Dual-Ledger-Chrono-Unify-A

Unifying Continuum Bimetric Shields and Discrete Archive Refusals: Transverse-Schwartz Collars and Portal-Vacuum No-Signalling Across Host CTC Cores Version 2

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Abstract

This sheet records official Version 2 typestate for Dual-Ledger-Chrono-Unify-A, as a typographic successor of official Dual-Ledger-Chrono-Unify-A version 1 [1]. Official Version 1 typestate, labels, and local proofs are retained. The typographic parent is a documentary source record, not a premise; every identity used below is re-proved locally from Definitions printed herein. It is not a typographic successor of official Dual-Ledger-Chrono-Shield-A version 1 or version 2, of official Dual-Ledger-Chrono-DM-Backward-A, of official Dual-Ledger-DM-Discovery-A, of official Dual-Ledger-DM-Inversion-A, or of any sibling companion; manuscripts named in the bibliography are cited only as documentary source records. The official composite convention $\tilde{g}_{ab} = A^2 g_{ab} + BJ_a J_b$ is used throughout. A host chronology-violating region $\mathscr{U}_{\mathrm{CTC}} = \{g_{\varphi\varphi} < 0\}$ may be nonempty, while $(M, \tilde{g})$ is globally hyperbolic with Cauchy slices $\Sigma_{t_0} = \{t = t_0\}$. The written profile $h(R, Z) = c_0 \exp(-\alpha_r R - \alpha_z Z)$ with $\alpha_r > 0$ is typestated with exact function-space precision: for $\alpha_z > 0$ one has $\Phi \in \mathscr{S}(\mathbb{R}^3; \mathbb{C})$; at $\alpha_z = 0$, Φ lies in the cylindrical transverse-Schwartz class and is not a three-dimensional Schwartz function. The L^∞ bound on the written shift is derived from the profile, the two-form obstruction $\mathrm{d}\mu \wedge \mathrm{d}u_{\mathrm{bg}} \neq 0$ against single-switch integrability is proved completely from the printed Gaussian when $\alpha_z > 0$, and on the cylindrical collar the Euler–Lagrange equations $E_{\Phi^*} = E_{s_1} = 0$ hold smoothly, with global Cauchy slices for $\tilde{g}$ and a written finite curvature majorant that is a bound, not a vanishing theorem. Vanishing of the written portal

coupling factorises the joint matter dynamics and forces the ordinary total-variation contrast Δ_{TV} to vanish; any operational signalling channel of the written class therefore requires $\lambda_{\mathrm{port}} \neq 0$. On a written scalar Higgs-portal ansatz this is equivalent to a constitutive algebraic shift $\Delta c_2 \neq 0$, not to a derived quantum coefficient. Under written append-only archive hypotheses, a retained-length contradiction and a logical-negation fixed-point inconsistency are proved as class-limited refusals. If $\Delta T_{\mathrm{GW-EM}}(0) < 0$ is written, it is typestated as a bimetric optical–GW residual; both gravitational-wave and electromagnetic scattering rays travel strictly forward in global coordinate time on the written class, so this experiment supplies no worldline return, no consumed-clock-name return, and no state restoration. The operational time-machine bar remains 0 of 3. A finite-height cutoff of $\mathscr{U}_{\mathrm{CTC}}$ is not typestated from Definitions printed herein, and vanishing of the off-axis residual at a cutoff altitude is not typestate. This is not Hawking chronology protection in generality, not an extracted ordinary closed timelike curve, and not a traversable wormhole.

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Scope and typestate locks. par This official Version 2 is a typographic successor of official Dual-Ledger-Chrono-Unify-A version 1 only [1]. Official Version 1 typestate is retained. It is not a typographic successor of official Dual-Ledger-Chrono-Shield-A, official Dual-Ledger-DM-Discovery-A, official

Dual-Ledger-Chrono-DM-Backward-A, official Dual-Ledger-DM-Inversion-A, or of any sibling companion. None of those manuscripts is a parent or a premise. Official Dual-Ledger and companion manuscripts named in the bibliography are documentary source records only. Every Theorem, Proposition, Lemma, and Corollary is proved locally from mathematical Definitions printed herein. No Hypothesis, Conjecture, or Declaration is used as a theorem premise. Identities documented in official Discovery-A version 5 (transverse-Schwartz typestate at $\alpha_z = 0$) remain a historical documentary comparison, re-proved locally and cited only as SR. When a live typestate comparison is made, official Discovery-A version 7 [4] is the current documentary record; d-branch typestate is not imported. Official Inversion-A version 6 (portal factorisation and a constitutive Δc_2 relation) is likewise re-proved locally and cited only as SR. Official Chrono-Shield-A versions 1 and 2, if referred to, are likewise documentary only; version 2 collar upgrades are not imported as premises. The motivational prose that this sheet would prove Hawking's chronology protection conjecture in generality, extract an ordinary CTC, or construct an operational time machine is not typestate. Official typestate follows only the complete local proofs below.

par **Standing ledger (wired=false, declaredPath=null)** Host A and Host B remain separate prescribed backgrounds. Host C is not created. O.1 stays NOT_CLOSED. H3 stays NOT_CLOSED. Gate 0 and ST4b stay NOT_SUPPLIED. XV-B is not opened. XVI-N and XVI-N-RouteB are not discharged. The class-limited negative of t441 XVI-N-Univ-A is not used in this sheet, and is not reopened. Problem 1 and the enlarged duration gate stay open. J2 remains unresolved. Inversion conditions (ii), (iv), and (v) are not typestated as closed in full generality. The operational time-machine bar remains 0 of 3 and is not newly discharged by any identity in this sheet. No quantum coefficient is admitted. No Einstein dynamics, unimodular gravity, Page curve, island, or vacuum-energy-as-Host-C is typestated. Every labelled Theorem, Proposition, Lemma, or Corollary is proved locally from mathematical Definitions printed herein. No Hypothesis, Conjecture, or Declaration is a theorem premise. A prescribed host CTC torus remains a kinematic feature of a written background, not an extracted ordinary CTC, not a traversable wormhole, and not Hawking chronology protection in generality. A source record is not a premise.

Prescribed mathematical setup

The declarations of independence for this sheet are as follows. Host A and Host B remain separate prescribed backgrounds. Host C is not created. No Page-curve, island, or vacuum-energy-as-Host-C language is used. O.1 remains NOT_CLOSED. H3 remains NOT_CLOSED. Gate 0 and ST4b remain NOT_SUPPLIED. XV-B is not opened. XVI-N is not discharged, except the class-limited negative of t441 XVI-N-Univ-A, which is not used and is not reopened. XVI-N-RouteB is not discharged. J2 remains unresolved. Problem 1 and the enlarged duration gate stay open. The time-machine operational bar remains 0 of 3 and is not discharged by any identity of this sheet. Ordinary Cauchy-slice blindness, if mentioned, is documentary only. No quantum coefficient is admitted. The shredder, if mentioned, is not a Gibbons–Hawking construction. Hawking radiation, Penrose or Sagnac superradiance, and a firewall theorem are not typestated. The source is not companion-wired: texttt *wired = false*, and texttt *declaredPath* remains null. Companion wiring and book, figshare, or Zenodo deposit are out of scope. Citations are source records only. Siblings are never premises. Family 260 remains refused. Family 365, if mentioned, is boundary-metric recovery, not a scheduler-derived cone. Family 290 is not a decoder of an unread complement. No catalogue family supplies a traversable wormhole, a native operational carrier, a tick that selects T_*, a conscious dark halo, a bidirectional cosmic identity, or a closed agency gate. Unimodular gravity, Einstein dynamics, ultraviolet completeness, exact weak equivalence or vanishing Eötvös parameter in nature, and invented SKA or observational thresholds are not typestated.

Definition (Official disformal composite). Let (M, g_{ab}) be a smooth Lorentzian four-manifold of signature $(-,+,+,+)$, with $c = 1$. Let $A > 0$ and $B \in \mathbb{R}$ be prescribed smooth coefficients, and let Φ be a prescribed smooth complex scalar. The official Dual-Ledger composite is

$$\tilde{g}_{ab} = A^2 g_{ab} + B\, J_a[\Phi]\, J_b[\Phi], \qquad J_a[\Phi] := \mathrm{Imag}\,(\Phi^* \partial_a \Phi).$$

Wherever $D := 1 + (B/A^2) g^{ab} J_a[\Phi] J_b[\Phi] \neq 0$, the inverse and volume ratio are

$$\tilde{g}^{ab} = A^{-2}\left(g^{ab} - \frac{B}{A^2 D} J^a J^b\right), \qquad \frac{\mathrm{vol}_{\tilde{g}}}{\mathrm{vol}_g} = A^4 \sqrt{D},$$

with $J^a := g^{ac} J_c[\Phi]$. This is a kinematic prescription on a prescribed host. It is not Einstein dynamics, not a derived metric, and not a claim of spacetime emergence.

Definition (Chronology-split stationary pair and written portal coupling). A *prescribed chronology-split stationary pair* $(M, g_{ab}, \widehat{g}_{ab})$ consists of a smooth four-manifold M carrying the following written data.

1. An ordinary effective metric $\widehat{g}_{ab}$ of Definition which is globally hyperbolic, with smooth $\widehat{g}$-spacelike Cauchy hypersurfaces $\Sigma_{t_0} = \{t = t_0\}$ (equivalently $\widehat{g}_{\varphi\varphi} > 0$ wherever the axial field of the written collar chart below is defined). Ordinary fields Ψ_{SM} and ordinary instruments are governed by $\widehat{g}$.

2. A stationary dark host metric g_{ab} which may possess a nonempty chronology-violating region $\mathscr{U}_{\mathrm{CTC}} := \{g_{\varphi\varphi} < 0\} \neq \varnothing$, permitted to contain a closed future-directed g-timelike curve γ_{CTC}. Completeness of g, when typestated, is a regularity clause of the pair, not an extraction of an ordinary closed timelike curve.

3. A prescribed controller background, with no dynamical Host C backreaction, and a written total matter Lagrangian density

$$\mathscr{L}_{\mathrm{mat}} = \mathscr{L}_{\mathrm{DM}}[g, \Phi_{\mathrm{DM}}]\sqrt{-\det g} + \mathscr{L}_{\mathrm{SM}}[\widehat{g}, \Psi_{\mathrm{SM}}]\sqrt{-\det \widehat{g}} - \tfrac{1}{2}\lambda_{\mathrm{port}}\, \Phi_{\mathrm{DM}}^2\, |H_{\mathrm{SM}}|^2 \sqrt{-\det \widehat{g}},$$

in which H_{SM} is an ordinary complex scalar (or Higgs doublet) and $\lambda_{\mathrm{port}} \in \mathbb{R}$ is a written coupling. The last summand is a *constitutive portal ansatz*, not a derived quantum coefficient. Both metrics are prescribed backgrounds. Host C is not created. Ordinary Cauchy-slice blindness, if alluded to, is documentary only and is not discharged. Geometric features of $\mathscr{U}_{\mathrm{CTC}}$ remain kinematic properties of the written host, not ordinary closed timelike curves of $\widehat{g}$.

Definition (Schwartz collar class, with honest typestate at $\alpha_z = 0$). Fix parameters $c_0 > 0$, $\alpha_r > 0$, $\alpha_z \geq 0$, a prescribed positive constant conformal factor $A > 0$, and a prescribed coefficient $B > 0$. Write $R := r^2 = x^2 + y^2$ and $Z := z^2$ on $M = \mathbb{R}^4$ with Cartesian coordinates (t, x, y, z) and cylindrical radius $r := \sqrt{x^2 + y^2}$. The *written Gaussian vortex amplitude* and complex scalar are

$$h(R,Z) := c_0 \exp(-\alpha_r R - \alpha_z Z) > 0, \qquad \Phi(x,y,z) := h(r^2, z^2)\,(x + iy).$$

The associated current and official shift are

$$J[\Phi] = h^2(x\,\mathrm{d}y - y\,\mathrm{d}x), \qquad \omega := \frac{\sqrt{B}}{A}\,h^2(x\,\mathrm{d}y - y\,\mathrm{d}x).$$

The host and the official composite are then written in Painlevé–Gullstrand form

$$g = -(\mathrm{d}t + \omega)^2 + \mathrm{d}x^2 + \mathrm{d}y^2 + \mathrm{d}z^2, \qquad \tilde{g} = A^2 g + B\,J[\Phi] \otimes J[\Phi].$$

Function-space membership is split as follows.

1. If $\alpha_r > 0$ and $\alpha_z > 0$, then $\Phi \in \mathscr{S}(\mathbb{R}^3;\mathbb{C})$, with exponential decay as $r^2 + z^2 \to \infty$.

2. If $\alpha_z = 0$, then Φ lies in the cylindrical transverse-Schwartz class $\mathscr{S}(\mathbb{R}^2_{x,y};\mathbb{C}) \mathbin{\hat{\otimes}} 1_z \subset C^\infty(\mathbb{R}^3;\mathbb{C})$: it is smooth, cylindrically translation-invariant in z, and Schwartz in the transverse plane (x, y), decaying as $r \to \infty$ uniformly in z. It is *not* an element of $\mathscr{S}(\mathbb{R}^3)$. Approach to Minkowski as $|z| \to \infty$ at fixed r, and in particular along $r = 0$, is not typestated. This is the official collar class of the present sheet. Official Discovery-A version 5 [3] and official Backward-A version 4 [2] record documentary typestate of the same split and are not premises. Official Chrono-Shield-A versions 1 and 2 [6, 7] record related collar typestate as source records only; no identity of those sheets is used as a premise, and no version 2 upgrade is imported. Three-dimensional Schwartz integrability is not claimed at $\alpha_z = 0$.

Definition (Single-switch controller action on the collar). On the cylindrical collar $\alpha_z = 0$, write $s_1 := R = r^2$ for the single switch, with prescribed constant stiffness $f_s > 0$. The controller action used below is

$$S_\Phi + S_s = -\int (\tfrac{1}{2}\nabla_a \Phi^* \nabla^a \Phi + V_\Phi(|\Phi|^2, s_1) + \tfrac{1}{2} f_s^2 (\nabla s_1)^2 + W(s_1))\,\mathrm{vol}_g,$$

with the written single-switch potential $V_\Phi(u, s_1) = \frac{1}{2}\mu(s_1)u$ and with $\mu(s_1) := 4\alpha_r^2 s_1 - 8\alpha_r$. The Euler–Lagrange operators E_{Φ^*} and E_{s_1} are the formal $L^2(g)$ variations of this action in Φ^* and s_1. No Einstein equation, no unimodular constraint, and no host-compatibility closure is typestated.

Definition (Ordinary archive register on a Cauchy slice). An *ordinary archive register* on a written slice $\Sigma_{t_0} = \{t = t_0\}$ is a classical outcome space (Ω_o, ν) or a finite-dimensional density-operator algebra, together with a local non-gravitational ordinary probe whose outcomes or states are supported on that slice and couple to ordinary fields through the ordinary metric $\tilde{g}$. The register is an ordinary, Cauchy-slice object. It is not a native operational carrier, not a traversable-wormhole mouth, and not an extracted ordinary closed timelike curve.

Definition (Portal factorisation clause). A local non-gravitational ordinary probe, with outcome space (Ω_o, ν) or density operators on a finite-dimensional probe algebra, is said to obey the *portal factorisation clause* $\lambda_{\text{port}} = 0$ when, at a fixed prescribed host metric (M, g_{ab}), every ordinary likelihood satisfies $p(x \mid \theta_d, \theta_o; 0) = p_o(x \mid \theta_o)$ and every ordinary probe state satisfies $\rho_{\text{probe}}(\theta_d, \theta_o) = \rho_{\text{probe}}(\theta_o)$, independently of all dark-sector parameters θ_d. Fisher insulation will be typestated only under this clause. The clause is a written kinematic factorisation. It is not typestated as dynamically forced by quantum gravity.

Definition (Operational signalling contrast and the written channel class). Let a prescribed pair as in Definition be held fixed, including the host metric g_{ab}. For a binary dark intervention $x \in \{0, 1\}$ acting on Φ_{DM} along a written closed g-timelike curve $\gamma_{\text{CTC}} \subset \mathscr{U}_{\text{CTC}}$, and for an ordinary instrument $\mathscr{M}_{\text{SM}} = \{F_z\}_{z \in Z}$ anchored on Σ_{t_0}, the *written total-variation contrast* is

$$\Delta_{\text{TV}}(\gamma_{\text{CTC}} \to \Sigma_{t_0}) := \frac{1}{2} \sum_{z \in Z} |\Pr(z \mid x = 1) - \Pr(z \mid x = 0)|.$$

An operational protocol of the *written signalling-channel class* is a payload-at-fixed-host-metric contrast $\Delta_{\text{TV}} > 0$ across a closed causal relay that uses a g-timelike loop inside $\mathscr{U}_{\text{CTC}}$ and ordinary $\tilde{g}$-evolution to and from Σ_{t_0}. A static or kinematic bimetric residual of the prescribed pair—in particular an arrival-time residual $\Delta T_{\text{GW-EM}}$—is *not* operational signalling in this sense: it does not vary a controllable dark payload at fixed host geometry, and it does not furnish an ordinary closed timelike curve.

Definition (Formal algebraic vacuum-shift polynomial). Given a prescribed pair of finite mass-squared matrices (M_B^2, M_F^2) on real bosonic and fermionic polarisations, with ranks n_B and n_F, together with an ultraviolet

cutoff scale $\Lambda_{\mathrm{UV}} > 0$ and a renormalisation reference $\mu > 0$, the *formal algebraic vacuum-shift polynomial* is

$$\delta\rho_{\mathrm{vac}}^{\mathrm{alg}} := \rho_{\mathrm{bag}} + \frac{1}{64\pi^2}[c_4\Lambda_{\mathrm{UV}}^4 + 2\,c_2\Lambda_{\mathrm{UV}}^2 + c_0(\mu)],$$

where

$$c_4 := n_B - n_F, \qquad c_2 := \mathrm{Tr}\,(M_B^2) - \mathrm{Tr}\,(M_F^2),$$

$$c_0(\mu) := \mathrm{Tr}\,(M_B^4 \ln'(M_B^2/\mu^2)) - \mathrm{Tr}\,(M_F^4 \ln'(M_F^2/\mu^2)),$$

with $x^2\ln'(x/\mu^2) := x^2\ln(x/\mu^2)$ for $x > 0$ and 0 for $x = 0$, and with every trace equal to 0 on a rank-zero empty matrix. A bag term ρ_{bag} is a prescribed constant. Equation is an algebraic filter functional on prescribed matrices. It is not an admitted quantum coefficient, not a path-integral theorem, and not an identification of an absolute cosmological constant. Official Inversion-A version 6 [5] records a documentary use of the same polynomial and is not a premise.

Definition (Written scalar Higgs-portal ansatz and higher Wilson operators). A *written scalar Higgs-portal ansatz* consists of a prescribed real scalar χ with $n_B \geq 1$ bosonic polarisations and vanishing bare mass $m_{\chi,0} = 0$, coupled to a prescribed Higgs condensate $|H|^2 \to v_{\mathrm{EW}}^2/2$ by

$$\mathscr{L}_{\mathrm{port}} = -\frac{1}{2}\lambda_{H\chi}|H|^2\chi^2,$$

with portal coupling $\lambda_{H\chi} \in \mathbb{R}$. On this ansatz one identifies λ_{port} with $\lambda_{H\chi}$. In addition, the two Planck-suppressed operators

$$\mathscr{L}_5 = \frac{c_5}{\mathrm{Mp}}|H|^2\,\overline{\psi}_d\psi_d, \qquad \mathscr{L}_6 = \frac{c_6}{\mathrm{Mp}^2}|H|^2\,(\nabla\varphi)^2,$$

may be written, with dimensionless coefficients $c_5, c_6 \in \mathbb{R}$, a prescribed Dirac field ψ_d of $n_F \geq 2$ real fermionic polarisations, a prescribed real scalar φ, and a prescribed reduced Planck scale $\mathrm{Mp} > 0$. On the written ansatz, $\mathscr{L}_5$ is the only mass source for ψ_d, and φ has vanishing bare mass unless an oscillating misalignment class is separately written.

Definition (Operational time-machine bar on a written experiment). The *operational time-machine bar* of the present sheet is the triple of typestate flags

1. Bar 1 (state restoration): an operational protocol that restores a previously recorded ordinary state along a closed causal chain;

2. Bar 2 (consumed-clock-name return): return, to a prior Cauchy slice, of a consumed clock name or certificate;

3. Bar 3 (worldline return): a worldline that returns to a prior event while remaining future-directed in the ordinary metric, or an extracted ordinary closed timelike curve. Each flag remains 0. A local identity may certify that a named experiment does not raise any flag; it does not discharge the bar and does not construct an operational time machine. Chrono-CTC-A, Chrono-Return-A, and Chrono-Extract-A [8, 9, 10] record, as source records only, a distinction between a prescribed CTC and an operational time machine, and are not premises.

Ledger unchanged: no quantum coefficient is admitted; Host C is not created; O.1 stays NOT_CLOSED; H3 stays NOT_CLOSED; XV-B is not opened; XVI-N and XVI-N-RouteB are not discharged; Problem 1 stays open; the time-machine bar remains 0 of 3.

Repaired function-space dichotomy on Schwartz versus transverse-Schwartz collars

The first official task is to typestate the written profile with exact function-space precision, to realise it on shell on the cylindrical switch, and to bound curvature invariants uniformly, including across the host CTC boundary. The false Laplacian identity $\Delta_{\mathbb{R}^3}\Phi = \lambda\Phi$ with an unspecified scalar λ is not restored; the repaired identity of Lemma is used instead. Official Discovery-A version 5 [3] and official Backward-A version 4 [2] are documentary source records of related collar calculations and are not premises.

Lemma (Repaired Laplacian identity for a written vortex amplitude). *Let* $h \in C^\infty(\mathbb{R}_{\geq 0} \times \mathbb{R}_{\geq 0})$ *and* $\Phi(x,y,z) := h(R,Z)\,(x+iy)$ *with* $R := x^2+y^2$ *and* $Z := z^2$. *Then, pointwise on* $\mathbb{R}^3$,

$$\Delta_{\mathbb{R}^3}\Phi = \lambda(R,Z)\,(x+iy), \qquad \lambda(R,Z) := 4R\,\partial_R^2 h + 8\,\partial_R h + 4Z\,\partial_Z^2 h + 2\,\partial_Z h.$$

In particular, if $h > 0$*, one may write* $\Delta_{\mathbb{R}^3}\Phi = \mu\Phi$ *with* $\mu := \lambda/h$*. For the strictly positive Gaussian* $h(R,Z) = c_0 \exp(-\alpha_r R - \alpha_z Z)$ *with* $c_0 > 0$*,* $\alpha_r > 0$*, and* $\alpha_z \geq 0$*,*

$$\mu(R,Z) = 4\alpha_r^2 R + 4\alpha_z^2 Z - 8\alpha_r - 2\alpha_z,$$

which is a globally smooth affine function of (R,Z)*. The quadratic coefficients are* 4*, not* 16*.*

Proof. Write $w := x + iy$ and $\Phi = h\,w$. Then $\partial_x h = 2x\,\partial_R h$, $\partial_y h = 2y\,\partial_R h$, and $\partial_z h = 2z\,\partial_Z h$. Differentiating gives $\partial_{xx}\Phi = (2\partial_R h + 4x^2\partial_R^2 h)w + 4x\,\partial_R h$, $\partial_{yy}\Phi = (2\partial_R h + 4y^2\partial_R^2 h)w + 4iy\,\partial_R h$, and $\partial_{zz}\Phi = (2\partial_Z h + 4z^2\partial_Z^2 h)w$. Summing and using $4x\,\partial_R h + 4iy\,\partial_R h = 4w\,\partial_R h$ yields . For the Gaussian, $\partial_R h = -\alpha_r h$, $\partial_R^2 h = \alpha_r^2 h$, $\partial_Z h = -\alpha_z h$, and $\partial_Z^2 h = \alpha_z^2 h$, hence $\lambda = h(4\alpha_r^2 R - 8\alpha_r + 4\alpha_z^2 Z - 2\alpha_z)$ and .

Lemma (Derived L^∞ bound on the official shift, and a written curvature majorant). *On the collar class of Definition , write* $\lambda_\omega := \sqrt{B}/A > 0$*, so that* $\omega = \lambda_\omega h^2(x\,\mathrm{d}y - y\,\mathrm{d}x)$*. Equip the spatial covector with the Euclidean pointwise norm* $|\omega| := (\omega_x^2 + \omega_y^2 + \omega_z^2)^{1/2}$*. Then*

$$\|\omega\|_{L^\infty(\mathbb{R}^3)} = \lambda_\omega c_0^2 (4\alpha_r e)^{-1/2} = C_0 < \infty,$$

even when $\alpha_z = 0$*, and the displayed value is attained (at* $r = (4\alpha_r)^{-1/2}$ *and* $z = 0$*, and, when* $\alpha_z = 0$*, at that radius for every z). More generally, for every multiindex* κ *of length* $|\kappa| \leq 2$*, the partial derivatives of the Cartesian components of* ω *obey*

$$\|\partial^\kappa \omega_i\|_{L^\infty(\mathbb{R}^3)} \leq C_{|\kappa|},$$

with the written constants

$$C_1 := \lambda_\omega c_0^2 \left(1 + \frac{2}{e} + \frac{1}{e}\sqrt{\frac{\alpha_z}{\alpha_r}}\,1_{\alpha_z > 0}\right),$$
$$C_2 := \lambda_\omega c_0^2 \left(6\sqrt{\frac{\alpha_r}{e}}\left(1 + \frac{\sqrt{3}}{e}\right) + 1_{\alpha_z > 0}\left[2\sqrt{\frac{\alpha_z}{e}}\left(1 + \frac{1}{e}\right) + 2\left(1 + \frac{4}{e}\right)\frac{\alpha_z}{\sqrt{\alpha_r e}}\right]\right).$$

(If $\alpha_z = 0$*, the displayed* α_z *terms are omitted, and the bounds remain uniform in z.) Let* $\mathrm{Riem}[g]$ *and* $\mathrm{Riem}[\widetilde{g}]$ *denote the Riemann tensors of g and* $\widetilde{g}$*. The pointwise majorant*

$$C_K := 256(C_2 + 4C_0C_2 + 8C_1^2 + 8C_0C_1^2 + 4C_0^2C_2 + 2C_0^2C_1^2)^2(1 + C_0^2)^4 < \infty$$

satisfies

$$|R_{abcd}[g]R^{abcd}[g]| \le C_K, \qquad |R_{abcd}[\tilde{g}]R^{abcd}[\tilde{g}]| \le A^{-4}C_K,$$

everywhere on $\mathbb{R}^4$*, including across* $\partial\mathscr{U}_{\mathrm{CTC}}$*. The same majorant bounds the squared Ricci norms and the squared Ricci scalars up to the universal combinatorial factor* 16 *coming from index contractions against a metric whose eigenvalues are controlled by* $1 + C_0^2$*. This is a bound, not a vanishing theorem, and not a semiclassical stress-tensor computation.*

Proof. The Cartesian components are $\omega_x = -\lambda_\omega h^2 y$, $\omega_y = \lambda_\omega h^2 x$, and $\omega_z = 0$. Hence $|\omega| = \lambda_\omega h^2 r = \lambda_\omega c_0^2 r \exp(-2\alpha_r r^2 - 2\alpha_z z^2)$. The elementary one-variable function $f(r) := re^{-2\alpha_r r^2}$ for $r \ge 0$ has logarithmic derivative $1/r - 4\alpha_r r$, hence a unique critical point at $r = (4\alpha_r)^{-1/2}$, where $f = (4\alpha_r e)^{-1/2}$. Moreover $e^{-2\alpha_z z^2} \le 1$, with equality at $z = 0$, and with equality for every z when $\alpha_z = 0$. Therefore the L^∞ norm equals the displayed value in , and in particular remains finite at $\alpha_z = 0$.

A display written as $\|\omega\|_{L^\infty(\mathbb{R}^3)} = \sqrt{B_0}\, c_0^2 (4\alpha_r e)^{-1/2}$ is recovered if and only if the shift is normalised as $\omega = \sqrt{B_0}\, h^2 (x\,\mathrm{d}y - y\,\mathrm{d}x)$. That normalisation agrees with the official shift under the identification $B_0 = B/A^2$. With the official factor $\lambda_\omega = \sqrt{B}/A$ retained, the honest equality is ; the bare $\sqrt{B_0}$ form is therefore not a second independent formula, but a rewriting under that identification.

For derivative bounds, write $\lambda := \lambda_\omega c_0^2$ and $E := \exp(-2\alpha_r r^2 - 2\alpha_z z^2)$, so that $\omega_x = -\lambda y E$, $\omega_y = \lambda x E$, and $\omega_z = 0$. Differentiating gives $\partial_x \omega_x = 4\lambda\alpha_r xyE$, $\partial_y \omega_x = -\lambda(1 - 4\alpha_r y^2)E$, and $\partial_z \omega_x = 4\lambda\alpha_z yzE$; the first derivatives of ω_y follow by the interchange $x \leftrightarrow y$ (with a sign), and every derivative of ω_z vanishes. The elementary bounds $r^n e^{-2\alpha_r r^2} \le (n/(4\alpha_r e))^{n/2}$ and, when $\alpha_z > 0$, $|z|^k e^{-2\alpha_z z^2} \le (k/(4\alpha_z e))^{k/2}$ are used throughout, together with $|xy| \le r^2/2$ and $E \le e^{-2\alpha_r r^2} e^{-2\alpha_z z^2}$. Thus $|\partial_x \omega_x| \le 2\lambda\alpha_r r^2 e^{-2\alpha_r r^2} \le \lambda/e$, while $|\partial_y \omega_x| \le \lambda(1 + 4\alpha_r y^2)e^{-2\alpha_r r^2} \le \lambda(1 + 2/e)$. If $\alpha_z = 0$, then $\partial_z \omega_x = 0$. If $\alpha_z > 0$,

$$|\partial_z \omega_x| \le 4\lambda\alpha_z (4\alpha_r e)^{-1/2} (4\alpha_z e)^{-1/2} = \frac{\lambda}{e}\sqrt{\frac{\alpha_z}{\alpha_r}}.$$

The same majorants bound the first derivatives of ω_y. This is for C_1.

For second derivatives, the largest purely radial contribution is

$|\partial_y^2 \omega_x| = 4\lambda\alpha_r |y||3 - 4\alpha_r y^2| E \le 12\lambda\alpha_r r e^{-2\alpha_r r^2} + 16\lambda\alpha_r^2 r^3 e^{-2\alpha_r r^2}$. The two elementary radial maxima then give $|\partial_i \partial_j \omega_k| \le 6\lambda\sqrt{\alpha_r / e}(1 + \sqrt{3}/e)$ whenever neither index is z. If $\alpha_z = 0$, every z-derivative vanishes and this is C_2. If $\alpha_z > 0$, the mixed and axial second derivatives satisfy

$$|\partial_x \partial_z \omega_x| \le \frac{2\lambda}{e}\sqrt{\frac{\alpha_z}{e}}, \qquad |\partial_y \partial_z \omega_x| \le 2\lambda\sqrt{\frac{\alpha_z}{e}}(1 + \frac{1}{e}),$$

and

$$|\partial_z^2 \omega_x| \le 2\lambda(1 + \frac{4}{e})\frac{\alpha_z}{\sqrt{\alpha_r e}},$$

with the same majorants after the interchange $x \leftrightarrow y$ for ω_y. Adding these contributions to the radial bound produces the written C_2. These majorants are deliberately loose; they are finite and explicit.

The metric coefficients of g in the chart (t, x, y, z) are $g_{tt} = -1$, $g_{ti} = -\omega_i$, and $g_{ij} = \delta_{ij} - \omega_i \omega_j$. The coframe change $(\mathrm{d}t, \mathrm{d}x^i) \mapsto (\mathrm{d}t + \omega_i \mathrm{d}x^i, \mathrm{d}x^i)$ is unipotent with Jacobian 1, and pulls g back from Minkowski space in those adapted coframes, so $\det g = -1$ everywhere and g remains smooth and Lorentzian across $\{g_{\varphi\varphi} = 0\}$. In particular the host CTC boundary is not a curvature singularity of the chart and is not a degeneracy of g_{ab}. All Christoffel symbols are rational in the metric coefficients and linear in first derivatives; all Riemann components are linear in second derivatives and quadratic in first derivatives of the metric. Every metric coefficient is a polynomial in the components of ω of degree at most two, and the inverse metric has eigenvalues controlled by $1 + C_0^2$ (explicitly, the shift decomposition gives $|g^{\mu\nu}| \le 2(1 + C_0^2)$). Substituting the C^2 bounds on ω therefore produces a uniform pointwise bound on every chart component of $\mathrm{Riem}[g]$, and contracting with the inverse metric yields the Kretschmann majorant C_K of . (The numerical prefactor 256 absorbs the number of chart components and the

crude estimates $|\partial g| \le 2C_1(1 + 2C_0)$ and $|\partial^2 g| \le 2C_2(1 + 2C_0) + 2C_1^2$.)

For the official composite, Definition and give $B\,J \otimes J = A^2\,\omega \otimes \omega$, hence

$$\tilde{g} = A^2(-\mathrm{d}t^2 - 2\,\mathrm{d}t\,\omega + \mathrm{d}x^2 + \mathrm{d}y^2 + \mathrm{d}z^2).$$

Thus $\tilde{g}$ is a constant conformal rescaling of the smooth metric $\hat{g} := -\mathrm{d}t^2 - 2\,\mathrm{d}t\,\omega + \mathrm{d}\mathbf{x}^2$, whose coefficients are polynomials of degree at most one in ω and whose inverse is bounded by $1 + C_0^2$. The same majorant therefore bounds the Kretschmann scalar of $\hat{g}$, and the constant rescaling $\tilde{g} = A^2\hat{g}$ multiplies that scalar by A^{-4}. All estimates are uniform on $\mathbb{R}^4$ and do not deteriorate on $\partial\mathscr{U}_{\mathrm{CTC}}$, because that locus is a closed smooth level set of the smooth function $g_{\varphi\varphi}$ and is not a singular locus of either metric.

Lemma (Host signature remains Lorentzian across the CTC torus). *On the collar class of Definition , the matrix of g_{ab} in the chart (t, x, y, z) has determinant $\det g = -1$ at every point of $\mathbb{R}^4$, including throughout $\mathscr{U}_{\mathrm{CTC}}$ and across $\partial\mathscr{U}_{\mathrm{CTC}}$. In particular, a vanishing or negative value of the axial component $g_{\varphi\varphi}$ does not change the four-dimensional Lorentzian signature of g_{ab}, and does not produce a curvature singularity. The ordinary metric $\tilde{g} = A^2\hat{g}$ likewise satisfies $\det\hat{g} = -(1 + |\omega|^2) < 0$ and remains Lorentzian of signature $(-, +, +, +)$.*

Proof. In the coframe $\theta^0 := \mathrm{d}t + \omega_i \mathrm{d}x^i$, $\theta^i := \mathrm{d}x^i$, one has $g = -(\theta^0)^2 + \delta_{ij}\theta^i\theta^j$. The change of coframe from $(\mathrm{d}t, \mathrm{d}x^i)$ to (θ^0, θ^i) is unipotent, with Jacobian determinant 1. Hence $\det g = \det\eta = -1$ in the original chart. The axial component $g_{\varphi\varphi}$ is a single chart coefficient in an adapted angular frame; its sign change at $\partial\mathscr{U}_{\mathrm{CTC}}$ rearranges which linear combinations of ∂_t and ∂_φ are timelike, but cannot alter the four eigenvalues' sign pattern while $\det g = -1$ and the metric remains smooth. For $\hat{g} = -\mathrm{d}t^2 - 2\,\mathrm{d}t\,\omega + \mathrm{d}\mathbf{x}^2$, the equivalent ADM form is $\hat{g} = -(\mathrm{d}t + \omega_i \mathrm{d}x^i)^2 + (\delta_{ij} + \omega_i\omega_j)\mathrm{d}x^i\mathrm{d}x^j$, whose spatial block $\delta + \omega \otimes \omega$ is positive definite and whose lapse-type factor is 1, so $\det\hat{g} = -(1 + |\omega|^2) < 0$. Constant conformal rescaling by $A^2 > 0$ preserves signature.

Theorem (Repaired function-space dichotomy on Schwartz versus transverse-Schwartz collars). *On the collar class of Definition , the following hold.*

1. *(Function-space split, exact cancellation, and global Cauchy slices.) For* $\alpha_z > 0$*, one has* $\Phi \in \mathscr{H}(\mathbb{R}^3;\mathbb{C})$*, decaying exponentially in all three spatial directions as* $r^2 + z^2 \to \infty$*. For* $\alpha_z = 0$*, one has* $\Phi \in \mathscr{H}(\mathbb{R}^2_{x,y};\mathbb{C}) \mathbin{\widehat{\otimes}} 1_z \setminus \mathscr{H}(\mathbb{R}^3;\mathbb{C})$*: the profile is smooth, exponentially decaying as* $r \to \infty$*, constant along z, and is not a three-dimensional Schwartz function. Across all of* $\mathbb{R}^4$*, the identity holds, and* $\tilde{g}_{\varphi\varphi} = A^2 r^2 > 0$ *for* $r > 0$*. Both* $(\mathbb{R}^4, g)$ *and* $(\mathbb{R}^4, \tilde{g})$ *are geodesically complete under the written uniform boundedness of* ω *in Lemma . If* $\alpha_z > 0$*, both metrics approach a constant rescaling of Minkowski space exponentially fast as* $r^2 + z^2 \to \infty$*. If* $\alpha_z = 0$*,* ω *decays exponentially as* $r \to \infty$*, uniformly in z, and* $\|\omega\|_{L^\infty} < \infty$*; approach to Minkowski as* $|z| \to \infty$ *at fixed r is not claimed. Every slice* $\{t = t_0\}$ *is a smooth global Cauchy surface for* $(\mathbb{R}^4, \tilde{g})$*.*

2. *(Active host CTC torus, when the written threshold is exceeded.) In cylindrical coordinates on* $\{r > 0\}$*,*

$$g_{\varphi\varphi}(r,z) = r^2\left(1 - \frac{B}{A^2} c_0^4 r^2 e^{-4\alpha_r r^2 - 4\alpha_z z^2}\right).$$

Whenever

$$\Gamma_{\text{vort}} := \frac{B c_0^4}{A^2 4\alpha_r e} > 1,$$

the open toroidal region $\mathscr{U}_{\text{CTC}} := \{g_{\varphi\varphi} < 0\}$ *is nonempty and contains the equatorial ring at* $r_{\text{pk}} := (4\alpha_r)^{-1/2}$*. Moreover,* $C_-(r,z) := -g_{\varphi\varphi}(r,z)$ *attains a strict positive global maximum at an equatorial point* $(r_*, 0)$ *at which* $\nabla C_-(r_*, 0) = 0$*, so every circle* $(t_0, r_* \cos\varphi, r_* \sin\varphi, 0)$ *is a smooth, closed, future-directed g-timelike geodesic. No ordinary* $\tilde{g}$*-timelike closed curve is typestated.*

3. *(Two-form obstruction against single-switch integrability, proved from the printed profile.) Let* $u_{\text{bg}} := R\, h(R,Z)^2$ *. For any smooth two-switch potential* $V_\Phi(u, s_1, s_2)$ *of* $u = |\Phi|^2$ *and* $(s_1, s_2) = (R, Z)$ *with* $\mu := 2\partial_u V_\Phi$*, the chain rule along a two-switch profile gives* $(\partial_{s_i} V_\Phi)|_u \, \mathrm{d}s_i = \mathrm{d}\widetilde{W} - \frac{1}{2}\mu \, \mathrm{d}u$ *with* $\widetilde{W} := V_\Phi(u(s), s)$*. Hence* $\mathrm{d}\mu \wedge \mathrm{d}u = 0$ *is the integrability condition for a switch potential W, for every such* V_Φ*, and is not automatic. For the printed Gaussian ,* $\mathrm{d}\mu \wedge \mathrm{d}u_{\text{bg}}$ *fails to vanish identically unless* $\alpha_z = 0$*. Adjoining a third scalar* $s_3 := RZ$ *with constant stiffness does*

not cancel the exponential two-form, because $\Delta_{\mathbb{R}^3}(RZ) = 4Z + 2R$ *is polynomial. No compact on-shell two-dimensional Gaussian, no general* $\alpha_z > 0$ *existence theorem, and no smooth* 2×2 *field-space switch metric* K_{AB} *is typestated.*

4. *(Exact on-shell realisation on the cylindrical collar.) Restrict to the z-independent collar* $\alpha_z = 0$*, with the single-switch data of Definition , so that* $\mu(s_1) = 4\alpha_r^2 s_1 - 8\alpha_r$ *and* $u_{\mathrm{bg}}(s_1) = c_0^2 s_1 e^{-2\alpha_r s_1}$*. The switch potential*

$$W(s_1) = 4f_s^2 s_1 + c_0^2(\alpha_r s_1 + \tfrac{1}{2})e^{-2\alpha_r s_1}$$

(up to an additive constant) satisfies $W'(s_1) = 4f_s^2 - \frac{1}{2}\mu'(s_1)u_{\mathrm{bg}}(s_1)$*, and the Euler–Lagrange equations* $E_{\Phi^*} = 0$ *and* $E_{s_1} = 0$ *hold identically and smoothly on all of* $\mathbb{R}^4$*. This collar inhabits the smooth-*μ *class and does not refute compact-sharpness, because h is not compactly supported. Finite total controller energy of a full switch-plus-vortex action is not typestated.*

5. *(Bounded curvature, not vanishing curvature.) On the written collar class, including across* $\partial\mathscr{U}_{\mathrm{CTC}}$*, the curvature invariants of g and* $\tilde{g}$ *are bounded by the written majorant of Lemma . In particular they remain finite at the host CTC boundary. Ordinary* $\tilde{g}$*-observers, whose causal structure is that of the globally hyperbolic metric* $\tilde{g}$*, cannot complete an ordinary closed timelike curve, and every ordinary archive supported on* $\{t = t_0\}$ *has a well-posed Cauchy development in* $\tilde{g}$*. This is chronology shielding on the written classical ansatz, with bounded (not necessarily zero) curvature, and with no claimed blow-up of a classical controller stress on that ansatz. par Non-claim. This theorem is not a proof of Hawking's chronology protection conjecture in generality [11], not a semiclassical* $\langle T_{ab}\rangle$ *computation, not a stress-tensor blow-up wall, not a typestate of zero curvature, not an extracted ordinary closed timelike curve, not a traversable wormhole, and not a discharge of the time-machine operational bar, which remains* 0 *of* 3*. Ordinary Cauchy-slice blindness remains documentary only. A general* $\alpha_z > 0$ *existence theorem is not typestated. par*

Proof. (1) The amplitude *h* is smooth and positive. For $\alpha_z > 0$ it (and hence $\Phi = h\,(x + iy)$) lies in $\mathscr{S}(\mathbb{R}^3;\mathbb{C})$, because it and all derivatives decay exponentially as $r^2 + z^2 \to \infty$. For $\alpha_z = 0$ the profile is cylindrically

translation-invariant, lies in the transverse-Schwartz class of Definition , and is not in $\mathscr{S}(\mathbb{R}^3)$, because it fails to be integrable against $|z|^N|\Phi|$ at infinity for large N. The identity $J[\Phi] = h^2(x\,\mathrm{d}y - y\,\mathrm{d}x)$ is immediate from Definition , and $B\,J \otimes J = A^2\omega \otimes \omega$ holds everywhere, which is . In cylindrical form one has $\tilde{g}_{\varphi\varphi} = A^2r^2 > 0$ for $r > 0$. The inverse component $\hat{g}^{tt} = -(1 + |\omega|^2)^{-1} < 0$ shows that t is a temporal function for $\hat{g}$ and hence for $\tilde{g} = A^2\hat{g}$. Because $|\omega| \le C_0 < \infty$ by Lemma , every $\tilde{g}$-causal curve has uniformly bounded Euclidean speed $|\mathrm{d}\mathbf{x}/\mathrm{d}t| \le \sqrt{1 + C_0^2} + C_0$. Thus every slice $\{t = t_0\}$ is a global Cauchy surface for $(\mathbb{R}^4, \tilde{g})$: any $\tilde{g}$-causal curve intersects each such slice exactly once, and can be extended for all coordinate time. Lemma guarantees that both metrics remain Lorentzian throughout, so the Cauchy clause is not purchased by a signature change. For geodesic completeness, the stationary Killing field ∂_t supplies a conserved energy $E = -g(\gamma, \partial_t)$ along g-geodesics and $\tilde{E} = -\tilde{g}(\gamma, \partial_t)$ along $\tilde{g}$ -geodesics. In the written charts the kinetic remainder is a positive-definite quadratic form in the spatial velocities, up to the uniformly bounded shift ω; a finite-energy geodesic therefore has bounded coordinate speed and cannot reach spatial infinity or a chart singularity in finite affine time. Completeness of both metrics follows. The same bound also prevents finite-time blow-up of Christoffel symbols along geodesics, because Lemma already supplies global C^2 control of ω. When $\alpha_z = 0$, this Cauchy and completeness typestate uses only the written uniform boundedness of ω; it does not typestate approach to Minkowski as $|z| \to \infty$ at fixed $r > 0$.

(2) From one has $g(\partial_\varphi, \partial_\varphi) = r^2 - \omega(\partial_\varphi)^2$. Since $\omega(\partial_\varphi) = \lambda_\omega h^2 r^2 = (\sqrt{B}/A)c_0^2 r^2 \exp(-2\alpha_r r^2 - 2\alpha_z z^2)$, this is . On $z = 0$, the function $r \mapsto re^{-2\alpha_r r^2}$ attains its global maximum $(4\alpha_r e)^{-1/2}$ at $r_{\mathrm{pk}}^2 = (4\alpha_r)^{-1}$, as already computed in the proof of Lemma . Under , $g_{\varphi\varphi}(r_{\mathrm{pk}}, 0) = r_{\mathrm{pk}}^2(1 - \Gamma_{\mathrm{vort}}) < 0$. Since $C_-(r,z) = -g_{\varphi\varphi}(r,z)$ is positive at $(r_{\mathrm{pk}}, 0)$, vanishes at $r = 0$, and tends to $-\infty$ as $r \to \infty$, the function C_- attains a strict global maximum at a point (r_*, z_*). Axial symmetry and evenness in z force $z_* = 0$ and $\nabla C_-(r_*, 0) = 0$. By Killing's identity for $K = \partial_\varphi$, $\nabla_K K = -\frac{1}{2}\nabla g(K,K) = \frac{1}{2}\nabla C_-(r_*, 0) = 0$, while $g(K, \partial_t) = -(\sqrt{B}/A)c_0^2 r_*^2 e^{-2\alpha_r r_*^2} < 0$, proving that the circles at $(r_*, 0)$ are closed future-directed g-timelike geodesics. The ordinary metric has $\tilde{g}_{\varphi\varphi} = A^2r^2 > 0$, so these circles are ordinary spacelike and are not ordinary CTCs.

(3) The chain-rule identity is the exterior differential of $\widetilde{W}(s) = V_{\Phi}(u(s), s)$, using $\mu = 2\partial_u V_{\Phi}$. Exterior differentiation then yields $\mathrm{d}((\partial_{s_i} V_{\Phi})|_u \, \mathrm{d}s_i) = -\frac{1}{2}\mathrm{d}\mu \wedge \mathrm{d}u$. With μ as in and $u_{\mathrm{bg}} = c_0^2 R \exp(-2\alpha_r R - 2\alpha_z Z)$, one has $\mathrm{d}\mu = 4\alpha_r^2 \, \mathrm{d}R + 4\alpha_z^2 \, \mathrm{d}Z$ and $\mathrm{d}u_{\mathrm{bg}} = c_0^2 e^{-2\alpha_r R - 2\alpha_z Z}((1 - 2\alpha_r R)\,\mathrm{d}R - 2\alpha_z R \, \mathrm{d}Z)$, so

$$\mathrm{d}\mu \wedge \mathrm{d}u_{\mathrm{bg}} = c_0^2 e^{-2\alpha_r R - 2\alpha_z Z}(-8\alpha_r^2 \alpha_z R - 4\alpha_z^2(1 - 2\alpha_r R))\,\mathrm{d}R \wedge \mathrm{d}Z.$$

The prefactor $c_0^2 e^{-2\alpha_r R - 2\alpha_z Z}$ never vanishes. The remaining scalar coefficient equals $-4\alpha_z^2$ at $R = 0$, hence vanishes identically if and only if $\alpha_z = 0$. This is a complete local proof from the printed profile: when $\alpha_z > 0$, a single-switch or polynomial constant-stiffness potential cannot integrate the written μ against u_{bg}. If a third switch $s_3 = RZ$ with constant stiffness f_3 is adjoined, $\Delta_{\mathbb{R}^3} s_3 = 4Z + 2R$ is polynomial, and the additional one-form $f_3^2 \Delta_{\mathbb{R}^3} s_3 \, \mathrm{d}s_3$ has exterior derivative $f_3^2(2R - 4Z)\,\mathrm{d}R \wedge \mathrm{d}Z$, which is polynomial and cannot cancel the exponential two-form for all (R, Z).

(4) On the collar $\alpha_z = 0$, both μ and u_{bg} are functions of the single variable $s_1 = R$, so $\mathrm{d}\mu \wedge \mathrm{d}u_{\mathrm{bg}} = 0$ automatically. Here $\Delta_{\mathbb{R}^3} s_1 = 4$ and $\mu'(s_1) = 4\alpha_r^2$. The Φ Euler equation from S_{Φ} with $V_{\Phi} = \frac{1}{2}\mu u$ is $\Delta_{\mathbb{R}^3}\Phi = \mu\Phi$, which holds by Lemma . The switch Euler equation is $f_s^2 \Delta_{\mathbb{R}^3} s_1 - W'(s_1) - \frac{1}{2}\mu'(s_1)u = 0$, which on $u = u_{\mathrm{bg}}$ reduces to $W'(s_1) = 4f_s^2 - 2\alpha_r^2 c_0^2 s_1 e^{-2\alpha_r s_1}$. Integrating, and using $\int s_1 e^{-2\alpha_r s_1} \, \mathrm{d}s_1 = -e^{-2\alpha_r s_1}(s_1/(2\alpha_r) + 1/(4\alpha_r^2))$, yields . Smoothness at $s_1 = 0$ is immediate, because the exponential is entire and the prefactor is linear.

(5) Lemma supplies the written majorant, including across $\partial\mathscr{U}_{\mathrm{CTC}}$. The classical controller stress of the written action is a smooth combination of Φ, s_1, and their first derivatives, all of which are smooth and, under the bounds already recorded, globally bounded on the collar class; no blow-up is typestated on this classical ansatz. Global hyperbolicity of $\widetilde{g}$ was proved in (1), so ordinary observers and ordinary archives on $\{t = t_0\}$ have unique Cauchy developments and cannot close an ordinary timelike curve. This is the written shielding statement. The time-machine bar is not addressed by a kinematic identity and remains 0 of 3.

Remark (Function-space typestate at $\alpha_z = 0$, and what is not claimed). The split in Definition and Theorem (1) is essential. For $\alpha_z > 0$, $\Phi \in \mathscr{S}(\mathbb{R}^3; \mathbb{C})$ and the two-form $\mathrm{d}\mu \wedge \mathrm{d}u_{\mathrm{bg}}$ of does not vanish identically, so a single-switch

potential is not available. For $\alpha_z = 0$, the profile is cylindrically translation-invariant: it lies in $\mathscr{S}(\mathbb{R}^2_{x,y};\mathbb{C})\,\widehat{\otimes}\,1_z$ and is deliberately not placed in $\mathscr{S}(\mathbb{R}^3)$. Uniform boundedness of ω still holds, by the derived maximum of $re^{-2\alpha_r r^2}$, and that bound alone supports the Cauchy and completeness typestate. Approach to Minkowski along the axis $r = 0$, $|z| \to \infty$, is not typestated, because the amplitude does not decay in z. The curvature majorant of Lemma is a finite written bound, not a vanishing statement, and is not upgraded to a semiclassical stress wall. Official Discovery-A version 5 [3] records documentary typestate of the same split and is not a premise of the local proofs above.

Ledger unchanged: no quantum coefficient is admitted; Host C is not created; O.1 stays NOT_CLOSED; H3 stays NOT_CLOSED; XV-B is not opened; XVI-N and XVI-N-RouteB are not discharged; Problem 1 stays open; the time-machine bar remains 0 of 3.

Portal-factorisation equivalence of ordinary chronology insulation

The second official task is to relate operational signalling of the written channel class to the written portal factorisation clause, to typestate Fisher insulation only under $\lambda_{\text{port}} = 0$, and, on a written scalar Higgs-portal ansatz, to a constitutive algebraic shift of c_2. A class-limited archive calibration refusal is recorded separately, under written append-only hypotheses, and is not promoted to a general prohibition on all signalling. Portal factorisation is not typestated as dynamically forced by quantum gravity. Official Inversion-A version 6 [5] and official Discovery-A version 5 [3] are documentary source records of portal and Δc_2 typestate and are not premises. Official Chrono-Shield-A [6, 7] is likewise documentary only.

Lemma (Portal insulation at vanishing portal coupling). *On a prescribed chronology-split pair as in Definition , suppose* $\lambda_{\text{port}} = 0$. *Then the written matter Lagrangian splits as a sum of a dark host term and an ordinary term, and the joint matter dynamics factorises on* $\mathscr{H}_{\text{DM}} \otimes \mathscr{H}_{\text{SM}}$. *Any dark intervention* $\mathscr{I}_x$ *acting solely on* $\mathscr{H}_{\text{DM}}$ *leaves ordinary instrument statistics on* Σ_{t_0} *independent of that intervention: for every joint input with fixed ordinary marginal* $\rho_{\text{SM}} = \text{Tr}_{\text{DM}}(\rho_{\text{DM,SM}})$ *and every ordinary instrument* $\{F_z\}$ *on* $\mathscr{H}_{\text{SM}}$,

$$\Pr(z \mid x) = \text{Tr}_{\text{SM}}(F_z \mathscr{E}_{\text{SM}}(\text{Tr}_{\text{DM}}[(\mathscr{I}_x \otimes \text{Id}_{\text{SM}})(\rho_{\text{DM,SM}})])) = \text{Tr}_{\text{SM}}(F_z \mathscr{E}_{\text{SM}}(\rho_{\text{SM}})),$$

where $\mathscr{E}_{\mathrm{SM}}$ *is the globally hyperbolic* $\hat{g}$*-evolution channel on* $\mathscr{H}_{\mathrm{SM}}$*. Consequently the written contrast* $\Delta_{\mathrm{TV}}(\gamma_{\mathrm{CTC}} \to \Sigma_{t_0})$ *vanishes identically. In particular, both the classical Fisher matrix* $\mathscr{I}_F(\theta_d)_{ij}$ *and the quantum Fisher matrix* $\mathscr{I}_Q(\theta_d)_{ij}$ *of an ordinary non-gravitational probe, with respect to dark-sector parameters* θ_d*, vanish identically under the factorisation clause of Definition . This is insulation under the written clause, not an all-orders vanishing theorem, not Hawking chronology protection in generality, and not a semiclassical* $\langle T_{ab} \rangle$ *computation.*

Proof. At $\lambda_{\mathrm{port}} = 0$, with the background $(g, \hat{g})$ held fixed, reduces to the decoupled sum $\mathscr{L}_{\mathrm{DM}}[g, \Phi_{\mathrm{DM}}]\sqrt{-\det g} + \mathscr{L}_{\mathrm{SM}}[\hat{g}, \Psi_{\mathrm{SM}}]\sqrt{-\det \hat{g}}$. The associated dynamics therefore act separately on the two factors of $\mathscr{H}_{\mathrm{DM}} \otimes \mathscr{H}_{\mathrm{SM}}$. Trace preservation of $\mathscr{I}_x \otimes \mathrm{Id}_{\mathrm{SM}}$ yields $\mathrm{Tr}_{\mathrm{DM}}[(\mathscr{I}_x \otimes \mathrm{Id}_{\mathrm{SM}})(\rho_{\mathrm{DM,SM}})] = \rho_{\mathrm{SM}}$ whenever the ordinary marginal is held fixed, which is . The two conditional laws $\Pr(\cdot \mid x = 0)$ and $\Pr(\cdot \mid x = 1)$ therefore coincide, so $\Delta_{\mathrm{TV}} = 0$.

Under Definition the same independence is stated at the level of ordinary likelihoods and probe states. Since $p(x \mid \theta_d, \theta_o; 0) = p_o(x \mid \theta_o)$ is independent of θ_d, one has $\partial_{\theta_d^i} \ln p = 0$ pointwise on $\mathrm{supp}(p_o)$, so

$$\mathscr{I}_F(\theta_d)_{ij} = \int_{\Omega_o} (\partial_{\theta_d^i} \ln p)(\partial_{\theta_d^j} \ln p)\, p \, \mathrm{d}\nu = 0.$$

Likewise, since $\partial_{\theta_d^i} \rho_{\mathrm{probe}}(\theta_d, \theta_o) = 0$, the symmetric logarithmic derivative equation $\frac{1}{2}(L_i \rho_{\mathrm{probe}} + \rho_{\mathrm{probe}} L_i) = \partial_{\theta_d^i} \rho_{\mathrm{probe}} = 0$ admits $L_i = 0$ on $\mathrm{supp}(\rho_{\mathrm{probe}})$, whence $\mathscr{I}_Q(\theta_d)_{ij} = \frac{1}{2}\mathrm{Tr}(\rho_{\mathrm{probe}}\{L_i, L_j\}) = 0$. Fisher insulation is typestated only under $\lambda_{\mathrm{port}} = 0$.

Lemma (Constitutive portal–mass-shift relation on the written Higgs ansatz). *On the written scalar Higgs-portal ansatz of Definition , the induced mass squared* $\Delta m_\chi^2 = \frac{1}{2}\lambda_{H\chi} v_{\mathrm{EW}}^2$ *shifts the coefficient* c_2 *of by*

$$\Delta c_2 = n_B \Delta m_\chi^2 = \frac{1}{2} n_B \lambda_{H\chi} v_{\mathrm{EW}}^2,$$

which vanishes if and only if $\lambda_{H\chi} = 0$*. Equivalently, on this ansatz the written model sets* $\Delta c_2 = 0$ *if and only if* $\lambda_{\mathrm{port}} = 0$*. The finite logarithmic term in , at generic* $\ln(\Delta m_\chi^2/\mu^2) = \kappa_\mu \neq 0$*, shifts by*

$$|\Delta c_0|/(64\pi^2) = \frac{n_B \lambda_{H\chi}^2 v_{\mathrm{EW}}^4 |\kappa_\mu|}{256\pi^2}.$$

These are algebraic identities on the written polynomial. They are not a derived one-loop quantum coefficient, not ultraviolet completeness, and not a solution of the cosmological constant problem. In particular the explicit Euclidean tadpole display

$$\Delta c_2^{\mathrm{DM}}(\lambda_{\mathrm{port}}; \Lambda_{\mathrm{UV}}) = \frac{d_H \lambda_{\mathrm{port}}}{16\pi^2}[\Lambda_{\mathrm{UV}}^2 - m_H^2 \ln(1 + \Lambda_{\mathrm{UV}}^2/m_H^2)]$$

is refused as typestate: no quantum coefficient is admitted.

Proof. Substituting $|H|^2 = v_{\mathrm{EW}}^2/2$ into yields $\mathscr{L}_{\mathrm{port}} = -\frac{1}{4}\lambda_{H\chi} v_{\mathrm{EW}}^2 \chi^2 = -\frac{1}{2}(\Delta m_\chi^2)\chi^2$ with $\Delta m_\chi^2 = \frac{1}{2}\lambda_{H\chi} v_{\mathrm{EW}}^2$. Hence $\Delta c_2 = n_B \Delta m_\chi^2 = \frac{1}{2} n_B \lambda_{H\chi} v_{\mathrm{EW}}^2$, which vanishes if and only if $\lambda_{H\chi} = 0$, since $n_B v_{\mathrm{EW}} \neq 0$. On the written identification $\lambda_{\mathrm{port}} = \lambda_{H\chi}$ this is the constitutive relation $\Delta c_2 = 0 \Leftrightarrow \lambda_{\mathrm{port}} = 0$. Substituting $\Delta m_\chi^4 = \frac{1}{4}\lambda_{H\chi}^2 v_{\mathrm{EW}}^4$ into the logarithmic coefficient c_0 gives . No momentum-space integral, Euclidean cutoff evaluation, or one-loop prefactor is used.

Theorem (Portal-factorisation equivalence of ordinary chronology insulation). *Let a prescribed chronology-split pair as in Definition be given, together with an ordinary archive register supported on a written slice Σ_{t_0} as in Definition . Then:*

1. *If $\lambda_{\mathrm{port}} = 0$, Lemma forces $\Delta_{\mathrm{TV}}(\gamma_{\mathrm{CTC}} \to \Sigma_{t_0}) = 0$ identically, and Fisher insulation holds for every ordinary non-gravitational probe.*

2. *Any operational signalling channel of the written class in Definition —a payload-at-fixed-host-metric contrast $\Delta_{\mathrm{TV}} > 0$ across a closed causal relay that uses a g-timelike loop inside $\mathscr{U}_{\mathrm{CTC}}$ and ordinary $\hat{g}$-evolution to and from Σ_{t_0}—requires $\lambda_{\mathrm{port}} \neq 0$, and therefore violates the written portal factorisation clause. Equivalently, an operational experiment prepared on Σ_{t_1} and read out in an ordinary instrument on Σ_{t_2} with $t_2 > t_1$, whose outcome probabilities depend on a causal perturbation localised along a closed g-timelike loop inside $\mathscr{U}_{\mathrm{CTC}}$, necessarily has $\lambda_{\mathrm{port}} \neq 0$, and hence $\mathscr{I}_F(\theta_{\mathrm{CTC}}) > 0$ on the written Fisher formula of Lemma .*

3. *On the written scalar Higgs-portal ansatz of Definition , the same violation is equivalent to a nonzero*

constitutive algebraic shift $\Delta c_2 \neq 0$ *in the vacuum polynomial of Definition , by Lemma . Thus, on that ansatz, operational archive signalling of the written class and a vanishing portal shift* $\Delta c_2 = 0$ *cannot hold simultaneously. Fisher insulation remains typestated only under* $\lambda_{\text{port}} = 0$. *A static bimetric residual of the prescribed pair, including* $\Delta T_{\text{GW}-\text{EM}}$ *in Proposition , is not operational signalling in the sense of Definition . par Non-claim. Portal factorisation is not typestated as dynamically forced by quantum gravity. The time-machine operational bar remains* 0 *of* 3 *and is not discharged. No ordinary CTC is extracted. No traversable wormhole is typestated. XV-B is not opened. Exact cutoff independence* $\Delta c_2 = 0$ *is not claimed to force all higher Wilson coefficients; in particular it does not force* $c_6 = 0$ *except on a written oscillating-condensate class, as typestated in Proposition and Corollary . No one-loop quantum coefficient is admitted. par*

Proof. (1) is Lemma .

(2) is the contraposition of (1), restricted to the written channel class of Definition . If an experiment prepared on Σ_{t_1} and read out on Σ_{t_2} has outcome probabilities that depend on a dark intervention localised along a closed g -timelike loop, then $\Delta_{\text{TV}} > 0$ for the associated binary intervention, so $\lambda_{\text{port}} \neq 0$. Under that violation the ordinary likelihood depends on the dark parameter θ_{CTC} labelling the intervention, hence the classical Fisher information of Lemma is strictly positive on the written formula. The host metric is held fixed throughout: the argument does not typestate a protocol that varies the background geometry itself, and it does not confuse a kinematic residual of the pair $(g, \widetilde{g})$ with a controllable payload. Global hyperbolicity of $\widetilde{g}$, already proved in Theorem (1) on the collar class and assumed in Definition in general, excludes ordinary causal curves that close or that travel from the host CTC as ordinary $\widetilde{g}$-causal signals; any residual coupling must therefore leave the ordinary $\widetilde{g}$-causal structure and enter a portal channel.

(3) On the written Higgs-portal ansatz, Lemma gives $\lambda_{\text{port}} \neq 0$ if and only if $\Delta c_2 \neq 0$. Combining this constitutive equivalence with (2) yields the stated incompatibility of operational archive signalling with $\Delta c_2 = 0$.

Proposition (Class-limited archive-calibration contradictions). *Retain Definition and the written signalling-channel class of Definition . Impose the following written hypotheses, and no others: a linear*

probability-conserving Enter execution; an append-only retained archive $\mathscr{A}$ *on* Σ_{t_0} *whose length (or rank)* $\ell(\mathscr{A})$ *is a strictly monotone function of each appended record token; and an unconstrained binary intervention freedom at* Σ_{t_0} *that would close a dependency loop on that slice, by feeding a record obtained at a receiving laboratory* $L_{\mathrm{rec}} \subset \Sigma_{t_0}$ *into an emitting laboratory* $L_{\mathrm{emit}} \subset \Sigma_{t_0}$ *that is* $\tilde{g}$*-spacelike to* L_{rec}*. Then, whenever* $\Delta_{\mathrm{TV}} > 0$ *for the written channel, the following two contradictions hold.*

1. *(Retained-archive length.) Every destructive readout appends a record token and raises* $\ell(\mathscr{A}) \mapsto \ell(\mathscr{A}) + 1$*. Closing the loop* $L_{\mathrm{rec}} \to L_{\mathrm{emit}} \to L_{\mathrm{rec}}$ *would force* $\ell(\mathscr{A}_{\mathrm{rec}}) < \ell(\mathscr{A}_{\mathrm{emit}}) < \ell(\mathscr{A}_{\mathrm{rec}})$*, which is impossible for a strictly ordered length.*

2. *(Logical-negation fixed point.) If* L_{rec} *computes a binary estimator* $\hat{x} \in \{0,1\}$ *satisfying* $\Pr(\hat{x} = x \mid x) \geq \frac{1}{2}(1 + \Delta_{\mathrm{TV}}) > \frac{1}{2}$ *(after equalising any asymmetric bias by randomised bit-flipping) and* L_{emit} *deterministically sets* $x := 1 - \hat{x}$*, then no joint law* $q(\hat{x}, x)$ *can obey both* $\Pr(x = 1 - \hat{x}) = 1$ *and* $\Pr(\hat{x} = x) > \frac{1}{2}$*. These refusals are class-limited: they apply only under the written archive and intervention hypotheses, and only to the written channel class. They do not typestate a general prohibition on all signalling, they do not extract an ordinary CTC, and they do not raise the* 0 *of* 3 *bar. Chrono-CTC-A, Chrono-Return-A, and Chrono-Extract-A [8, 9, 10] are not used as premises.*

Proof. Under the written append-only hypothesis, the length function is strictly increasing along any chain of destructive readouts. A closed dependency loop on a single Cauchy slice would require a strict increase of ℓ around a cycle, which is impossible. This is (1).

For (2), write $p_* := \Pr(\hat{x} = x)$. The written estimator bound and the randomised-symmetrisation reduction give $p_* > \frac{1}{2}$. The intervention rule $x = 1 - \hat{x}$ forces $\Pr(\hat{x} = x) = 0$, a contradiction. Equivalently, the two constraints cannot be realised by any joint probability table on $\{0,1\} \times \{0,1\}$. Both arguments use only the written hypotheses and the assumption $\Delta_{\mathrm{TV}} > 0$; they do not appeal to a general no-signalling theorem, and they do not vary the prescribed host metric.

Proposition (Dimension-five and dimension-six portal shifts). *Retain Definition and the vacuum polynomial of Definition . Assume that, on the written ansatz, $\mathscr{L}_5$ is the only mass source for ψ_d and that φ has vanishing bare mass. Then the algebraic shifts of the filter coefficients are*

$$\Delta c_2 = -n_F m_d^2 = -\frac{n_F c_5^2 v_{\mathrm{EW}}^4}{4\mathrm{Mp}^2}, \qquad \Delta c_0 = -n_F m_d^4 \kappa_\mu = -\frac{n_F c_5^4 v_{\mathrm{EW}}^8}{16\mathrm{Mp}^4}\kappa_\mu,$$

where $m_d := c_5 v_{\mathrm{EW}}^2/(2\mathrm{Mp})$ and $\kappa_\mu := \ln'(m_d^2/\mu^2)$. The dimension-six operator $\mathscr{L}_6$ contributes neither to Δc_2 nor to Δc_0 on this massless static ansatz: after the substitution $|H|^2 \to v_{\mathrm{EW}}^2/2$ it is a pure kinetic dressing of a massless scalar, and the mass-matrix polynomial is insensitive to a wave-function factor at vanishing mass. Consequently, exact cutoff independence $\Delta c_2 = 0$ forces $c_5 = 0$. The same conclusion is not forced upon c_6.

Proof. Substituting $|H|^2 = v_{\mathrm{EW}}^2/2$ into $\mathscr{L}_5$ produces the Dirac mass term $m_d \bar{\psi}_d \psi_d$ with $m_d = c_5 v_{\mathrm{EW}}^2/(2\mathrm{Mp})$. Definition then gives $\Delta c_2 = -\mathrm{Tr}\,(\Delta M_F^2) = -n_F m_d^2$ and $\Delta c_0 = -n_F m_d^4 \kappa_\mu$, which is . Hence $\Delta c_2 = 0$ if and only if $c_5 = 0$, since $n_F v_{\mathrm{EW}} \mathrm{Mp} \neq 0$. The operator $\mathscr{L}_6$ becomes $\frac{c_6 v_{\mathrm{EW}}^2}{2\mathrm{Mp}^2}(\nabla\varphi)^2$, a pure kinetic dressing. A massless static scalar contributes 0 to both $\mathrm{Tr}\,(M_B^2)$ and $\mathrm{Tr}\,(M_B^4 \ln'(\cdot))$, independently of a finite wave-function renormalisation. Thus $\mathscr{L}_6$ does not shift c_2 or c_0 on this ansatz, and $\Delta c_2 = 0$ does not force $c_6 = 0$. No further Wilson coefficient is claimed to vanish.

Corollary (Class-limited oscillating-condensate constraint on c_6). *Retain the typestate of Proposition : exact $\Delta c_2 = 0$ forces $c_5 = 0$ on the written ansatz, and does not force $c_6 = 0$ on a massless static scalar. Let φ be a written homogeneous oscillating misalignment field $\varphi(t) = \varphi_0 \cos(mt)$ on a prescribed host, with $m > 0$ and cycle-averaged energy density $\langle \rho_\varphi \rangle = \frac{1}{2} m^2 \varphi_0^2 > 0$. Then $\dot{\varphi}(t)^2 = \langle \rho_\varphi \rangle (1 - \cos(2mt))$. On a written mostly-plus host, $(\nabla\varphi)^2 = -\dot{\varphi}^2$. Substituting $|H|^2 = \frac{1}{2}(v_{\mathrm{EW}} + h)^2$ into $\mathscr{L}_6$ produces a quadratic Higgs-mass shift $\delta m_h^2(t) = \frac{c_6}{\mathrm{Mp}^2}\dot{\varphi}(t)^2$ whose oscillating piece is at frequency $2m$. Let an ordinary narrowband clock or cavity probe be written to couple linearly to that $2m$-harmonic shift, with nonzero written coupling and with $\varphi_0 \neq 0$. Then the classical Fisher information for c_6 in that probe is strictly positive, so the portal factorisation clause of Definition does not hold for this probe on the present ansatz. Joint imposition of $\Delta c_2 = 0$ (which forces $c_5 = 0$) and a nullity of this written $2m$*

-probe therefore constrains the pair (c_5, c_6) *on the present oscillating ansatz. This is not a global closure of every dimension-six operator, not an all-orders quantum-gravity vanishing theorem, and not a dynamical derivation of portal factorisation.*

Proof. Differentiating $\varphi = \varphi_0 \cos(mt)$ gives $\dot{\varphi} = -m\varphi_0 \sin(mt)$, so $\dot{\varphi}^2 = m^2\varphi_0^2 \sin^2(mt)$. The identity $1 - \cos(2mt) = 2\sin^2(mt)$ and $\langle \rho_\varphi \rangle = \frac{1}{2} m^2 \varphi_0^2$ yield $\dot{\varphi}^2 = \langle \rho_\varphi \rangle (1 - \cos(2mt))$. On the written host $g = -\mathrm{d}t^2 + \cdots$, a homogeneous scalar satisfies $(\nabla\varphi)^2 = -\dot{\varphi}^2$. The expansion of $\mathscr{L}_6$ is

$$\mathscr{L}_6 = \frac{c_6}{\mathrm{Mp}^2} \cdot \frac{1}{2}(v_{\mathrm{EW}} + h)^2 (\nabla\varphi)^2 = \frac{c_6}{2\mathrm{Mp}^2}(v_{\mathrm{EW}}^2 + 2v_{\mathrm{EW}}h + h^2)(\nabla\varphi)^2.$$

The h^2 term contributes $-\frac{1}{2}\delta m_h^2 h^2$ with $\delta m_h^2 = (c_6/\mathrm{Mp}^2)\dot{\varphi}^2$. Its Fourier content at frequency $2m$ is nonzero whenever $c_6 \langle \rho_\varphi \rangle \neq 0$. A written ordinary probe whose mean residual is linearly proportional to that $2m$ mode, in stationary non-degenerate noise, has classical Fisher information $\mathscr{I}_F(c_6) = \sigma^{-2} \int (\partial_{c_6} \mu(t))^2 \, \mathrm{d}t > 0$. Hence the ordinary likelihood depends on the dark-sector parameter c_6, which is the negation of Definition for this probe. The last typestate clauses are as stated: Proposition already forces $c_5 = 0$ from $\Delta c_2 = 0$, and the present corollary does not close operators outside the written pair.

Ledger unchanged: no quantum coefficient is admitted; Host C is not created; O.1 stays NOT_CLOSED; H3 stays NOT_CLOSED; XV-B is not opened; XVI-N and XVI-N-RouteB are not discharged; Problem 1 stays open; the time-machine bar remains 0 of 3.

Preservation of the 0 of 3 operational time-machine bar

The third official task is to typestate a written zero-impact optical–GW residual as a bimetric comparison, never as signalling and never as an operational closed timelike curve, and to prove that both gravitational-wave and electromagnetic scattering rays travel strictly forward in global coordinate time on the written class. That certification is local to the written experiment: it does not discharge the operational time-machine bar, which remains 0 of 3 in the sense of Definition . Vanishing of $\Delta T_{\mathrm{GW-EM}}$ at a finite-height CTC cutoff is not typestated.

Proposition (Preservation of the 0 **of** 3 **operational time-machine bar).** *On the equatorial plane* $z = 0$ *of the written collar of Theorem , the pair takes the form*

$$g|_{z=0} = -\mathrm{d}t^2 - 2a(r)\,\mathrm{d}t\,\mathrm{d}\varphi + (r^2 - a(r)^2)\mathrm{d}\varphi^2 + \mathrm{d}r^2,$$

$$\tilde{g}|_{z=0} = A^2(-\mathrm{d}t^2 - 2a(r)\,\mathrm{d}t\,\mathrm{d}\varphi + r^2\,\mathrm{d}\varphi^2 + \mathrm{d}r^2),$$

with $a(r) := \omega(\partial_\varphi) = (\sqrt{B}/A)c_0^2 r^2 e^{-2\alpha_r r^2} \geq 0$ *decaying faster than* r^{-2} *as* $r \to \infty$. *For a future-directed equatorial null geodesic with Killing energy* $E > 0$ *and signed impact parameter* $b_{\mathrm{imp}} := L/E$, *the radial turning functions and coordinate-time slopes (above an outermost simple turning radius, and after stripping the irrelevant constant conformal factor of* $\tilde{g}$*) are*

$$\mathscr{R}_g(r; b_{\mathrm{imp}}) = 1 - \frac{(b_{\mathrm{imp}} + a(r))^2}{r^2},\ \mathscr{T}_g(r; b_{\mathrm{imp}}) = \frac{r^2 - a(r)(b_{\mathrm{imp}} + a(r))}{r^2\sqrt{\mathscr{R}_g(r; b_{\mathrm{imp}})}},$$

$$\mathscr{R}_{\tilde{g}}(r; b_{\mathrm{imp}}) = 1 - \frac{(b_{\mathrm{imp}} + a(r))^2}{r^2 + a(r)^2},\ \mathscr{T}_{\tilde{g}}(r; b_{\mathrm{imp}}) = \frac{r^2 - a(r)b_{\mathrm{imp}}}{(r^2 + a(r)^2)\sqrt{\mathscr{R}_{\tilde{g}}(r; b_{\mathrm{imp}})}}.$$

Write $r_+^{\mathrm{CTC}} := \max\{r > 0 : a(r) = r\}$ *whenever this set is nonempty, and write* λ *for an affine parameter along the geodesic with* $\mathrm{d}t/\mathrm{d}\lambda = \dot{t}$. *Then the following hold.*

1. *(Forward travel in global coordinate time.) On an active host CTC core (*$\max_{r>0} a(r)/r > 1$, *equivalently* $\Gamma_{\mathrm{vort}} > 1$*), the ordinary* $\tilde{g}$*-null ray at vanishing impact satisfies* $\mathscr{R}_{\tilde{g}}(r; 0) = r^2/(r^2 + a(r)^2) > 0$ *for all* $r > 0$ *and*

$$\frac{\mathrm{d}t}{\mathrm{d}\lambda}\Big|_{\tilde{g},\, b_{\mathrm{imp}}=0} = E\,\frac{r^2}{r^2 + a(r)^2} > 0$$

everywhere on $\{r > 0\}$. *The host g-null ray at vanishing impact turns at the outer chronology locus* $r_+^{\mathrm{CTC}} > 0$, *and on the exterior scattering branch*

$$\frac{\mathrm{d}t}{\mathrm{d}\lambda}\Big|_{g,\, b_{\mathrm{imp}}=0} = E\left(1 - \frac{a(r)^2}{r^2}\right) > 0 \qquad \text{for all} r > r_+^{\mathrm{CTC}}.$$

Thus both gravitational-wave and electromagnetic scattering rays travel strictly forward in global coordinate time on the written class.

2. *(The residual is a bimetric optical–GW comparison.) The Minkowski-renormalised coordinate-time shifts obey*

$$\Delta T^{(\hat{g})}_{\mathrm{ren}}(0) = -2\int_0^\infty \frac{a(r)^2}{\sqrt{r^2+a(r)^2}\,(r+\sqrt{r^2+a(r)^2})}\,\mathrm{d}r < 0,$$

and

$$\Delta T^{(g)}_{\mathrm{ren}}(0) < \Delta T^{(\hat{g})}_{\mathrm{ren}}(0) < 0, \qquad \Delta T_{\mathrm{GW-EM}}(0) := \Delta T^{(g)}_{\mathrm{ren}}(0) - \Delta T^{(\hat{g})}_{\mathrm{ren}}(0) < 0.$$

The residual $\Delta T_{\mathrm{GW-EM}}(0) < 0$ *is a bimetric optical–GW comparison at the prescribed background. It is not an operational closed timelike curve, not causal signalling from* $\mathscr{U}_{\mathrm{CTC}}$ *in the sense of Definition , and not a discharge of the time-machine bar.*

3. *(The bar remains* 0 *of* 3 *on this experiment.) Because both scattering rays satisfy* $\mathrm{d}t/\mathrm{d}\lambda > 0$ *on the written loci of (1), this experiment supplies no worldline return to a prior event (Bar 3 remains* 0*), no consumed-clock-name return to a prior Cauchy slice (Bar 2 remains* 0*), and no restoration of a previously recorded ordinary state along a closed causal chain (Bar 1 remains* 0*). The operational time-machine bar of Definition remains* 0 *of* 3*. The experiment is not an operational time machine, not a traversable wormhole, and not an opening of XV-B.*

Proof. The equatorial reductions – are the restriction of and , using $\omega = a(r)\,\mathrm{d}\varphi$ and $\hat{g}_{\varphi\varphi} = A^2 r^2$. A constant conformal factor does not change unparametrised null curves, so the ordinary null geometry may be computed from the unimodular representative $\hat{g}$. Setting $F_g(r) = r^2$, $C_g(r) = r^2 - a(r)^2$ for g, and $F_{\hat{g}}(r) = r^2 + a(r)^2$, $C_{\hat{g}}(r) = r^2$ for $\hat{g}$, the Killing identities $\dot{t} + a\dot{\varphi} = E$ and $-a\dot{t} + C\dot{\varphi} = Eb_{\mathrm{imp}}$ give $\dot{\varphi}/E = (b_{\mathrm{imp}} + a)/F$, $\dot{t}/E = (C - ab_{\mathrm{imp}})/F$, and $(\dot{r}/E)^2 = 1 - (b_{\mathrm{imp}} + a)^2/F$, which is –.

In particular, at vanishing impact one has $\dot{t}/E = (C/F)$. For $\hat{g}$ this is $r^2/(r^2 + a(r)^2) > 0$ for every $r > 0$, which is . For g this is $1 - a(r)^2/r^2$. Under $\Gamma_{\mathrm{vort}} > 1$, the continuous function $a(r)/r$ tends to 0 as $r \to 0$ and as $r \to \infty$, and attains a global maximum strictly larger than 1, so the set $\{r > 0 : a(r) = r\}$ is nonempty and bounded, and $r_+^{\mathrm{CTC}} := \max\{r > 0 : a(r) = r\}$ exists and is positive. For $r > r_+^{\mathrm{CTC}}$ one has $a(r) < r$, hence $1 - a(r)^2/r^2 > 0$, which is . Future-directedness is the written condition $E > 0$. This is (1).

At $b_{\mathrm{imp}} = 0$ one has $\mathscr{T}_g(r;0) = r/\sqrt{r^2 + a(r)^2} \le 1$, and the identity

$$1 - \frac{r}{\sqrt{r^2 + a^2}} = \frac{a^2}{\sqrt{r^2 + a^2}(r + \sqrt{r^2 + a^2})}$$

yields , which is strictly negative as soon as a is not identically zero. The host g-null ray at vanishing impact cannot penetrate past r_+^{CTC}, where $a(r) = r$ and $\mathscr{R}_g(r;0) = 0$. Writing $\Delta T_{\mathrm{ren}}^{(g)}(0) := -2r_+^{\mathrm{CTC}} + 2\int_{r_+^{\mathrm{CTC}}}^{\infty} (\mathscr{T}_g(r;0) - 1)\,\mathrm{d}r$ and $\mathscr{T}_g(r;0) = \sqrt{1 - a(r)^2/r^2}$ on the exterior, one has, for $r > r_+^{\mathrm{CTC}}$ and $a(r) > 0$,

$$\mathscr{T}_g(r;0)^2 = 1 - \frac{a(r)^2}{r^2} < 1 - \frac{a(r)^2}{r^2 + a(r)^2} = \mathscr{T}_{\tilde{g}}(r;0)^2,$$

hence $\mathscr{T}_g(r;0) < \mathscr{T}_{\tilde{g}}(r;0) \le 1$. Splitting the difference gives

$$\Delta T_{\mathrm{ren}}^{(g)}(0) - \Delta T_{\mathrm{ren}}^{(\tilde{g})}(0) = -2r_+^{\mathrm{CTC}} + 2\int_{r_+^{\mathrm{CTC}}}^{\infty} (\mathscr{T}_g - \mathscr{T}_{\tilde{g}})\,\mathrm{d}r - 2\int_0^{r_+^{\mathrm{CTC}}} (\mathscr{T}_{\tilde{g}} - 1)\,\mathrm{d}r$$

$$= -2\int_0^{r_+^{\mathrm{CTC}}} \mathscr{T}_{\tilde{g}}(r;0)\,\mathrm{d}r + 2\int_{r_+^{\mathrm{CTC}}}^{\infty} (\mathscr{T}_g - \mathscr{T}_{\tilde{g}})\,\mathrm{d}r.$$

The first integrand is strictly positive on $(0, r_+^{\mathrm{CTC}})$, and the second integrand is strictly negative wherever $a > 0$ on the exterior. Therefore the difference is strictly negative, which is . The residual is computed from the prescribed pair $(g, \tilde{g})$ at fixed geometry, with no controllable dark payload and with no ordinary closed timelike curve. By Definition it is not operational signalling from $\mathscr{U}_{\mathrm{CTC}}$. Theorem therefore remains compatible with a nonzero arrival-time residual under portal factorisation: the residual is a kinematic comparison, not an archive channel. This is (2).

For (3), a scattering ray that is strictly future-directed in the global time function t, on the written loci of (1), cannot return to a prior event of the same experiment, cannot deliver a consumed clock name or certificate back to a prior slice Σ_{t_0}, and cannot restore a previously recorded ordinary state along a closed causal chain of this experiment. The three flags of Definition therefore remain 0 on this experiment. The bar is not raised and is not newly discharged; it remains 0 of 3. No ordinary CTC is extracted, XV-B is not opened, and the residual of (2) is not re-read as signalling.

Ledger unchanged: no quantum coefficient is admitted; Host C is not created; O.1 stays NOT_CLOSED; H3 stays NOT_CLOSED; XV-B is not opened; XVI-N and XVI-N-RouteB are not discharged; Problem 1 stays open; the time-machine bar remains 0 of 3.

Provenance, refusals, and standing locks

This official Version 2 is a typographic successor of official Dual-Ledger-Chrono-Unify-A version 1 [1] only, and retains official Version 1 typestate, labels, and local proofs. Official Dual-Ledger-Chrono-DM-Backward-A version 4 [2], official Dual-Ledger-DM-Discovery-A version 5 [3], official Dual-Ledger-DM-Discovery-A version 7 [4], official Dual-Ledger-DM-Inversion-A version 6 [5], official Dual-Ledger-Chrono-Shield-A version 1 [6], official Dual-Ledger-Chrono-Shield-A version 2 [7], Chrono-CTC-A [8], Chrono-Return-A version 2 [9], and Chrono-Extract-A [10] are documentary source records only. Identities used above were re-proved locally from Definitions printed in Section . Official Discovery-A version 5 remains the historical documentary record of the transverse-Schwartz typestate cited in the body; official version 7 is the live documentary comparison, without importing d-branch typestate. Official Chrono-Shield-A version 2 collar upgrades are not imported as premises. Sibling companions, if any, are likewise documentary only and are not premises. Suggested problem-card language #problem-bimetric-chronology-unify is documentary intent only; it is not a registration and not a landing page. No new landing-page, figshare, or Zenodo URL is invented, and no deposit or Scholar-inclusion campaign is opened.

The following are refused as typestate of this sheet, and are not theorems, propositions, lemmas, or corollaries herein: Hawking's chronology protection conjecture in generality; a semiclassical $\langle T_{ab} \rangle$ computation or blow-up wall; a typestate of zero curvature where only a bound is proved; three-dimensional Schwartz integrability at $\alpha_z = 0$; an extracted ordinary closed timelike curve; an operational time machine; a new discharge of the 0 of 3 bar; a traversable wormhole; an opening of XV-B; conflation of $\Delta T_{\mathrm{GW-EM}}$ or of Δ_{TV} with signalling or with an operational CTC; vanishing of $\Delta T_{\mathrm{GW-EM}}$ at a finite-height CTC cutoff; a general $\alpha_z > 0$ existence theorem; finite total controller energy of a full switch-plus-vortex action; a stationary d'Alembertian lemma, coframe scalars, or

an $\alpha_z = 3\alpha_r$ solution imported from official Chrono-Shield-A version 2; the claim that $\Delta c_2 = 0$ forces all higher Wilson coefficients; the claim that portal factorisation is dynamically forced by quantum gravity; a derived one-loop formula for Δc_2^{DM}; a general prohibition on all signalling beyond the written archive hypotheses of Proposition ; any quantum coefficient; Einstein dynamics; unimodular gravity; ultraviolet completeness; exact weak equivalence in nature; invented observational thresholds; a solution of the cosmological constant problem, the problem of time, or the information paradox; laboratory confirmation; deposit; companion wiring; a Scholar-inclusion campaign; and invented landing-page URLs.

Standing locks remain as in the front-matter ledger. Host C is not created. O.1 stays NOT_CLOSED. H3 stays NOT_CLOSED. Gate 0 and ST4b stay NOT_SUPPLIED. XV-B is not opened. XVI-N and XVI-N-RouteB are not discharged. Problem 1 and the enlarged duration gate stay open. J2 remains unresolved. Inversion conditions (ii), (iv), and (v) are not typestated as closed in full generality. The time-machine operational bar remains 0 of 3. texttt *wired = false*. texttt *declaredPath* remains null. Confirmation remains required before any deposit, companion wiring, Host C, or Arb, Lean, or compile campaign. Informal typographic checks of this source are not a compile.

No fidelity bound is typestated in this sheet. In particular, neither a lower bound $F \geq \exp(-I/2)$ nor an illicit ceiling $F \leq \exp(-I/2)$ or floor $1 - F \geq 1 - e^{-I/2}$ is claimed, and no appeal is made to a relative-entropy inequality $D \geq -2\ln F$ or to monotonicity of a Rényi family D_α in the order α. Product Petz recovery, islands, and Page curves are outside the present scope. Official half-diamond notation is not required here, and $T = \sqrt{1 - F_e}$ is not restored.

Documentary negative controls

Table records a one-page documentary ledger of OpenAI catalogue families and refused slogans. The entries are unverified external catalogue items, cited only as documentary source records [12], and are isolated to this section. They are not theorem premises, not scheduler-derived cones, not typestate of a Page curve, island, bounce, or de Sitter state, and not a discharge of the operational time-machine bar, which remains 0 of 3 for ordinary observers with Enter instruments. No retained official identity in this sheet depends on these entries. Written dark-ledger

identities, where retained, remain on the written dark ledger and the printed class; they are not chronology engines in nature and not uniqueness of dark matter.

Official Dual-Ledger-Chrono-Shield-A version 2 [7] typestates, as a documentary source record only, a finite-height cutoff of $\mathscr{U}_{\mathrm{CTC}}$ at $\alpha_z = 3\alpha_r$. That identity is not re-proved from Definitions printed in this sheet, and it is not imported as a theorem premise. Official Version 2 of the present sheet therefore does not typestate a finite-height CTC cutoff, and explicitly refuses vanishing of the off-axis residual at the cutoff altitude. The Shield-A conjecture labelled conj:off-axis is not upgraded to a Unify theorem. These clauses sharpen ordinary Cauchy protection and the statement that a prescribed host core is not an operational CTC; they do not move Card 11.

References

[1] Cheung, N. (2026). Dual-Ledger-Chrono-Unify-A: Unifying Continuum Bimetric Shields and Discrete Archive Refusals: Transverse-Schwartz Collars and Portal-Vacuum No-Signalling Across Host CTC Cores. *Enter Calculus Companion*, official version 1 (request t526u). Typographic parent of the present official Version 2; typestate addendum t528u. *Source record; not a premise.*

[2] Cheung, N. (2026). Dual-Ledger-Chrono-DM-Backward-A: Backward sector attribution from prescribed chronology asymmetry. *Enter Calculus Companion*, official version 4 (request t514u). *Source record; not a premise.*

[3] Cheung, N. (2026). Dual-Ledger-DM-Discovery-A: Five Conditional Conjectures and a Four-Tier Multi-Cone Protocol for Acquiring the Chronological Dark-Matter Slot. *Enter Calculus Companion*, official version 5 (request t523u). Historical documentary record of transverse-Schwartz typestate, re-proved locally herein. Typestate addendum t524u. d-branch typestate is not imported. *Source record; not a premise.*

[4] Cheung, N. (2026). Dual-Ledger-DM-Discovery-A: Five Conditional Conjectures and a Four-Tier Multi-Cone Protocol for Acquiring the Chronological Dark-Matter Slot. *Enter Calculus Companion*, official version 7 (request

t542u). Live typestate comparison only. d-branch typestate is not imported. *Source record; not a premise.*

[5] Cheung, N. (2026). Dual-Ledger-DM-Inversion-A: Backwards Selection Rules for Residual Matter Sectors under an Algebraic Quantum-Gravity Filter. *Enter Calculus Companion*, official version 6 (request t522u). Cited for documentary portal and constitutive Δc_2 typestate, re-proved locally herein. *Source record; not a premise.*

[6] Cheung, N. (2026). Dual-Ledger-Chrono-Shield-A: Nonsingular Bimetric Cauchy-Slice Protection, Transverse-Schwartz Collars, and Operational Portal-Archive No-Signalling Across Smooth Host CTC Cores. *Enter Calculus Companion*, official version 1 (request t525u). *Source record; not a premise.*

[7] Cheung, N. (2026). Dual-Ledger-Chrono-Shield-A: Nonsingular Bimetric Cauchy-Slice Protection, Transverse-Schwartz Collars, and Operational Portal-Archive No-Signalling Across Smooth Host CTC Cores. *Enter Calculus Companion*, official version 2 (request t533u). Cited only as a documentary record. Version 2 collar upgrades are not premises of the present sheet. *Source record; not a premise.*

[8] Cheung, N. (n.d.). Chrono-CTC-A: Destructive Clock Calibration on a Prescribed Chronology-Violating Background: Local Consistency and the Closed-Archive Obstruction. *Enter Calculus Companion*. No version or registration locator is invented. *Source record; not a premise.*

[9] Cheung, N. (2026). Chrono-Return-A: No Return of a Consumed Clock: Sharp Recovery Limits and the Re-preparation Boundary. *Enter Calculus Companion*, official version 2 (request t444u). *Source record; not a premise.*

[10] Cheung, N. (n.d.). Chrono-Extract-A: Finite calibration records, enriched certificates, and continuum stencil limits do not extract total viciousness. *Enter Calculus Companion*. No version or registration locator is invented. *Source record; not a premise.*

[11] Hawking, S. W. (1992). The chronology protection conjecture. *Proceedings of the Royal Society of London A* , **435**, 649–668. Cited only as the published statement of a conjecture that this sheet does not typestate in generality.

[12] Documentary unverified external catalogue entries: Oai365-A (Family 365), Oai290-A (Family 290), Oai265-A/B, Oai276-A, Oai212-A, and refused Family 260. Unverified documentary negative controls only; isolated to Section and Table ; never premises. Family 365 is boundary-metric recovery, not a scheduler-derived cone or a time machine. Family 290 is not a decoder of an unread complement and cannot decode $r_{\mathrm{ord}} = 1$. Oai265-A/B is not a Page curve; Oai276-A is not a free clock; Oai212-A is not worldline return. Family 260 remains refused.