4,t}$ meets all four, with $\gamma^{joint} = \sin t$, $c = \cos t$, $c^2 + 4\delta_{leak}^2 = 1$, and spectator distance $\sin(t/2) = \varepsilon_{*}(\sin t)$. *Conjecture (not addressed):* an open-system primordial model with declared finite mode subspaces meets (C1)–(C4).

Plan corrections (PC-12 to PC-20)

PC-12 (Item 1.) The plan says the joint complement can depend ``strongly'' on the input while both marginals are constant. The strength is bounded: $\gamma^{joint} \le D \le 2\delta_{leak}$ always, and for pure outputs with equal marginals $D \le h(\sigma)$ (Theorem (iii)), a bound that fails for mixed outputs (Proposition). The general relation used here is $\gamma^{joint} \le D \le 2\delta_{leak}$, not $h(\sigma)$.

PC-13 (Item 1, attribution.) The plan cites arXiv:1801.09949 for open-system models in which environmental interactions affect ``the primordial power spectrum and higher-order statistics''. The abstract of 1801.09949 concerns decoherence and corrections to the power spectrum (with upper and lower bounds on interaction strengths and a heavy test scalar giving a quasi-scale-invariant correction); its outline treats the power spectrum and the decoherence rate. Higher-order statistics are the subject of arXiv:1805.05609. The citation is therefore used here for the power spectrum only.

PC-14 (Item 1, scope.) The plan's statement of the 1805.05609 result matches its abstract (bispectrum zero, four-point functions non-vanishing, trispectrum constraints more stringent than power-spectrum constraints ``in some regimes''). The qualifier ``in some regimes'' is kept, and the finite family of Theorem is an analogue only: in that paper the power spectrum is also modified, while in $W_{n,t}$ every lower-order marginal is exactly fixed.

PC-15 (Item 2.) Tracing the probe multiplies the coherence $kb\ 10$ by $\langle\varphi_0|\varphi_1\rangle$, the complex conjugate of the plan's $s = \langle\varphi_1|\varphi_0\rangle$ (the coherence $kb\ 01$ carries s); $v = |s|$ is unaffected. The identity $v^2 + 4\delta_{leak}^2 = 1$ holds for pure binary controlled probes only; in general $c^2 + 4\delta_{leak}^2 \le 1$, and ``retained coherence'' must be defined through decoders (Definition).

PC-16 (Item 3.) The sampler formula $(\kappa_1 - \kappa_0)\sin^2\eta$ is the case $\theta_{-} = 0$ of $(\kappa_1 - \kappa_0)\sin(\theta_{-} + \theta_{+})\sin\Delta$; the approximation $\kappa_1 - \kappa_0 \approx \Delta x^{\mu}\nabla_{\mu}\mathcal{R}$ needs a declared profile class (mean zero, bounded support), disjoint supports, a convex region and the remainder $M_3|\Delta x|^3/6$; the gradient is a coordinate gradient in a declared chart; ``$w \propto \eta^2$'' holds with the explicit error of Theorem (iv); ``scales with separation'' holds for the leading term; the ordering claim needs the stated inequality. The averages are written $\mathcal{R}_a$ to avoid any reading as a coefficient.

PC-17 (Item 4.) Presentation only: γ is the response normalized by $2\|O\|_{\infty}$, ε bounds the trace distance of every

probe output from the spectator state (equivalently it is the hypothesis of Theorem), and the threshold is sharp. The value $\sqrt{(0.\ 1)} \approx 0.\ 316$ is correct.

PC-18 (Item 5.) ``Better observations of the same type" is made precise as data laws that are kernels of the admitted datum, including adaptive designs; the floor is then exact for every precision index.

PC-19 (Item 6.) The plan's bound holds under the access model of Definition . With a pre-shared system the relevant dimension is kd_B, and the bound is $F_e \le kd_B/d$.

PC-20 (Programme.) The four criteria are stated informally. They are formalized as (C1)–(C4) of Proposition ; the phrase ``framework for falsifiable cosmological models" is not adopted.

Draft corrections (DC-25 to DC-27)

DC-25 (Structure.) A main section ``Conditional cosmological extrapolations" is inserted before the limitations; the title, date, abstract (finding (10)), main-results list, scope and organisation are updated; all labels of versions 1–3 are kept (Appendix).

DC-26 (prop:side-loosened.) The last sentence of the proposition in version 3 was asserted without proof. It is proved here as Theorem (ii): $F_e \le kd_B/d$ when the decoder retains a pre-shared system of dimension d_B.

DC-27 (Scope.) The scope paragraph of the introduction is extended to the conditional layer: no statement of Section is a cosmological prediction.

Citation verification

The three arXiv records named in the plan were retrieved by read-only requests to their abstract pages on October 25, 2026, with the tracking parameters of the plan's links removed. Each is a source record; not a premise; none is used in a proof.

• [MartinVennin2018a] (arXiv:1801.09949, J. Martin and V. Vennin): inflationary perturbations as an open system with Lindblad evolution; decoherence and corrections to the power spectrum; observational upper bounds and decoherence-completion lower bounds on interaction strengths; a heavy test scalar gives a quasi-scale-invariant correction. Cited for the power spectrum only (PC-13).

• [MartinVennin2018b] (arXiv:1805.05609, J. Martin and V. Vennin): non-Gaussianities from decoherence in the Lindblad formalism; the bispectrum remains zero while four-point functions become non-vanishing; Planck trispectrum constraints are, in some regimes, more stringent than those from the power spectrum. Cited as stated (PC-14).

• [Burgess2022] (arXiv:2211.11046, C. P. Burgess, R. Holman, G. Kaplanek, J. Martin and V. Vennin): decoherence rate of super-Hubble fluctuations from gravitational interactions with unobserved shorter-wavelength scalar and tensor modes, by Open Effective Field Theory methods, minimal in single-clock models with General Relativity self-interactions. The plan's description matches.

Corrections needed to make the proposed plan valid

toprule Potential inference in the plan Correct statement used here

midrule endfirsthead toprule Potential inference in the plan Correct statement used here

midrule endhead bottomrule endfoot

No coupling is declared, therefore the geometric channel is constant. An unspecified channel has no proved response property. A printed spectator extension is constant on G (Definition and Theorem).

A constant G-marginal places every response in the E-marginal. This follows in the product spectator model, not in general. Response may appear only in EG correlations (Proposition).

Add $\mathcal{O}_G$, and geometric response becomes determined. The coupling, preparation, input task, and relevant observable pullbacks must also be supplied (Theorem).

Any finite set of blind geometric observables proves a constant geometric channel. Only if the set has the required operator coverage. Otherwise it proves blindness of the declared set only (Lemma).

Residual response fails the host-fibre criterion in every restricted model. It fails on the explicitly stated account

class with varying carriers. A constant target, or a separately imposed host-dependent carrier law, can factor through the host.

A probe response changes the cone's curvature. The supplied coupling changes a finite calibrated probe state. The prescribed curvature labels and metric remain unchanged (Theorem).

Host-B moments can always vary independently on a fixed inverse-source metric. A moment already defined from a fixed metric is fixed by that definition. Non-selection of an independent matter completion requires an explicitly stated source class; the two-completion certificate is conditional (Theorem).

The radiation-label orbit always confounds κ and α. Only a data contract omitting α has that confounding. Big04-A-coeff supplies α; coefficient-sensitive absolute labels are additional data [Big04Coeff].

A classical factor, plus other systems with constant marginals, is a complete classical output. The joint accessible output must be classical. Fixed marginals do not exclude message-bearing correlations (Definition).

A finite-code endpoint is evaporation. Endpoint leakage and an append-only archive entropy are different functions. No gravitational endpoint follows (Proposition).

Source-record crosswalk and programme separations

The following records are included for attribution and interface comparison. They are not hypotheses of the local proofs. A failed web retrieval or a supplied excerpt is not treated as an inspection of a complete manuscript. The documentary source basis is the supplied development brief and excerpts, supplemented by accessible companion pages and the publisher record for [CheungEnter]. This is not an exhaustive corpus audit.

toprule Record Source landmarks Role and retained limit

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En04-A [En04A] thm:exact, thm:global, cor:noimplication, thm:cliffordcriterion, thm:rotation, thm:drop, prop:geometrywitness, thm:endpoint, prop:recurrence Established finite separations. No parent revision or new magic criterion.

I-B [IB] thm:instrument, thm:main, prop:holonomy, prop:nonunique, prop:no-ccr Prescribed cone and finite readout. Dictionary not uniquely reconstructed from records; no metric output.

I-B-G [IBG] thm:green, prop:nonGH Green operators after extension data. No channel selection of the extension.

I-B-G-S [IBGS] thm:spin2, thm:selection Domain-dependent spin-2 comparison. No leakage or magic certificate.

I-B-VP [IBVP] thm:friedrichs, thm:current, thm:krein Local field quantities after declared realizations and state data. No code-to-source map.

I-B-VP-CR [IBVPCR] thm:main One scalar Ward gate and the stated positive-core obstruction. No response-based apex selector.

I-C [IC] thm:A, thm:B; echo-functional separation Sharp classical-return floor and archive monotonicity. An informative echo law is not a whole-code decoder.

I-C-Th [ICTh] Access, reset, and reservoir-heat ledgers No automatic heat assignment from readout or discard; no identification of geometric mouths.

I-D [ID] def:host-A, def:host-B, thm:v5-census, thm:v5main; U6 source-selection line Two prescribed hosts, resonance record, and conditional finite hosting. No selected code-to-moment source.

Big01-A [Big01] thm:C, thm:fibre, thm:Hcert, prop:Dyncert Host-fibre and external-label discipline. No finite Hilbert space or dynamics derived from the host.

Big02-A [Big02] def:dark Access-relative dark capacity, not a substance or a canonical complementary factor.

Big03-A [Big03] prop:R-vac-sep A supplied coefficient evaluation does not select an absolute vacuum term or a matter law.

Big04-A [Big04] doc:DR-vacterm Vacuum-term separation; no coefficient or source identification.

Big04-A-coeff [Big04Coeff] thm:C-adaptive, prop:C-orbit Coefficient-blind experiments and qualified orbit

statement. Readable coefficient-sensitive data are supplies.

Big05-A plan [Big05Plan] Proposed split of a prescribed total source Plan only in this manuscript. No registered theorem or source split is used.

En07-A [En07A] Locally restated recovery criterion Not absorbed or re-proved as a new En04 result.

En08-A [En08A] Scheduler-versus-cone separation Schedule consistency does not by itself select a Lorentz cone.

En09-A / En09-C [En09A,En09C] Destructive clock; internal phase modulo a stabilizer No returned quantum clock or removal of the external parameter.

XIV-H / XIV-I / XIV-J [AnalyticRecords] Historical H2; constructed internal I2; missing full I3/J2 map Finite hosting, spectral domains, and fibre arguments do not supply the characteristic graph or admit its coefficient.

Neighbouring En and catalogue boundaries

En05–En09 retain their own distinctions concerning dependency cones, operational speeds, observation algebras, control layers, Landauer language, scheduling, and destructive clocks. This paper neither rewrites those sheets nor transfers their models into the present finite carrier.

The OpenAI catalogue is used only through the supplied documentary separation record [OAICatalogue]. Family 265 concerns a two-dimensional gapped area law, not a radiation history or this complete complement. Families 272 (entanglement without secret key; PPT-square) and 276 (classical capacity of qubit generalized amplitude damping) are not the leakage functional defined here. Family 280 (strong locality for strongly rational unitary vertex operator algebras) is not a specification of this isometry (DC-4). Family 003 (quasi-Riemann hypothesis) supplies neither a magic criterion nor a value for an unfilled coefficient slot. Family 282 (scale-to-conformal enhancement) is not this apex certificate. No catalogue family is used to supply geometric backreaction, and no catalogue proof is verified here.

The inherited analytic chain is not entered

The source-specific chain from a full joint characteristic map, through a joint section and remainder, transverse estimates, contact compatibility, output wavefront control, and quantum admission is not a step of En04-B. An internal tree kernel or its Fourier representation is not that characteristic composition. The existence of technical XV-B lifting results is not an opened downstream quantum-admission exit [AnalyticRecords]. No source-specific Ward defect is formed from an unadmitted coefficient.

The binding plan t322u: item verdicts and plan corrections

The plan (file PLAN_t322u.md, sha256 d9527f00e77633710ba9b3ffacdccd69897ac0bda0a69790d296c24d1e5d4006) is binding. Every label and quoted formula was checked against a read-only retrieval of the registered source (Appendix).

toprule Plan item Verdict Where and what is proved

midrule endfirsthead toprule Plan item Verdict Where and what is proved

midrule endhead bottomrule endfoot thm:current-blind held Theorem ; strengthened: blind under every coupling, and J does not identify β even with a source supply.

thm:curved held (PC-3) Theorem ; the constant curvature of DSS_H has scalar compressions, blind under every coupling; a responding curvature sampler needs nonconstant curvature (Corollary).

thm:leak-exact held Theorem : $\delta_{leak} = 1/2 \sin \Delta$ on the arc ($1/2 \sin \eta$ for v1's family); $\gamma \le 2\delta_{leak}$ is saturated by O_{*}; a rod saturates iff $\lambda_1 = -\lambda_0$ and $\theta_{-} + \theta_{+} = \pi/2$.

thm:echo held (PC-1) Theorem , with the exact decoder error $1 - 1/d^2$.

thm:phase held Theorem , including the code-dependent clock as a confounding supply.

thm:dyn-hosts held Theorem ; metrics printed with I-D's declared profile data.

prop:not-mouth held (PC-4) Proposition , with an explicit radiation-fibre pair.

prop:sector held Proposition (typed separation).

d-dim thm:declared held Theorem .

Printed correlation isometry held Section , matrix W_{corr}.

Symbolic-check table held Appendix .

Author field unset user instruction verb || kept empty pending confirmation.

No compilation asserted user instruction The paper asserts none; builds are described only outside the paper.

Plan corrections.

PC-1 The plan says the I-C echo kernel ``distinguishes prescribed deficits''. The source [IC] proves $|s(\alpha_1) - s(\alpha_2)| \geq \pi/2|\alpha_1 - \alpha_2| - 2E_J$ on non-shadow sectors, exact vanishing at $\alpha = 1$ on $1/2 < \alpha \leq 1$, and strict monotonicity only for sufficiently short gates. The qualified form is used.

PC-2 The plan summarizes prop:robustblind as moving ``the witness by at most 2ε''. v1 proves $|\hat{w}_O| \leq 4\|O\|_{\infty}\varepsilon$ and $\gamma \leq 2\varepsilon$ (normalized). The sharp constant is $b(\varepsilon) = 2\varepsilon\sqrt{(1 - \varepsilon^2)}$ for $\varepsilon \leq 1/\sqrt{(2)}$ (Theorem).

PC-3 The plan's gap table asks for ``a curvature label rather than a flat rod'' as a witness. A curvature label represented as $o(h)I_G$ has zero witness under every coupling, and on DSS_H every compression of the constant curvature is scalar (Theorem (iii)). A nonzero curvature witness exists only as a *sampling* witness of a nonconstant prescribed curvature function (Corollary , Theorem); it is not curvature response.

PC-4 The plan calls the Res01-C objects ``not a mouth metric''. Res01-C itself constructs bookkeeping *mouth forms* in the finite Haar model and states that they are not a gravitational metric; the Res-series item ``a metric identifying the mouths'' is not discharged. The formulas $\langle\varphi^2\rangle_{ren} = (\alpha^{-2} - 1)/(48\pi^2 r^2)$, the $(\alpha^{-4} - 1)$ stress piece, $\mathscr{J} = \beta(1 - \beta)(2\beta - 1)(12\pi^2\alpha^2 r^2)^{-1}\, d\varphi$, $R = 12H^2/c^2$, and all labels named by the plan were found as stated.

Review of version 1

Each v1 result was re-proved locally; symbolic or numerical checks are listed in Appendix .

toprule v1 result Verdict Note

midrule endfirsthead toprule v1 result Verdict Note

midrule endhead bottomrule endfoot lem:observable held (DC-7) Bound sharp on $[0, 1/2]$ (Theorem); qualitative half recorded in En04-A.

lem:clock held Check V01.

thm:host held Ideal placement only.

thm:blind held Check V02.

cor:green held Instantiated by Theorem .

thm:declared held Check V03; generalized by Theorem .

prop:correlations held Check V04; characterized by Theorem .

prop:robustblind held (DC-8) Constant sharpened to $b(\varepsilon)$.

thm:shred held Check V05–V06; attained for every recoverable V (Theorem).

ex:syndrome held Check V05.

cor:approxshred held Exactly optimal (Theorem); check V11.

thm:spin held Check V07; the I-B-G-S threshold $1/2 < \alpha < 1$ agrees with [IBGS].

thm:apex held Check V08.

thm:dyn held Instantiated by Theorem .

lem:fibre held Elementary.

thm:fibre held (DC-9) Check V09; exact minimax in Theorem .

prop:coefficient held Exact minimax in Proposition .

prop:archive held Check V10.

thm:release corrected (DC-1) Typo in item (ii).

Draft corrections.

DC-1 ``nonge{}metric" (abstract and Theorem (ii)) corrected to ``nongeometric".

DC-2 Required lines were absent: the citation line, the line ``No quantum coefficient is admitted.", a standing ledger in the abstract and at the end, a non-claim after every result, and source tags on citations. All are added.

DC-3 Publisher claim. The Frontiers in Physics Quantum Engineering and Technology section listing, retrieved on October 25, 2026, shows the article with this title, author Ngo Cheung, as ``Accepted on 28 Sep 2026" [Frontiers]. The volume number and the DOI given in v1 could not be verified: the DOI did not resolve (doi.org and Crossref returned 404 on that date). They are marked unverified and are not repeated as fact.

DC-4 Catalogue descriptions. Family 280 is strong locality for strongly rational unitary vertex operator algebras, not ``printed-channel certificates"; Family 276 is the classical capacity of qubit generalized amplitude damping; Family 272 is entanglement without secret key and the PPT-square conjecture; Family 265 is the two-dimensional gapped area law; Family 003 is the quasi-Riemann hypothesis. The separations are restated accordingly.

DC-5 Registration status. En04-B's manuscript API route returned 404, so the sheet is not registered; the companion's /browse/ route returns an application page for any identifier, including unregistered ones, so it is not evidence of registration. Big05-A and EntPhil also return 404 on the API route; EntPhil is cited as the documentary page https://enter.grok.me/enter.

DC-6 Version numbers. For I-B-G, I-B-VP-CR, En04-A, En07-A, En08-A, En09-A, XIV-H, XIV-I, XIV-J and XV-B the retrieved source carries no version marker; the v1 version numbers are kept as stated in v1 and marked unverified. Big03-A's source header records version 2 inserted over version 1 (its title still reads version 1).

DC-7 The qualitative half of Lemma is recorded in [En04A]; attribution added.

DC-8 The constant 2ε of Proposition is valid but not sharp (Theorem).

DC-9 The floor *1/4* of Theorem (i) is valid but not optimal; the exact minimax is *1/2(1 − 1/d^2)* (Theorem).

DC-10 v1 treated Big05-A only as a plan. Big05-A v1 now exists as an unregistered manuscript; it is cited as a parallel source record only.

User instruction (not a correction). The author field is kept unset until authorship is confirmed.

v2 programme (self-derived)

Before the plan arrived, a programme was derived from the open gaps, non-claims and status of v1. It is now secondary to the plan; its sound results are kept in Appendix .

toprule Gap in v1 Verdict Result

midrule endfirsthead toprule Gap in v1 Verdict Result

midrule endhead bottomrule endfoot Is $\gamma \le \min\{1, 2\delta_{leak}\}$ sharp? proved Proposition , Theorem .

Robust-blindness constant proved (exact) Lemma , Theorem .

When do correlations hide response? proved (exact) Theorem .

Shredder attainment beyond the identity proved Theorem .

Robust shredder optimality proved (exact) Theorem .

Classical record plus quantum side proved (exact for every k) Theorem .

Optimal host-only leakage floor proved (exact) Theorem .

Coupling-angle identifiability proved Theorem .

Coefficient minimax proved Proposition .

Extremal hidden distinguishability for mixed outputs open Theorem (ii) covers pure-output pairs only.

Optimal constant in the $2\sqrt{(\delta)}$ robust form open Bracket $[0, 2\sqrt{(\delta)}]$; optimality not claimed.

v1 → v2 crosswalk

All v1 labels are kept with their v1 statements; corrections are recorded as DCs and not silently absorbed.

toprule v1 v2

midrule endfirsthead toprule v1 v2

midrule endhead bottomrule endfoot Abstract Rewritten; typo fixed; ledger and citation line added.

cor:green Instantiated: thm:current-blind.

thm:declared Generalized: def:declared-d (moved to Section), thm:declared-d; exact leakage thm:radius, thm:leak-exact.

prop:correlations Matrix printed; exact characterization thm:B-hidden.

prop:robustblind Sharp constant thm:B-robustconst; complement form thm:robust-spectator.

thm:shred, cor:approxshred thm:B-shredattain, thm:B-robustshred, thm:B-sideshred.

thm:dyn thm:dyn-hosts.

thm:fibre On a curved host: thm:curved; exact minimax thm:B-fibreminimax.

prop:coefficient prop:B-kappa; coupling angle thm:B-eta.

Clock remark, I-C records thm:phase, thm:echo.

Records appendix OpenAI descriptions corrected (DC-4); new records added.

thm:release Kept; thm:release-v2 added.

midrule *New in v2 (t325u package, Section and Section).*

t325u Thm 1 thm:opt-response.

t325u Thm 2 thm:radius.

t325u Thm 3 merged into thm:leak-exact (PC-6).

t325u Thm 4 thm:sampling.

t325u Thm 5 thm:nonident.

t325u Thm 6 thm:param-recovery.

t325u Thm 7 thm:joint-output (PC-7); counterexample is prop:correlations.

t325u Thm 8 thm:robust-spectator; sharp form thm:B-robustconst.

t325u Cor 9 cor:curv-sampling.

midrule *Findings t324u labels.*

thm:current-blind merged into thm:current-blind.

prop:current-sampling prop:current-sampling.

thm:radius thm:radius.

thm:leak-exact arc form in thm:leak-exact.

cor:original-rod cor:original-rod.

thm:curved merged into thm:curved.

thm:echo item (i) of thm:echo.

cor:echo-error cor:echo-error.

thm:phase item (iii) of thm:phase.

prop:clock-confound prop:clock-confound.

thm:dyn-hosts items (ii)–(iv) of thm:dyn-hosts and census paragraph.

thm:curvature-sampling thm:curvature-sampling.

prop:not-mouth item (iii) of prop:not-mouth.

prop:sector second statement of prop:sector.

prop:split prop:split.

thm:enriched thm:enriched.

Declarations Author unset (user instruction); verification paragraph revised.

Version 2→version 3 crosswalk

Every label of version 2 (which contains every label of version 1, Appendix) resolves in version 3. Equation labels are omitted from the table and are all kept. ``Revised'' marks the results re-proved in version 3 (Appendix); the labels thm:robust-spectator and thm:B-robustconst now resolve to the same merged theorem. New labels of version 3: def:side-access, prop:hidden-mixed, prop:side-loosened, and section labels.

toprule v2 label v3 number page location

midrule endfirsthead toprule v2 label v3 number page location

midrule endhead bottomrule endfoot sec:intro main

sec:finite main

def:carrier main

def:leak main

rem:established main

def:probe main

lem:observable main

sec:core main

def:declared-d main

thm:opt-response main

thm:radius main

thm:sampling main

thm:nonident main

cor:curv-sampling main

sec:host appendix

lem:clock appendix

thm:host appendix

sec:blind appendix

def:spectator appendix

thm:blind appendix

def:greenrep appendix

cor:green appendix

thm:declared appendix

prop:correlations appendix

prop:robustblind appendix

sec:shred appendix

def:shred appendix

thm:shred appendix

ex:syndrome appendix

cor:approxshred appendix

sec:domains appendix

thm:spin appendix

thm:apex appendix

sec:dynamic appendix

def:dyn appendix
thm:dyn appendix
sec:fibres appendix
def:accounts appendix
lem:fibre appendix
thm:fibre appendix
prop:coefficient appendix
sec:endpoint appendix
prop:archive appendix
sec:v2 appendix
def:hostscalar main
thm:current-blind main
prop:current-sampling main
def:curvedhost main
thm:curved main
thm:declared-d appendix
thm:leak-exact appendix
cor:original-rod appendix
thm:echo main, revised
cor:echo-error main
thm:param-recovery main
thm:joint-output main
thm:phase appendix
prop:clock-confound appendix
thm:dyn-hosts appendix
thm:curvature-sampling main
prop:not-mouth appendix
prop:sector appendix
prop:split appendix
thm:enriched appendix
thm:robust-spectator main, revised
sec:release appendix
thm:release appendix
thm:release-v2 appendix
app:debug appendix
app:records appendix
app:plan appendix
app:review appendix
app:programme appendix
app:crosswalk appendix
app:t325 appendix
app:findings appendix

app:self appendix

prop:B-gamma appendix

thm:B-gamma-sharp appendix

lem:B-ball main

thm:B-robustconst main, revised

thm:B-hidden main, revised

thm:B-shredattain appendix

thm:B-robustshred appendix

thm:B-sideshred main, revised

thm:B-fibreminimax appendix

thm:B-eta appendix

prop:B-kappa appendix

app:checks appendix

app:sources appendix

Version 3→version 4 crosswalk

Every label of version 3 (which contains every label of versions 1 and 2, Appendices and) resolves in version 4. Equation labels are omitted from the table and are all kept. No version-3 statement is changed; the last sentence of Proposition is now proved (Theorem (ii), DC-26). The rows marked ``new'' are the results of Section ; new section labels are sec:conditional, its subsections and the subsections of Appendix .

toprule v3 label v4 number page location

midrule endfirsthead toprule v3 label v4 number page location

midrule endhead bottomrule endfoot sec:intro main

sec:finite main

def:carrier main

def:leak main

rem:established main

def:probe main

lem:observable main

sec:core main

def:declared-d main

sec:central-dist main

thm:opt-response main

thm:radius main

sec:central-sampling main

thm:sampling main

sec:central-nonident main

thm:nonident main

sec:central-robust main

lem:B-ball main

thm:robust-spectator main

thm:B-robustconst main

sec:central-hidden main

thm:B-hidden main
prop:hidden-mixed main
sec:central-recovery main
thm:param-recovery main
def:side-access main
thm:B-sideshred main
prop:side-loosened main, completed (DC-26)
sec:examples main
sec:ex-current main
def:hostscalar main
thm:current-blind main
prop:current-sampling main
sec:ex-curved main
def:curvedhost main
thm:curved main
cor:curv-sampling main
thm:curvature-sampling main
sec:ex-echo main
thm:echo main
cor:echo-error main
thm:joint-output main
sec:limits main
mainend main
app:v1 appendix
sec:host appendix
lem:clock appendix
thm:host appendix
sec:blind appendix
def:spectator appendix
thm:blind appendix
def:greenrep appendix
cor:green appendix
thm:declared appendix
prop:correlations appendix
prop:robustblind appendix
sec:shred appendix
def:shred appendix
thm:shred appendix
ex:syndrome appendix
cor:approxshred appendix
sec:domains appendix
thm:spin appendix

thm:apex appendix
sec:dynamic appendix
def:dyn appendix
thm:dyn appendix
sec:fibres appendix
def:accounts appendix
lem:fibre appendix
thm:fibre appendix
prop:coefficient appendix
sec:endpoint appendix
prop:archive appendix
sec:v2 appendix
thm:declared-d appendix
thm:leak-exact appendix
cor:original-rod appendix
thm:phase appendix
prop:clock-confound appendix
thm:dyn-hosts appendix
prop:not-mouth appendix
prop:sector appendix
prop:split appendix
thm:enriched appendix
app:self appendix
prop:B-gamma appendix
thm:B-gamma-sharp appendix
thm:B-shredattain appendix
thm:B-robustshred appendix
thm:B-fibreminimax appendix
thm:B-eta appendix
prop:B-kappa appendix
sec:release appendix
thm:release appendix
thm:release-v2 appendix
app:v3 appendix
app:debug appendix
app:records appendix
app:plan appendix
app:review appendix
app:programme appendix
app:crosswalk appendix
app:crosswalk-v3 appendix
app:t325 appendix

app:findings appendix

app:checks appendix

app:sources appendix

def:cx-supply main, new

lem:cx-cq main, new

thm:cx-hidden main, new

def:cx-coh main, new

thm:cx-coherence main, new

thm:cx-gradient main, new

prop:cx-neck main, new

thm:cx-exclusion main, new

thm:cx-precision main, new

thm:cx-register main, new

prop:cx-programme main, new

Theorem package t325u: verdicts and plan corrections

The user's theorem package (file PLAN_t325u.md, sha256 4779f62c9663046c69d9ebdf28da88653527f5c8baedf9ec32605a407b1d011f) proposes nine items. Each is proved here in the stated or the corrected form; the user's priority items 1, 4 and 5 form Section .

toprule Item v2 label Verdict Note

midrule endfirsthead toprule Item v2 label Verdict Note

midrule endhead bottomrule endfoot Thm 1 thm:opt-response held As stated; attained by a Helstrom observable (N01).

Thm 2 thm:radius held (PC-5) Saturation criterion made precise for a fixed observable (N02, N03).

Thm 3 thm:leak-exact corrected (PC-6) The family must contain both endpoints; rod saturation needs $λ_1 = −λ_0$ and $θ_{−} + θ_{+} = π/2$ (N04, N05).

Thm 4 thm:sampling held (PC-11) Typed: orthonormal modes, real bounded field, code states in $\mathscr{D}(C)$; item 3 made precise; converse added (N06).

Thm 5 thm:nonident held (PC-9) Data map written $D(h, W)$ (N07).

Thm 6 thm:param-recovery held, sharpened (PC-10) $F_e = 1/d^2$ with equality; distinguished from the shredder floor $1 − 1/d$ (N08).

Thm 7 thm:joint-output corrected (PC-7) Ill-typed equation replaced by a dilation statement and a recovery statement; counterexample merged with prop:correlations (N09, V04).

Thm 8 thm:robust-spectator held, sharpened (PC-8) $γ_O ≤ b(ε) ≤ 2ε$; $δ_{leak}(W_0) = δ_{leak}(V)$ (N10).

Cor 9 cor:curv-sampling held Needs nonconstant curvature; on DSS_H the compression is scalar and the witness vanishes for every coupling (N11, F06); instance thm:curvature-sampling.

PC-5 Theorem 2's ``saturated iff $D_{probe} = 2δ_{leak}$ and the observable is an optimal Helstrom observable for a diameter-realizing pair'' is proved with the meaning: for a fixed $O ≠ 0$, $γ_O = 2δ_{leak}$ iff $D_{probe} = 2R_{probe}$ and some diameter-realizing pair has $|o_i − o_j| = 2‖O‖_{∞}D(P_i, P_j)$. Helstrom observables are not unique.

PC-6 Theorem 3 states $δ_{leak} = 1/2 \sin Δ$ for ``any finite family of probe states contained in this arc'' with $Δ = b − a$ the arc width. This is true only when the family contains both endpoints; otherwise the leakage is $1/2 \sin$ of the family's own span (check N04: states at $0.4, 0.6$ inside $[0.1, 0.9]$ give $1/2 \sin 0.2$). Rod saturation requires $Δ > 0$, $λ_1 = −λ_0$ and $a + b = π/2$; both conditions are stated.

PC-7 Theorem 7's equation $δ_{leak}(\mathscr{Q}_{λ} ⊗ \mathscr{T}_{ω_{λ}}) = δ_{leak}(\mathscr{Q}_{λ})$ is ill-typed: leakage is defined on the complete complement of an isometry, not on a channel. The proved statements are $δ_{leak}(V ⊗ ψ_{ω}) = δ_{leak}(V)$

for an input-independent report with any purification, and equality of the optimal recovery errors with and without the report. An input-dependent report can change leakage.

PC-8 Theorem 8's $\gamma_O \le 2\varepsilon$ is valid and agrees with Proposition , but is not sharp; the sharp constant is $b(\varepsilon) = 2\varepsilon\sqrt{(1-\varepsilon^2)}$ for $\varepsilon \le 1/\sqrt{(2)}$ (Theorem). The comparison leakage is $\delta_{leak}(W_0) = \delta_{leak}(V)$, not zero in general.

PC-9 Theorem 5 writes the data map as $D(h, \Delta)$; it is $D(h, W)$.

PC-10 Theorem 6 states $F_e \le 1/d^2$; for every decoder $F_e = 1/d^2$ exactly.

PC-11 Theorem 4 does not type its compression. Proved form: f_a orthonormal in $L^2(U, dvol_h)$, f_h real and bounded on their supports, code states ranging over all of $\mathscr{D}(C)$; item 3 is read as independence of the sampled expectation from the code state. Added: O_f is scalar iff every coupling gives zero witness.

Supplied findings t324u: verdicts and draft corrections

The supplement ``En04-B: New Findings Beyond Version 1'' (file findings_t324u.tex, sha256 ad8f17f932eb17b52ad3740e1ea354b7d42261a879f21235045d056dd611b856) was re-proved item by item; every quoted source formula and label was checked against the read-only API sources (check F12). Where it overlaps v2's own plan results, the stronger form is kept.

toprule Findings label Verdict v2 location and note

midrule endfirsthead toprule Findings label Verdict v2 location and note

midrule endhead bottomrule endfoot thm:current-blind held Merged; v2's form (antisymmetry, source supply) kept; every CPTP channel covered by Theorem (F01).

prop:current-sampling held Proposition (F01).

thm:radius held Theorem , with diameter bounds (N02).

thm:leak-exact held Arc form adopted in Theorem , notation $\theta_{\pm}$ (DC-18; F02, N04).

cor:original-rod held Corollary ; ratio $< 1/2$ added.

thm:curved held (DC-14) Merged; floor $1/4$ kept with the exact $3/8$ for qubit codes (F04).

thm:echo held (DC-15) Item (i) added to Theorem ; C_J not computed (F07).

cor:echo-error held Corollary .

thm:phase held Rescaling and phase fibre added as item (iii) (F08).

prop:clock-confound held Proposition (F08).

thm:dyn-hosts corrected (DC-11) Profiles and census verified; notation ε, P (F09, F12).

thm:curvature-sampling held Theorem (F05).

prop:not-mouth held Area statement added as item (iii) (F05).

prop:sector held Insufficiency example added (F10).

prop:split held Proposition (F04).

thm:enriched held Theorem (F11).

Check ledger S1–S7 corrected (DC-16) Re-run as checks F02, F03, V04; S4 is a negative control.

DC-11 The findings state that the complete I-D document was unavailable and attribute the host profiles to antecedent displays. On October 25, 2026 the I-D source was retrieved read-only; def:host-A, def:host-B and thm:v5-census (counts 7, 6, 8, 7, 8, 8; total 44; the box; $|Im\ \omega| \ge 0.12816$) were verified there, and the profile formulas were verified in Hawk07-C-Dyn (eq:F, eq:dynamic-metric) and Hawk07-D (eq:neck-profile, eq:F, eq:metric), with the sources' β, W, ℓ renamed.

DC-12 Version numbers in the findings' bibliography are copied only where the retrieved source carries a marker: I-B-VP (v3), I-B-G-S (v2), Big01-A (v5), I-C (v2), En09-C (v5), I-D (v5), Res01-C (v5), XVI-O1-CONE-G0 (v5), Prob02-B (v5), Big04-A-coeff (v5 header). Big04-A's header records v5 inserted over a title reading Version 4. No marker was found for I-B-VP-0, I-B-G, I-B-VP-CR, En09-A, Hawk07-C-Dyn, Hawk07-D, Hawk07-C, En08-A, En04-A, XIV-H, XIV-I, XIV-J or XV-B; those numbers are not copied.

DC-13 Titles: En04-A's full title is longer than the findings' entry; the catalogue's recorded title is ``OpenAI Research Catalogue''. The findings describe Big05-A from a development record without full text; a local Big05-A v1 source exists (sha256 recorded in the bibliography) and is unregistered (API 404).

DC-14 The two-point floor *1/4* in the findings' thm:curved(iii) is valid but not optimal over all carriers (as DC-9).

DC-15 The findings' echo statement holds for sufficiently small *u_{*}* with an uncomputed *C_J*. Numerically (check F07, *r_e = 1*, *r_r = 2*, uniform weight, *J = [0. 6, 1]*) the deviation *|s^{'} − q_0^{'}|* is about *0. 79* at *u_{*} = 0. 1* and *2. 93* at *u_{*} = 0. 2*, scaling as *u_{*}^2*, while *max_J s^{'}* stays below *−π/2 + 0. 006*; the uniform-constant form is therefore conservative, and no value of *C_J* is asserted.

DC-16 The findings' check ledger labels its items analytic and not executed, with S4 marked FAIL and S7 NOT RUN. In v2 these items are executed checks (F02, F03, V04); S4 is the negative control of Corollary ; the paper asserts no compilation.

DC-17 The findings' standing boundary is not the plan's verbatim boundary; v2 carries the plan's bullets verbatim, with which the findings' items are consistent.

DC-18 The findings use *a, b* for arc endpoints, which clash with the scale factor *a(η)* and the neck radius *b*; v2 uses *θ_{±}*.

Symbolic and numerical checks (pass/fail record)

The accompanying check script records the following results. Symbolic items use exact computer algebra; leakage and half-diamond values are semidefinite-programme evaluations at tolerance *10^{−5}*; ``mutation'' items are negative controls that must detect a deliberately wrong value. Items V01–N11 and F01–F12 are those of version 2; items X01–X07 and MX1–MX3 are the version-3 re-examinations of Appendix ; items Y01–Y07 and MY1–MY3 check the conditional results of Section . Item X03 is an exact rational certificate. These checks do not replace the proofs. Summary: 74 of 74 mathematical items pass. Source-text checks of this file are recorded separately with the check script.

toprule ID Check Result

midrule endfirsthead toprule ID Check Result

midrule endhead bottomrule endfoot V01 { ttfamily lem:clock CPTP and Tr_(X) M_(K)(Z)=Tr_(K) Z} pass

V02 { ttfamily thm:blind leak(W0)=leak(V), C_(G) constant} pass

V03 { ttfamily thm:declared rod witness (l1-l0)sin² eta (sympy)} pass

V04 { ttfamily prop:correlations: printed W_(c)orr isometry, marginals I/2, outputs orthogonal, XX witness 2, leak 1/2} pass

V05 { ttfamily thm:shred/ex:syndrome: constant complement, exact decoder, shredded error = 1-1/d, F_e=1/d} pass

V06 { ttfamily thm:shred: 30 random shredder/decoder pairs have F_e<=1/d} pass

V07 { ttfamily thm:spin: L r^nu2=2nu2 r^-nu1, ell?u r^nu=0, energy density 2nu² $r^(-2nu-1)$} pass

V08 { ttfamily thm:apex: U ell_l/2 U^-1=-d², kernels solve ODE, BCs, jump -1, difference e^(-p(r+s))/p} pass

V09 { ttfamily thm:fibre: leak 0 and 1/2; T-precomposition invariant; TXT^(d)ag not Pauli} pass

V10 { ttfamily prop:archive: independent fair bits give strictly increasing entropy n log 2} pass

V11 { ttfamily cor:approxshred bound 1-1/d-eps attained by (1-p)Delta+p id} pass

P01 { ttfamily thm:current-blind: J(1-b)=-J(b), J(0)=J(1/2)=0; scalar representative pulls back to scalar} pass

P02 { ttfamily thm:curved: flat-chart DSS_(H) scalar curvature R=12H²/c² (Christoffel computation)} pass

P03 { ttfamily thm:leak-exact: leak($W_e$ta)=sin(eta)/2 (SDP), full gamma=sin eta=2 leak (saturated)} pass

P04 { ttfamily thm:leak-exact(iii): rod-only ratio = sin(eta)|l1-l0|/(2||O||) <1 (strict) for 0<eta<pi/2} pass

P05 { ttfamily thm:declared-d / thm:leak-exact(i): d=3 pullback diag(o_j); leak = Chebyshev radius (=half diameter for a coplanar real family)} pass

P06 { ttfamily thm:echo: replacement decoder error >= 1-1/d², = for I/d (d=2,3)} pass

P07 { ttfamily thm:phase(iii): code-dependent clock gives leak 1/2 with transmitting V} pass

P08 { ttfamily prop:not-mouth: same radiation channel, rod witnesses 0 and l1-l0} pass

S01 { ttfamily lem:B-ball: SDP widths <= b(eps) and attained (n=2,3)} pass

S02 { ttfamily thm:B-robustconst: dhalf=sin t, holonomy response=b(eps); leak Lipschitz equality} pass

S03 { ttfamily thm:B-hidden: robust 2 sqrt(delta) bound (SDP, 5 random); overlap >= max(0,2lmax-1), attained} pass

S04 { ttfamily thm:B-shredattain: M_x=D0^(*)(|x><x|) attains 1-1/d for random recoverable V} pass

S05 { ttfamily thm:B-sideshred: cyclic Lambda? has dhalf=1-k/d, F_e=k/d, PSD decomposition; random rank<=2 Kraus F_e<=k/d} pass

S06 { ttfamily thm:B-fibreminimax: leak(id_(d))=1-1/d^2 (d=2,3); random <=3/4; SWAP path 0->3/4} pass

S07 { ttfamily thm:B-eta: w_(O)=A $\sin^2$ eta + B sin 2 eta (sympy); line-case max fibre width in eta = min(phi,pi-phi)} pass

M01 { ttfamily negative control: leak(diary)=3/4, so a mutated value 1/2 is rejected} pass

M02 { ttfamily negative control: robust constant eps (instead of 2eps sqrt(1-eps^2)) is violated by the attaining family at t=0.5} pass

M03 { ttfamily negative control: block pinching (3,2) has dhalf 1/2 > 1-k/d, so cyclic windows are needed} pass

M04 { ttfamily negative control: mutated correlation isometry (sign flipped) has equal complement outputs (no response)} pass

M05 { ttfamily negative control: mutated current factor (2b+1) loses antisymmetry} pass

N01 { ttfamily Thm1 (thm:opt-response): sup_(O) gamma_(O) = D?robe; Helstrom attains; 3000 random O never exceed; pure formula sqrt(1-|<b_i|b_j>|^2)} pass

N02 { ttfamily Thm2 (thm:radius): leak = R?robe (joint SDP vs Chebyshev SDP), D/2<=leak<=D, random d,g} pass

N03 { ttfamily Thm2 saturation: Helstrom O saturates when D=2leak; centred rod off-direction does not; equilateral triple has D=sqrt3/2<2leak=1 (no O saturates)} pass

N04 { ttfamily Thm3 (thm:leak-exact): arc leak=sin(Delta)/2 incl. intermediate points (d=2..4), sigma* radius on 2001-point arc, ||O*||=1, gamma_(O)*=sin Delta, rod formula; saturation iff lambda1=-lambda0 and a+b=pi/2; endpoint-free family gives its own span (PC)} pass

N05 { ttfamily Thm3 sympy: dtr(P?,sigma*)^2 = (1+$\cos^2$D-2cosD cos2(t-m))/4, endpoint value $\sin^2$D/4, monotone in |t-m| for cosD>=0} pass

N06 { ttfamily Thm4 (thm:sampling): zero witness on all code states <=> W^(d)ag(I(x)O_(f))W scalar (5 random W); nonscalar O_(f) has a coupling with witness = spectral spread; scalar compression blind; disjoint-mode compression diagonal with kappa0!=kappa1} pass

N07 { ttfamily Thm5 (thm:nonident): two-point minimax error = Delta_(T)/2 (grid over estimators), leak pair 0 vs sin(eta)/2} pass

N08 { ttfamily Thm6 (thm:param-recovery): F_e(D o K)=1/d^2 exactly (equality, stronger than <=), dhalf>=1-1/d^2 attained by I/d; shredder Delta_(d) has 1-1/d < 1-1/d^2 (different channel class)} pass

N09 { ttfamily Thm7 corrected (thm:joint-output): leak(V(x)psi$_o$mega)=leak(V) for input-independent report; input-dependent copied report changes leak (control)} pass

N10 { ttfamily Thm8 (thm:robust-spectator): gamma_(O)<=2eps (and <= b(eps)), |leak-leak(W0)|<=eps; leak(W0)=leak(V) is generally nonzero (random V)} pass

N11 { ttfamily Cor9 (cor:curv-sampling): witness (kappa1-kappa0)$\sin^2$ eta (sympy); constant-R host (DSS_(H)) compression scalar -> zero (see N06/F06); requires nonconstant R} pass

F01 { ttfamily thm:current-blind (every CPTP) and prop:current-sampling: j antisymmetric, r-dependent; sampled witness (j1-j0)$\sin^2$ eta} pass

F02 { ttfamily findings rational instance: w=32/25, leak=2/5, gamma=16/75, sigma*, O*, O*²=I (exact)} pass

F03 { ttfamily findings syndrome instance: C?yn(|i><j|)=delta$_{ij}$ diag(1/3,2/3); Bell-block eigenvalues -2/3,1/3,1/3; dhalf(Delta$_3$,id)=2/3} pass

F04 { ttfamily thm:curved / vacuum remark: Gamma^(t)$_{ij}$=(H/c²)e^(2Ht)delta, Gamma^{i}?j=H delta, Ric=3H²/c² g, R=12H²/c², c0 g+cG G=(c0-3H²cG/c²)g; s g conserved (nabla g=0)} pass

F05 { ttfamily thm:curvature-sampling: R_(B)=-2b²/(a$_i$nf²(x²+b²)²), nonconstant; prop:not-mouth: torus area 2 pi a$_i$nf² b L_(z)} pass

F06 { ttfamily constant-curvature compression (DSS_(H)) is scalar: zero witness for 5 random couplings (negative control for Cor9 on DSS_(H))} pass

F07 { ttfamily thm:echo(i): q(alpha,0)=q0; q0'=-(x-sin x cos x)/(alpha² sin² x)<=-pi/2 on (1/2,1]; |s'-q0'|=O(u*²) (ratio u*=0.2 vs 0.1 approx 4) on J=[0.6,1]} pass

F08 { ttfamily thm:phase clock rescale e^(-i(A/a)(at))=e^(-iAt); prop:clock-confound identity Tr(O F_(c)lk(rho))=Tr(rho sum m? F?) and example witness (l1-l0)sin² eta} pass

F09 { ttfamily thm:dyn-hosts: P(r)=sqrt(r²+b²) on r<=L0 (sympy); d0=P(L1)-L1>0 and P(L1)>=sqrt(L1²+b²) (numeric, b=0.5,L0=1,L1=2)} pass

F10 { ttfamily prop:sector: I0,I1 agree on S={(x,0)}, I1(0,1)=1 while r(0,1)=0} pass

F11 { ttfamily thm:enriched: two-point floors sin(eta)/4 and |l1-l0|sin²(eta)/2 (half-separation)} pass

F12 { ttfamily findings: 14 quoted source formulas and 32 cited labels found in read-only API sources} pass

X01 { ttfamily thm:robust-spectator attainment: (H?u-H?u^(d)ag)/2i=-sin mu (I(x)sigma_(y)); unnormalized w=2|sin mu|sin2t, normalized gamma=b(eps) for every mu with sin mu!=0 (7 mu x 5 eps); sigma_(y) alternative witness; dhalf(W?,W$_0$)=sin t (SDP)} pass

MX1 { ttfamily negative control: at mu=pi and mu=0 the holonomy observable vanishes and the real part is scalar, so no holonomy witness attains b(eps) there} pass

X02 { ttfamily thm:B-hidden(iii) pure case: equal marginals give TD <= h(sigma) = sqrt(1 - max(0, 2 lmax - 1)²) (9 spectra incl. degenerate, dim E in {n,n+1}, 15 random commuting U each); polygon-closure minimum equals max(0,2lmax-1)} pass

X03 { ttfamily prop:hidden-mixed: exact rational certificate (dim E=3, dim G=2, sigma=diag(7/10,3/10)): both states PSD (all principal minors), equal E-marginals, G-marginals sigma, 0<=P<=I, Tr P(F0-F1)=lb with lb²>h(sigma)²=21/25} pass

X04 { ttfamily mixed outputs (real SDP, alternating): max TD exceeds h(sigma) for (dimE,dimG,lmax)=(3,2,.7),(4,2,.9) and stays <1; no gain for (2,2,.7)} pass

X05 { ttfamily thm:B-hidden(ii) sharp: f(delta) = (delta + sqrt(4 delta - 3 delta²))/2 (sympy: top eigenvalue of |Psi><Psi|-|u><u|; concavity); attained by sqrt(1-d)|0g>+sqrt(d)|1g?erp>; 960 random pure/mixed states per delta never exceed; phi<=delta+sqrt(delta(1-delta))<=2sqrt(delta)} pass

MX2 { ttfamily negative control: the constant sqrt(delta) (dropping delta/2) is violated by the attaining state at delta=0.1} pass

X06 { ttfamily thm:B-sideshred access model: 100 random instruments C->X(x)K with record-dependent decoders using fresh ancillas give F$_e$<=k/d; Lambda? attains k/d; loosened model (pre-shared Bell pair retained by decoder, k=1, 4-valued record = teleportation) gives F$_e$=1>1/2} pass

X07 { ttfamily thm:echo(i) local only: q=q0 D/(D+cosh(u/a)-1) (sympy); (q-q0)/u² -> -q0/(2a²D) so C_(J) >= C?ead(J)=max_(J) |d/da(q0/(a² D))|/2 = 6.2376 [.75,1], 242.10 [.6,1], 3870.6 [.55,1]; numerical sup on [.6,1], u<=0.05 matches; d$_a$lpha q(0.55,3)>0 while d$_a$lpha q(0.55,0.01)<0 (no global monotonicity)} pass

MX3 { ttfamily negative control: the window u*=0.1 on J=[0.6,1] violates pi/2-C?ead u*²>0, so the local hypothesis is not vacuous} pass

Y01 { ttfamily thm:cx-hidden: GHZ? family (n=2,3,4 sectors): every marginal on <=n-1 sectors input-independent; D=sin t; product n-point observable X..X(sin t X+cos t Y) has |w|=2 sin t (gamma=sin t);

leak=sin(t)/2 (SDP, n=2,3), so gamma$_j$oint=2 leak; random cq complements D/2<=leak<=D} pass

MY1 { ttfamily negative control: replacing |1111> by |1110> makes some 3-sector marginal input-dependent (detected)} pass

Y02 { ttfamily thm:cx-coherence: pure controlled carriers v^2+4 $leak^2$=1 (12 random, dG=2..4); mixed probe records: v<=F, c(W)=F (SDP), v^2+D^2<=1, c^2+4$leak^2$<=1; strict example c=1/sqrt2, leak=1/4 (sum 3/4); trine d=3: leak=1/2 with 4$leak^2$+min v^2>=1 and $leak^2$<=1-max? min$_j$ $v_j k^2$} pass

Y03 { ttfamily thm:cx-gradient: Host-B neck R_(B), antiderivative and R_(B)'=8b^2 l/(a^2(l^2+b^2)^3) (sympy); mirror placement gives equal sampled averages exactly; uniform-profile exact averages: |dk - Dx R_(B)'(xb)| <= M3 Dx^3/6 (16 placements), error ratio 6..10 under halving (7.77 at xb=0.2); |sin^2 eta - eta^2|<=eta^4/3; ordering: constant K=100 gives witness 0, neck with |R|<=2e-4 gives nonzero witness} pass

MY2 { ttfamily negative control: a remainder bound 100x smaller (M3 Dx^3/600) is violated at xb=0.5, Dx=0.4} pass

Y04 { ttfamily thm:cx-exclusion: eps*(gamma)=sqrt((1-sqrt(1-$gamma^2$))/2) inverts b exactly (sympy at 3/5: eps*=sqrt(1/10)); 100-point grid: b(eps*)=gamma, eps*>=gamma/2, eps*<=1/sqrt2, b(eps*-1e-3)<gamma (threshold sharp), attained by the v3 family} pass

MY3 { ttfamily negative control: the naive threshold eps=gamma/2 cannot produce gamma=0.99 (b(0.495)<0.99), so gamma/2 is not the exclusion threshold} pass

Y05 { ttfamily thm:cx-precision: identical admitted-data laws for every n and noise level keep two-point minimax error Delta/2; converse: one coupling-sensitive probe measurement (Bernoulli sin^2 eta) gives L?=sqrt(phat)/2 with sup$_e$ta E|L?-leak| <= 1/(2 sqrt n) (exact binomial sums, n=10..10^4); Bhattacharyya bound $P_e$rr<=BC^n/2} pass

Y06 { ttfamily thm:cx-register: with a pre-shared system of dim dB retained by the decoder, F_e<=k dB/d (15 random instruments, d=4,k=1,dB=2); one-time pad d=3: record uniform and register marginal I/d for every input, yet record-conditioned decoder gives F_e=1} pass

Y07 { ttfamily prop:cx-toy: 4-sector GHZ? toy meets C1 (all 1-,2-,3-sector statistics input-independent), C2 (4-point product witness 2 sin t), C3 (R-coherence cos t, c^2+4 $leak^2$=1 with SDP leak), C4 (best pure-spectator centre at distance sin(t/2)=eps*(sin t); numerical search never lower)} pass

Source retrieval record

Read-only GET requests to https://enter.grok.me/api/manuscript/<ID> on October 25, 2026. The table lists the HTTP status and the first sixteen hexadecimal digits of the sha256 of the returned source. A retrieved source identifies a record; it is not a premise.

toprule ID Status sha256 (prefix)

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midrule endhead bottomrule endfoot Big01-A 200 8849b3556e2925be

Big02-A 200 8936ba43152e4e52

Big03-A 200 c71007c5e5455227

Big04-A-coeff 200 69d97b6fb3d598e7

Big04-A 200 a0126c6a30370f62

DS-OB-1-fibre 200 b81d93b4bf81bd01

En04-A 200 91ebd6ca004f0593

En05-A 200 9e9e7506cbf793b8

En06-A 200 ffd2b5ac55fc0beb

En07-A 200 5b2641e125dec924

En08-A 200 cdff861a40c80028

En09-A 200 189f81cbe6da7a49

En09-C 200 789b2ef40be69d73

Hawk07-C-Dyn 200 aa615946d5ee868c

Hawk07-C 200 900aa417f0968ace

Hawk07-D 200 67b629bad060d69a

I-B-G-S 200 85fb6c760df8732e

I-B-G 200 db8462db2e350fcd

I-B-VP-0 200 a208bfed4ecb51f5

I-B-VP-CR 200 1734ae3f9c57498b

I-B-VP 200 62ec03eadddff422

I-B 200 d070cbb8e973eeeb

I-C-Th 200 3eb1165a52673a06

I-C 200 10f3878a3e890d8d

I-D 200 4431dd996c43678d

OpenAI 200 76314b644e51864f

Prob02-B 200 b0855a79b0a32823

Res01-C 200 5311218b51faedfe

XIV-H 200 4c491cf6109f8c89

XIV-I 200 a7aaf8d9a3095e9a

XIV-J 200 b7a1c430139d8635

XV-B 200 b8c24754cad5e7c0

XVI-O1-CONE-G0 200 c0a19108c31ee3b3

Big05-A 404 —

En04-B 404 —

EntPhil 404 —

Declarations

Authorship. The new manuscript's author field is intentionally unset pending confirmation, as instructed by the user. Companion title pages naming Ngo Cheung are cited as source records; they do not establish authorship of this new text. The journal article is attributed as shown on the publisher's section listing (DC-3).

Contribution. The exact-correction criterion, measure-and-prepare obstruction, trace-norm duality, two-point minimax bounds, teleportation and the controlled-rotation carrier are established background. The contribution claimed here is the explicit prescribed-host interface, the identities and sharp constants of Section , the same-host blindness and supplied-probe certificates, the correlation correction, and the typed non-selection tests, and the conditional layer of Section (the joint-witness, coherence, gradient, exclusion, precision and retained-access bounds with attaining witnesses). No claim of first discovery of the underlying channel inequalities is made.

Physical and analytic scope. The mode register is a finite laboratory probe, not a constructed gravitational Hilbert space. Ideal finite placement is not physical compilation. Local radial domain calculations are not new global spin Green theorems. Formal source slots are not realized matter solutions. A declared label is not an admitted quantum coefficient. The results of Section are conditional statements about declared finite data, not cosmological predictions. No dynamical, cosmological or foundational quantum-gravity claim is made.

Verification and delivery. No compilation is asserted. No proof-assistant verification, referee approval, or journal acceptance of En04-B is asserted. The symbolic and numerical checks of Appendix are recorded as pass/fail; they support, and do not replace, the explicit proofs above. This file performs no registration, site wiring, parent revision, or change to a programme status. En04-B is not registered.

Standing ledger (repeated)

No quantum coefficient. The coefficient slot stays unfilled. No Einstein dynamics, derived metric, spacetime emergence, de Sitter state, Page curve, or gravitational endpoint. Host A and Host B stay separate. Host C is not created. O.1 stays NOT_CLOSED. Gate 0 and ST4b stay NOT_SUPPLIED. XV-B is not opened. XVI-N is not discharged. H2, I3, J2, T3 stay unresolved. U6-sel is not moved. Magic is not leakage. Residual response is not geometric response. Readout-and-drop is not physical deletion. A finite probe witness is not an identification with a field or metric degree of freedom. Cited sheets, including OpenAI catalogue entries and Big05-A, are source records and are not premises. Parents are not revised. En05–En09 are not rewritten. No quantum coefficient is admitted. No numerical κ is supplied.

Citations identify source records only; no proof transfer. No compilation is asserted.

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Every companion entry below is a source record; not a premise.

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