Enter, Big05-A-v3, 2026, pp. 1-70

Big05-A: Is Spacetime Curvature Mainly Caused by Dark Matter and Cosmic Expansion?

A declared-data analysis on prescribed classical hosts: split non-selection, bare-host triviality, exact crossover radii, and what local readings see Big05-A, version 3

Ngo Cheung

25 October 2026 (version 3; version 2: 25 October 2026; version 1: 24 October 2026)

Abstract

We test, inside the declared-data discipline of the Enter framework, the hypothesis ``if the curvature of spacetime is mainly, to the most extent, caused by the dark matter and expanding universe instead". On a prescribed classical metric with declared cosmological label Λ and classical coupling $\chi \neq 0$, the total source $T_{\mathrm{tot}} = \chi^{-1}(G + \Lambda g)$ is fixed by the metric, but its split $T_{\mathrm{tot}} = T_{\mathrm{b}} + T_{\mathrm{dm}} + T_{\Lambda}$ into ordinary, dark and vacuum pieces is not: every dominance target (pointwise energy, norm suppression, averaged ratio) takes both truth values on one data fibre, also with every piece of positive energy, so no rule of host data decides it (worst-case indicator error $\frac{1}{2}$, ratio error infinite). Only the combination $\Lambda + \chi\rho_{\Lambda}$ is fixed. Conservation makes a supplied law compatible only when it sums to T_{tot}. On the bare host DSS_H every split into pieces obeying the null energy condition is of vacuum type, so the hypothesis holds there trivially and says nothing local. On Kottler (Schwarzschild–de Sitter) hosts the Ricci part of the curvature is exactly the Λ piece and the Weyl part exactly the mass label; the mass label dominates the Kepler, Kretschmann and tidal readings exactly inside $(3m/\Lambda)^{1/3} < (18m^2/\Lambda^2)^{1/6} < (6m/\Lambda)^{1/3}$ and the Λ piece outside. Null orbit shapes are Λ-free, bound orbits need $m > 0$, and Λ enters the perihelion advance first through $\pi\Lambda a^3\sqrt{1-e^2}/m$. Local dark dominance is therefore either a relabelling invisible to every reading or a change of the metric labels that the readings decide. Big02-A's operational dark capacity is not a host functional and is not identified with stress-energy. Observational numbers enter only as a documentary record; the plan's $H_0^2 r \approx 10^{-15}\,\mathrm{m\,s^{-2}}$ at 1 AU is corrected to $7.1 \times 10^{-25}\,\mathrm{m\,s^{-2}}$. The user's draft v0 is integrated item by item.

Version 2. Version 2 is an insertion-only upgrade: every result of version 1 keeps its label and text. It adds six local results, each proved from definitions printed here and checked by computer algebra or numerics with negative controls. (i) On Kottler hosts, with a declared static-observer optical contract, the finite-distance bending angle and the emitter's radar interval are exact quadratures. They are constant on split fibres, and the observer angle depends on Λ although the orbit shape does not; two angles of one ray at known radii, with known turning radius, decide (m, Λ) (Theorem). (ii) Effective rank four is C^4-open and dense, and attained by an explicit analytic metric; on every rank-four metric the total is not of vacuum form somewhere, and the dominance targets stay non-selected (Theorem). (iii) On a prescribed McVittie comparison metric the effective total, the tides and a Kretschmann comparison function are explicit; the Ricci part couples to the mass through $\dot{H}/\sqrt{1-2m/r}$, and the source pressure is unbounded at $r = 2m$ iff $\dot{H} \neq 0$ (Theorem). (iv) A separately prescribed halo-plus-Λ host has exact halo/central and Λ/mass crossover equations, and it is not a Kottler host (Theorem). (v) Declared clocks do not select a split or remove the external parameter (Proposition). (vi) The radiation-label coefficient orbit and the split are independent coordinates (Proposition). (vii) At the user's request t323u the sheet is organized around a central theorem: every observable built from the metric, its curvature, declared observers, clocks, references and other split-independent declarations is constant on the compatible split fibre, so ordinary/dark/vacuum attribution needs a split-coupled observation or a constitutive law (Theorem); it is supported by general identifiability theorems (quotient, convex fibre, observation kernel, two-point bounds), a rank/split separation, McVittie, halo, optical and contract-relative results, some of them partial (Appendix). The user's version-2 draft (t320u) is

integrated item by item, with verdicts in Appendix . Items (c) and (d) of t315u are closed in the scoped sense stated in Section .

Version 3. Version 3 is insertion-only over version 2 and turns non-selection into auditable, conditional predictions. (i) Past geometry does not fix the future. Over smooth expanding flat hosts with a de Sitter past, whose effective totals obey the null and weak energy conditions with $\Lambda = 0$, the event-horizon radius takes exactly the values $[c/H_{\mathrm{E}}, \infty]$. Every value is attained by a future that agrees with the past to all orders, and a horizon smaller than c/H_{E} forces a violation of the null energy condition. Over real-analytic futures the future is forced (Theorem). (ii) Without any evolution law, comoving redshift drift and transverse distance obey $[(1+z)H_0 - \dot{z}]D' = c$ on flat hosts, and a z-independent curvature combination on curved ones. The drift curve is stationary exactly at acceleration transitions (Theorem). (iii) A separately declared, optional closure $\dot{H} = -\frac{n}{2}(H^2 - H_\infty^2)$, which is not a premise of the sheet, gives $H^2 = H_\infty^2 + (H_0^2 - H_\infty^2)(1+z)^n$ on all three branches and the diagnostic $N(z) \equiv n$, with its exact relation to Om. The acceleration transition, the full drift curve and the asymptotic horizon c/H_∞ then follow jointly (Theorems ,). At the documentary Planck-2018 benchmark, with radiation neglected, the conditional values are $z_{\mathrm{acc}} = 0.6316$, $z_* = 1.9162$, $\Delta v = +2.160$ and $-5.503\ \mathrm{cm\,s^{-1}}$ over ten years at $z = 1$ and 4, and $c/H_\infty = 17.543$ Gly. (iv) On the McVittie comparison, $\mathscr{D}_{\mathrm{K}}/(r-2m) \to 1/(32m^5\dot{H}^2)$, so the slow-expansion limit is not uniform at $r = 2m$ (Theorem). (v) Every forecast is constant on split fibres: predicting expansion does not identify its source decomposition (Proposition). This matters because each prediction now names the theorem that yields it, the supply it depends on and the observation that could falsify it.

noindentCitations identify source records only; no proof transfer. No quantum coefficient is admitted.

Standing ledger. No quantum coefficient is admitted. Host C is not created. O.1 stays NOT_CLOSED. XVI-N is not discharged. XV-B is not opened. H2, I3, and J2 stay unresolved. T3 stays unresolved. U6-sel is not moved. Gate 0 stays NOT_SUPPLIED. No compilation is asserted. No machine-checked proof is claimed. Numerical execution is not asserted. This is not metric reconstruction, not Einstein dynamics, not a Page curve, not a de Sitter state, not spacetime emergence, and not quantized relational time without an external clock.

Standing ledger of the plan (t316u), carried verbatim. No quantum coefficient is admitted. Host A and Host B stay separate. Host C is not created. O.1 stays NOT_CLOSED. XV-B is not opened. XVI-N is not discharged. H2, I3, J2 stay unresolved. T3 stays unresolved. U6-sel is not moved. Gate 0 stays NOT_SUPPLIED. ST4b stays NOT_SUPPLIED. Absolute vacuum energy stays open. No Einstein dynamics, derived metric, spacetime emergence, external-clock removal, or Page curve is claimed. Cited sheets (including OpenAI catalogue entries) are source records and are not premises. A source record is not a premise.

Bibliographic record

Title	Big05-A: Is Spacetime Curvature Mainly Caused by Dark Matter and Cosmic Expansion?
Author	Cheung, Ngo
Publication date	2026
Institution	Enter
Report number	Big05-A-v3
Publisher	Cheung Ngo Medical Limited
First page	1
Last page	70
Language	en

Introduction

The question. The user's hypothesis is that spacetime curvature is mainly caused by dark matter and the expanding universe rather than by ordinary matter. The plans of requests t315u and t316u ask that it be placed

inside the framework of Big01-A and Big02-A and that whatever can be proved be proved. The user's draft v0 (request t318u) already corrects several quantifiers of the plan; it is integrated here item by item.

The answer in one paragraph. On a prescribed metric the curvature is an input. What the metric fixes, once Λ and χ are declared, is a single total tensor T_{tot}; it fixes nothing about how T_{tot} is divided among named components. So the hypothesis has two readings. Read as a statement about the *split* (H-split), it is undecidable from host data: it is a declaration, and it changes no reading. Read as a statement about the *geometry* (H-geom), it is decided exactly: on the bare de Sitter host all curvature is of expansion type; on Kottler hosts the expansion piece dominates exactly outside explicit crossover radii and the mass label dominates inside them. Local dominance of dark and expansion pieces is then either a relabelling or a change of metric labels; neither is supplied by the theorems of Big01-A or Big02-A, and the second is decided by the very readings the hypothesis would have to explain.

Contributions.

• Conservation with correct quantifiers and the corrected supplied-law certificate (Lemma , Proposition); the affine family of all splits and the vacuum trade-off $\Lambda + \chi\rho_{\Lambda}$ (Proposition , Theorem).

• Null-cone rigidity (Lemma) and bare-host triviality on DSS_H (Theorem), with the dust obstruction as a corollary (Corollary).

• Fibre non-selection of dominance with positive pieces, sharp minimax risks and the reorganization separation (Theorem , Proposition , Corollary).

• The vacuum fibre, the FLRW invisible direction and attained ranks, and the linear-supply criterion (Section); blind adaptive experiments and the two-epoch horizon fibre (Section).

• Exact Kottler crossover radii, the orbit readings and the relabel-or-remetric dichotomy (Theorems , ,).

• Big02-A dark capacity is not stress-energy (Proposition); mouth-form blindness only under an explicit factorization (Proposition).

• A documentary record of the observational numbers with verified arithmetic (Section), the scale-by-scale placement (Section) and the release theorem (Theorem).

Scope. Every result is proved here from definitions printed here. Cited sheets are source records only. No matter law, field equation, dark-sector model or Solar-System fit is derived, and Big01-A and Big02-A are not revised.

Conventions. Signature $(-+++)$; $R^a{}_{bcd} = \partial_c \Gamma^a_{db} - \partial_d \Gamma^a_{cb} + \Gamma^a_{ce}\Gamma^e_{db} - \Gamma^a_{de}\Gamma^e_{cb}$, $R_{bd} = R^a{}_{bad}$, $G = \mathrm{Ric} - \frac{1}{2}Rg$. The classical coupling is written $\chi \neq 0$ (physically $8\pi G/c^4$, but no value is used). Big01-A writes κ both for this coupling ([Big01-A], source record; not a premise) and for the coefficient in the slot of $\hbar$ ([Big01-A], source record; not a premise); we never use κ for the coupling (PC-15). A mass label is $m = GM/c^2$, a length. Constants Λ, χ are constant throughout.

Organisation of version 2

Version 2 is organized around one central result, Theorem : every observable generated by the metric, its curvature, declared observers, clocks, references and other split-independent declarations is constant on the compatible source-split fibre, so ordinary/dark/vacuum attribution needs a split-coupled observation or a constitutive law. Its four corollaries (curvature-scalar, optical, orbital and tidal blindness, and minimax bounds) collect the host-specific sections. Section proves the general identifiability theorems it rests on (quotient factorization, affine and convex fibres, the observation-kernel criterion and measurement dimension, two-point bounds); Section separates curvature-direction rank from split identifiability; Sections – give the optical, McVittie, galactic and contract-relative results. The version-1 text is kept unchanged; Appendix maps the sixteen directions of the user's request t323u to statements and verdicts.

Organisation of version 3

Version 3 adds predictions without adding premises to the core. Section , ``From non-selection to predictive closure'', separates four levels. The core is unchanged. A geometric prediction package (Theorem) gives a distance–drift consistency test that needs no evolution law. An optional evolution package rests on a declared

closure (Hypothesis , Theorems ,) and carries a table of conditional calculations. A dark-sector package is given as requirements only (Proposition). Two results join the core: past geometry does not determine the future horizon (Theorem , Section), and the McVittie comparison has an inner Ricci-dominated layer (Theorem , Section). Every forecast is constant on split fibres (Proposition). The version-2 text is kept unchanged; Appendix gives the verdicts on the user's request t331u.

Background: the Enter framework (motivation only)

This section is motivation only. It explains, in plain prose, what the source sheets record about the Enter framework. Every statement points to a sheet and is tagged source record; not a premise; nothing here is used as a premise of a theorem.

Enter as a discipline. Big01-A describes the Enter calculus as a linear quantum lambda calculus in which measurement is an explicit operation, *Enter*, that consumes quantum names and returns classical records; in its gravitational sheets Enter supplies a *discipline*: what is input, what is accessible, what is returned, and what further construction a proposed interpretation would need ([Big01-A], source record; not a premise). The introductory essay it cites organizes this into four separations, the last being that an analogue is not an identification, and it stresses that a refusal of identification is not a refusal of the local result ([EntPhil], as recorded in [Big01-A], source record; not a premise).

Prescribed classical hosts. The basic object is a *prescribed* host. Big01-A's host DSS_H is the de Sitter hyperboloid with its induced metric; the metric, H, c and the time orientation are *inputs*, and nothing derives them ([Big01-A], source record; not a premise; the same host is [Red06-G-DSS] and [En08-ST-DSS], source record; not a premise). Its scalar curvature is $R = 12H^2/c^2$ ([Big01-A], source record; not a premise). The dynamical Enter specification it records treats the metric as immutable model data: an instruction does not output a replacement metric ([Big01-A], source record; not a premise). Two-epoch FLRW comparison hosts are prescribed in the same way, and are explicitly not solutions of any field equation ([Big01-A], source record; not a premise; [nuADaM01-A], source record; not a premise).

Declared data, host functionals, reorganizations. Everything beyond the host is *declared data*: registers, codes, encodings, circuits, tick rules, decoders, programs and calibration words. A *host functional* depends on the host alone; a *reorganization* is any map of accounts that fixes the host ([Big01-A], source record; not a premise). Big01-A proves that host functionals are exactly the reorganization-invariant maps ([Big01-A], source record; not a premise), and that the supremum of a figure of merit over reorganizations is a host functional, while the declared dimension is unbounded on a fixed host ([Big01-A], [Big01-A], source record; not a premise). Its basic tool is the fibre criterion: a target is a function of some data exactly when it is constant on every fibre of the data map ([Big01-A], source record; not a premise).

Negative certificates. Much of the corpus consists of *negative certificates*: proofs that a target is *not* a function of admitted data. The horizon labels $T_{\mathrm{GH}}, S_{\mathrm{GH}}, N_{\mathrm{GH}}$ depend injectively on the coefficient in the slot of $\hbar$, so no rule of admitted data reproduces them, and supplying the coefficient is supplying a quantum coefficient ([Big01-A], source record; not a premise). The equation $G + \Lambda g = \kappa T$ ``for some conserved symmetric T'' holds for every metric and selects nothing unless a matter law is supplied ([Big01-A], source record; not a premise; [VC-OB-1-CERT], source record; not a premise). On Einstein regions the vacuum term is not determined by local geometry ([VC-OB-1-CERT], [DS-OB-1-CERT], source record; not a premise), and the event-horizon radius is carried by the prescribed future, not by the past ([Big01-A], source record; not a premise).

The standing ledger and its refusals. Each sheet ends with a *standing ledger*: a fixed list of what is not supplied and not claimed: no quantum coefficient, Host A and Host B separate, no Host C, O.1 not closed, and no Einstein dynamics, derived metric, spacetime emergence or Page curve ([Big01-A], [Big02-A], source record; not a premise). The refusals follow from the discipline above. Dynamics would require a supplied matter law, which [Big01-A] shows is not contained in the host. Emergence would require the metric to be an output, whereas it is an input. A quantum coefficient would fill the slot that [Big01-A] proves is not filled by admitted data (source record; not a premise).

Lineage. Big01-A turned the fixed-size quantum-computer analogy for the de Sitter static patch into theorems

about DSS_H, resting on the de Sitter sheets Red06-G-DSS, En08-ST-DSS and V-DST-DSS ([Big01-A], source record; not a premise). Big02-A is its companion on ``dark capacity'' ([Big02-A], source record; not a premise). Coefficient sheets (Big03-A, Big04-A, Big04-A-coeff), vacuum-term sheets (VC-OB-1-CERT, DS-OB-1-CERT, DS-OB-1-fibre) and conversions of physics plans (nuADaM01-A) continue the same pattern on prescribed hosts ([Big03-A,Big04-A,Big04-A-coeff,DS-OB-1-fibre,nuADaM01-A], source record; not a premise).

**What ``dark'' means in Big02-A.** Big02-A's motivation is an analogy in which ``dark'' means any part of a finite, horizon-bounded register that constrains usable computation while lying outside the controllable, readable logical subspace ([Big02-A], source record; not a premise). What it certifies is access-relative: relative to a declared logical account, dark capacity is coding, syndrome or gauge allocation (D1), information excluded from the accessible channel (D2), unused sectors or residual factors (D3), or information excluded by a causal cut (D4) ([Big02-A], source record; not a premise). Big02-A says that this is an operational classification, not a substance ([Big02-A], source record; not a premise), and that the analogy supplies no particle species, no clustering mechanism and no derivation of dynamics ([Big02-A], source record; not a premise). Its Theorem IV shows that a fixed past event can be dark for one prescribed future and visible for another ([Big02-A], source record; not a premise). In this operational sense ``dark'' is not dark matter. Whether the two can be identified is Proposition .

The hypothesis

In the user's words

The hypothesis to be tested is, verbatim (request pt315u): ``if the curvature of spacetime is mainly, to the most extent, caused by the dark matter and expanding universe instead''. It is to be placed inside the framework of Big01-A and Big02-A.

Physical motivation (documentary record; not a premise)

The plan motivates the hypothesis by the observed budget of the universe. This paragraph is a documentary record; not a premise; its numbers are checked in Section . On cosmological scales the Planck 2018 fit gives $\Omega_\Lambda \approx 0.685$, $\Omega_\mathrm{c} \approx 0.265$ and $\Omega_\mathrm{b} \approx 0.049$ [Planck2018], so dark energy and dark matter supply about 95% of the density that enters the expansion history. On galactic scales rotation curves and lensing indicate that dark matter dominates the dynamical mass outside the central regions (plan statement; not verified here). On Solar-System scales the Sun's mass accounts for orbits, light deflection, Shapiro delay and perihelion advance, while the local dark-matter density and the expansion term are many orders of magnitude too small (Section). So, on the plan's own account, the hypothesis is approximately true on the largest scales, partly true on galactic scales, and the decisive question is the local one.

Formal restatement as a data-enlargement claim

Inside the framework, curvature is an input, so ``caused by'' cannot mean ``derived from''. We separate two precise readings, defined in Section .

Hypothesis (H-split). For a prescribed metric g, declared Λ, χ, a region U and an observer field u, there is a *supplied* split $T_\mathrm{tot} = T_\mathrm{b} + T_\mathrm{dm} + T_\Lambda$, compatible with g, in which the dark and vacuum pieces dominate the ordinary piece on U for a stated dominance target (Definition).

Hypothesis (H-geom). For a prescribed metric in a family with a declared mass label m and expansion label Λ, a stated curvature reading at U (Kretschmann share, tidal eigenvalue, Kepler term) is dominated by its Λ-dependent part (Definition).

Both are *data enlargements*: H-split adds a split to the declared data, H-geom adds a family and a reading. Neither is a theorem of Big01-A or Big02-A. The plan's formulation (t316u) is H-split with the dark piece taken from Big02-A's operational dark capacity or from the external Λ, H labels; that identification is examined in Proposition . The results below say exactly when each reading is decidable and what it decides. par *Non-claim.* Neither hypothesis is adopted as a premise. The restatement is a definition of targets, not evidence for them. par

Setting: hosts, data maps, splits and dominance

Definition (Hosts). DSS_H is the prescribed host of [Big01-A] (source record; not a premise); on a flat patch

$g_H = -c^2\,\mathrm{d}t^2 + e^{2Ht}\,\mathrm{d}\mathbf{x}^2$, on a static patch $g_H = -c^2 f_0\,\mathrm{d}t^2 + f_0^{-1}\,\mathrm{d}r^2 + r^2\,\mathrm{d}\Omega^2$, $f_0 = 1 - H^2r^2/c^2$; put $\Lambda_H := 3H^2/c^2$. For $m \geq 0$, $\Lambda > 0$ with $9m^2\Lambda < 1$, the *Kottler host* $K_{m,\Lambda}$ is

$$g_{m,\Lambda} = -c^2 f\,\mathrm{d}t^2 + f^{-1}\,\mathrm{d}r^2 + r^2\,\mathrm{d}\Omega^2, \qquad f(r) = 1 - \frac{2m}{r} - \frac{\Lambda r^2}{3},$$

on its static region $\{f > 0\} = (r_b, r_c)$, which is nonempty exactly when $9m^2\Lambda < 1$ (the maximum of f on $r > 0$ is $1 - (9m^2\Lambda)^{1/3}$, at $r_s = (3m/\Lambda)^{1/3}$). K_{0,Λ_H} is the static patch of DSS_H. Kottler hosts are prescribed comparison metrics; they are not new ledger hosts and their central source is not constructed.

Definition (Data maps). An *account* is $x = (g, \Lambda, \chi, \Delta, \sigma)$, with Δ declared data in the sense of [Big01-A] (source record; not a premise) and σ an optional split. The data maps are $D_g(x) = (g, \Delta)$, $D_{\Lambda,\chi}(x) = (g, \Lambda, \chi, \Delta)$ and $D_{\mathrm{tot}}(x) = (g, \Lambda, \chi, \Delta, T_{\mathrm{tot}})$. All are host-aware. None contains a split. A family is *split-blind* for a data map if its members share the data value while the split varies.

Definition (Total source, compatible splits). Put $\Theta_\Lambda[g] = G[g] + \Lambda g$ and $T_{\mathrm{tot}} := \chi^{-1}\Theta_\Lambda[g]$. A *split* on an open set U is a triple $\sigma = (T_{\mathrm{b}}, T_{\mathrm{dm}}, T_\Lambda)$ of symmetric, (weakly) divergence-free tensor fields; it is *compatible* if $T_{\mathrm{b}} + T_{\mathrm{dm}} + T_\Lambda = T_{\mathrm{tot}}$ on U, and of *vacuum form* in its last slot if $T_\Lambda = -\rho_\Lambda g$ with constant ρ_Λ. The set of compatible splits is $\mathscr{S}(g, \Lambda, \chi; U)$. A symmetric tensor S obeys the *null energy condition* (NEC) at p if $S(k,k) \geq 0$ for every null $k \in T_pM$, and the *weak energy condition* (WEC) if $S(v,v) \geq 0$ for every timelike v.

Definition (Dominance targets). Fix a future unit timelike field u ($g(u,u) = -1$) and, for a split, $\rho_X := T_X(u,u)$.

• *Pointwise energy dominance* on U: $\rho_{\mathrm{b}} < \rho_{\mathrm{dm}} + \rho_\Lambda$ at every point of U.

• *Norm suppression* on a compact $K \subset U$ at level $\varepsilon \in (0,1)$ (from v0): with $h = g + 2u \otimes u$ and $\|S\|_K = \sup_K (h^{ac}h^{bd}S_{ab}S_{cd})^{1/2}$, $\mathrm{lVertT_b}\|_K \leq \varepsilon \mathrm{lVertT_{dm}} + T_\Lambda\|_K$.

• *Averaged ratio* (from v0): for $w \in C_c^\infty(U)$, $w \geq 0$, $\int w\,\mathrm{dvol} = 1$, $\mathscr{E}(S) = \int wS(u,u)\,\mathrm{dvol}$ and, when $\mathscr{E}(T_{\mathrm{b}}) > 0$, $\mathscr{R} = \mathscr{E}(T_{\mathrm{dm}} + T_\Lambda)/\mathscr{E}(T_{\mathrm{b}})$; the predicate is $\mathscr{R} > A$ for a declared $A > 0$.

Definition (Geometric readings). On $K_{m,\Lambda}$: the *Kretschmann reading* $\mathscr{K} = R_{abcd}R^{abcd}$ with its Weyl part $\mathscr{C}^2 = C_{abcd}C^{abcd}$; the *tidal readings* $\mathrm{t}_r, \mathrm{t}_\perp$, the eigenvalues of $\xi \mapsto -c^2 R^{\widehat{\mathrm{imath}}}{}_{\widehat{t}\,\mathrm{jmath}\,\widehat{t}}\,\xi^{\widehat{\mathrm{jmath}}}$ for static observers; the *Kepler reading* $\Omega^2(r)$, the squared coordinate angular velocity of circular geodesics. A reading is a function of the metric (and of declared observer and orbit data); it is never a function of a split.

Conservation, compatibility and the supplied-law certificate

Lemma (Conservation with its correct quantifiers). *Let g be a C^2 Lorentzian metric. Then $\Theta_\Lambda[g]$ is symmetric and weakly divergence-free (pointwise if $g \in C^3$). For every $\chi \neq 0$ there is exactly one tensor T with $\Theta_\Lambda[g] = \chi T$, namely T_{tot}, and it is conserved. Conservation of an independently supplied symmetric T is necessary but not sufficient for $\Theta_\Lambda[g] = \chi T$.*

Proof. For C^3 metrics the contracted Bianchi identity gives $\nabla^a R_{ab} = \frac{1}{2}\nabla_b R$, so $\nabla^a G_{ab} = 0$, and $\nabla^a(\Lambda g_{ab}) = 0$ because Λ is constant. For C^2 metrics, approximate locally in C^2 by smooth Lorentzian metrics; the integrated identity $\int \Theta^{ab}\nabla_a Z_b\,\mathrm{dvol} = 0$ for compactly supported smooth Z passes to the limit, and a partition of unity globalizes it. Existence and uniqueness: $\chi(T_1 - T_2) = 0$ forces $T_1 = T_2$. Insufficiency: on DSS_H with $\Lambda = \Lambda_H$, $\Theta_\Lambda = 0$ (Theorem), while $T = -g_H$ is symmetric and conserved and $0 \neq -\chi g_H$.

par *Non-claim.* This is the existential statement of [Big01-A] and [VC-OB-1-CERT] (source record; not a premise) with its quantifier made explicit; no stronger predecessor claim is transferred. A variable Λ gives $\nabla^a\Theta_{ab} = \nabla_b\Lambda$ and is a different problem. par

Proposition (Supplied-matter-law certificate, corrected). *Fix g, Λ, χ and an open U.*

• *A supplied symmetric $T = T_{\mathrm{b}} + T_{\mathrm{dm}} + T_{\Lambda}$ is compatible on U iff its residual $\mathfrak{C} = G + \Lambda g - \chi T$ vanishes on U. If T is conserved, $\mathfrak{C}$ is conserved but need not vanish.*

• *For every conserved symmetric T_{b} and every constant ρ_{Λ} there is exactly one T_{dm} making $(T_{\mathrm{b}}, T_{\mathrm{dm}}, -\rho_{\Lambda} g)$ compatible, namely $T_{\mathrm{dm}} = T_{\mathrm{tot}} - T_{\mathrm{b}} + \rho_{\Lambda} g$. In particular the declaration ``$T_{\mathrm{b}} = 0$ on U'' (or any declared bound on T_{b}) is always consistent.*

• *That completion obeys the NEC (resp. WEC) on U iff $T_{\mathrm{tot}} - T_{\mathrm{b}}$ obeys the NEC (resp. $T_{\mathrm{tot}} - T_{\mathrm{b}} + \rho_{\Lambda} g$ obeys the WEC).*

• *The metric is the prescribed metric throughout. No law is selected: a constitutive law $T[g, \psi]$ must in addition have an admissible configuration ψ with $\mathfrak{C}[g, T[g, \psi]] = 0$.*

Proof. (a) is the definition and Lemma with linearity. (b) Compatibility determines T_{dm}; it is conserved as a combination of conserved tensors. (c) For null k, $g(k,k) = 0$; for unit timelike v, $(\rho_{\Lambda} g)(v,v) = -\rho_{\Lambda}$. (d) Nothing in (a)–(c) changes g.

par *Non-claim.* This does not reproduce light deflection, Shapiro delay, perihelion advance or Cavendish measurements; those are external comparisons. The plan's statement that $\Theta = \kappa T$ ``holds'' for a declared law by [Big01-A] (source record; not a premise) is corrected (PC-3, PC-4): it holds iff the law sums to T_{tot}. par

Proposition (Affine family of all splits). *Let $\mathcal{S}_g(U)$ be the conserved symmetric fields on U. The compatible splits are exactly $\sigma = (B, T_{\mathrm{tot}} - B - V, V)$, $B, V \in \mathcal{S}_g(U)$. If $\lVert T_{\mathrm{tot}} \rVert_K > 0$ and $\lVert B \rVert_K \le \theta \lVert T_{\mathrm{tot}} \rVert_K$ with $0 \le \theta \le \varepsilon/(1+\varepsilon)$, then σ is norm-suppressed at level ε. If $T_{\mathrm{tot}} = 0$ on K, norm suppression forces $B = 0$ on K.*

Proof. Compatibility determines the middle slot. By the reverse triangle inequality $\lVert T_{\mathrm{tot}} - B \rVert_K \ge (1-\theta) \lVert T_{\mathrm{tot}} \rVert_K$, so $\lVert B \rVert_K / \lVert T_{\mathrm{tot}} - B \rVert_K \le \theta/(1-\theta) \le \varepsilon$. If $T_{\mathrm{tot}} = 0$, the condition reads $\lVert B \rVert_K \le \varepsilon \lVert B \rVert_K$ with $\varepsilon < 1$.

par *Non-claim.* The labels $T_{\mathrm{b}}, T_{\mathrm{dm}}$ are names of tensor slots; no baryons, collisionless dark matter or equation of state is constructed. par

Theorem (Compatibility trichotomy and the vacuum trade-off). *Fix g, χ, a conserved symmetric T_{m} and put $T_v = T_{\mathrm{m}} - v g$, $v \in \mathbb{R}$.*

• *For fixed Λ at most one v makes (Λ, T_v) compatible; fixed (g, Λ, χ) admits exactly one compatible total, T_{tot}, while its split may be non-unique.*

• *If (Λ_0, T_{v_0}) is compatible, then $(\Lambda_0 - \chi(v - v_0), T_v)$ is compatible for every v. Equivalently, for vacuum-form $T_{\Lambda} = -\rho_{\Lambda} g$, compatibility reads $G + (\Lambda + \chi \rho_{\Lambda}) g = \chi (T_{\mathrm{b}} + T_{\mathrm{dm}})$: the metric and $T_{\mathrm{b}} + T_{\mathrm{dm}}$ fix only $\Lambda_{\mathrm{eff}} := \Lambda + \chi \rho_{\Lambda}$.*

• *The family in (b) is a fibre for data omitting Λ and v, and not a fibre of $D_{\Lambda, \chi}$ unless v is fixed.*

Proof. (a) Subtracting two compatible equations gives $\chi(v_1 - v_2) g = 0$. (b) $G + (\Lambda_0 - \chi(v - v_0)) g = \chi T_{v_0} - \chi(v - v_0) g = \chi T_v$; the second form is a rearrangement. (c) follows from (a), (b).

par *Non-claim.* How much of Λ_{eff} is ``geometric $\Lambda$'' and how much is ``vacuum source ρ_{Λ}'' is a declaration; this parallels [VC-OB-1-CERT] and [DS-OB-1-CERT] (source record; not a premise). Absolute vacuum energy stays open. par

Null-cone rigidity and the bare host

Lemma (Null-cone rigidity). *Let (V, g) be a four-dimensional Lorentzian vector space.*

• *A symmetric bilinear S with $S(k,k) = 0$ for all null k is $S = s g$ for a real s.*

• *If $S_1, \dots, S_N$ obey the NEC and $\sum_j S_j = \mu g$, then $S_j = s_j g$ with $\sum_j s_j = \mu$. If moreover S_j obeys the WEC, $s_j \le 0$, i.e. $S_j = -a_j g$ with energy density $a_j \ge 0$ for every observer and pressure $-a_j$.*

• *On a connected open set, a conserved field of the form sg with s a locally integrable function has s constant.*

Proof. (a) In an orthonormal frame put $k_{\pm} = e_0 \pm n$, n a unit spatial vector. Then $S_{00} \pm 2S_{0n} + S_{nn} = 0$, so $S_{0n} = 0$ and $S_{nn} = -S_{00}$ for all unit n. A quadratic form on $\mathbb{R}^3$ that is constant on the unit sphere is a multiple of the identity, so $S_{ij} = -S_{00}\delta_{ij}$ and $S = -S_{00}\,g$. (b) $\sum_j S_j(k,k) = \mu g(k,k) = 0$ with every term ≥ 0, so each $S_j(k,k) = 0$, and (a) applies. For unit timelike v, $S_j(v,v) = -s_j \geq 0$. (c) $\nabla^a(sg_{ab}) = \partial_b s = 0$ weakly, so s is constant.

par *Non-claim.* The lemma is pointwise linear algebra; it is stated for the named energy conditions only. par

Theorem (Bare-host triviality on DSS_H). *On DSS_H (any patch):*

• $R_{abcd} = \frac{H^2}{c^2}(g_{ac}g_{bd} - g_{ad}g_{bc})$, $C_{abcd} = 0$, $\mathrm{Ric} = \Lambda_H g$, $R = 12H^2/c^2$, $G = -\Lambda_H g$, $\mathscr{K} = 24H^4/c^4$, *and* $T_{\mathrm{tot}} = \chi^{-1}(\Lambda - \Lambda_H)g$.

• *For every observer the tidal operator is $\xi \mapsto H^2\xi$ (isotropic stretching, proper time in seconds); there is no trace-free (mass-tidal) part.*

• *On a connected open U, every compatible split whose three pieces obey the NEC consists of constant multiples of g: $T_{\mathrm{b}} = -a\,g$, $T_{\mathrm{dm}} = -b\,g$, $T_\Lambda = -\rho_\Lambda g$, with $a + b + \rho_\Lambda = (\Lambda_H - \Lambda)/\chi$; under the WEC, $a, b \geq 0$.*

• *Consequently H-geom holds trivially (every curvature reading is a function of Λ_H alone), and in every NEC split the ``ordinary'' piece is of cosmological-constant type: uniform, isotropic, with pressure equal to minus its density. No localized ordinary matter is compatible with the bare host, so the hypothesis says nothing local there.*

Proof. (a) For flat-slicing FLRW $g = -c^2\,\mathrm{d}t^2 + a(t)^2\,\mathrm{d}\mathbf{x}^2$ with $h = \dot{a}/a$ one computes $R_{tt} = -3(\dot{h} + h^2)$, $R_{ij} = \frac{a^2}{c^2}(\dot{h} + 3h^2)\delta_{ij}$, $R = \frac{6}{c^2}(\dot{h} + 2h^2)$, $G_{tt} = 3h^2$, $G_{ij} = -\frac{a^2}{c^2}(2\dot{h} + 3h^2)\delta_{ij}$ (check C-Big05-09); at $h = H$ these give $\mathrm{Ric} = \Lambda_H g$, $R = 12H^2/c^2$ and $G = -\Lambda_H g$. The constant-curvature form and $C = 0$ are checked on the static patch (C-Big05-01, C-Big05-10); then $\mathscr{K} = 2 \cdot 12\,(H^2/c^2)^2 = 24H^4/c^4$. (b) In an orthonormal frame of any observer $R_{\hat{\imath}\hat{t}\hat{\jmath}\hat{t}} = -(H^2/c^2)\delta_{ij}$; geodesic deviation gives $\ddot{\xi} = H^2\xi$. (c) T_{tot} is a multiple of g; apply Lemma (b),(c) to the three pieces. (d) restates (a)–(c).

par *Non-claim.* Which constants a, b, ρ_Λ are declared is not decided by the host (Theorem). This is not a no-go theorem for perturbed de Sitter metrics, inhomogeneous cosmology, modified gravity or sectors violating the NEC. par

Corollary (Dust obstruction on exact de Sitter; from v0). *On a de Sitter region, a compatible source consisting of finitely many perfect fluids $(\rho_j + p_j)v_j \otimes v_j + p_j g$ with $\rho_j + p_j \geq 0$ and a vacuum term has $\rho_j + p_j = 0$ for all j; in particular all dust densities vanish.*

Proof. Each fluid obeys the NEC, since $T_j(k,k) = (\rho_j + p_j)g(v_j,k)^2 \geq 0$; apply Theorem (c). Directly: $g(v_j,k) \neq 0$ for timelike v_j and null $k \neq 0$, so the null contraction forces $\rho_j + p_j = 0$.

par *Non-claim.* Theorem (c) is the stronger form: it needs no fluid ansatz. The positive-dust split of Example cannot be imported into exact de Sitter. par

Example (A positive-dust split on a matter-era FLRW host; from v0). With $c = 1$, $a(t) = t^{2/3}$ on $t > 0$, $\Lambda = 0$, $\chi > 0$, the formulas above give $T_{\mathrm{tot}} = \frac{4}{3\chi t^2}\,\mathrm{d}t^2$, positive dust at rest in the comoving frame (C-Big05-11). All splits $(sT_{\mathrm{tot}}, (1-s)T_{\mathrm{tot}}, 0)$, $s \in [0,1]$, consist of positive dust.

Fibre non-selection of dominance

Lemma (Fibre criterion and two-point certificate). *Let $D : \mathscr{X} \to \mathscr{Y}$, $\tau : \mathscr{X} \to \mathscr{Z}$. A map F with $\tau = F \circ D$ exists iff τ is constant on every fibre of D. If $(\mathscr{Z}, d)$ is metric, $D(x_0) = D(x_1)$ and $d(\tau(x_0), \tau(x_1)) = \Delta$, every F has* $\max_i d(F(D(x_i)), \tau(x_i)) \geq \Delta/2$.

Proof. A factorization is constant on fibres; conversely fibre constancy makes $F(y) := \tau(x)$, $D(x) = y$, well

defined. The bound is the triangle inequality through $F(D(x_0)) = F(D(x_1))$.

par *Non-claim.* Parallel records: [Big01-A], [EM-OB-1], [VC-OB-1], [TS-OB-1] (source record; not a premise). These are separate statements of the same elementary principle, not one theorem (PC-8); the principle proves nothing without a fibre witness. par

Theorem (Fibre non-selection of local dominance). *Fix g, Λ, χ, a connected open U, a compact $K \subset U$, u and w as in Definition , and suppose $T_{\mathrm{tot}} \equiv 0$ on K. For $s \in [0,1]$ let $\sigma_s = (sT_{\mathrm{tot}}, (1-s)T_{\mathrm{tot}}, 0)$.*

• *Every σ_s is compatible, and all have the same D_{tot}-value. If T_{tot} obeys the NEC, WEC or dominant energy condition on U, so does every piece of every σ_s.*

• *σ_s is norm-suppressed at level ε iff $s \le \varepsilon/(1+\varepsilon)$.*

• *If $\mathscr{E}(T_{\mathrm{tot}}) > 0$, then $\mathscr{R}(s) = (1-s)/s$ on $(0,1]$, with range $[0,\infty)$ on $(0,1]$ and every threshold $A > 0$ crossed.*

• *If $\rho_{\mathrm{tot}} = T_{\mathrm{tot}}(u,u) > 0$ on U, then σ_s has pointwise energy dominance on U iff $s < \frac{1}{2}$.*

• *Hence none of these predicates, nor s or $\mathscr{R}$, is a function of D_{tot}, $D_{\Lambda,\chi}$ or D_g: every rule has worst-case error at least $\frac{1}{2}$ on each indicator and infinite worst-case error on $\mathscr{R}$. This holds for every host functional and every reorganization-invariant map (Corollary).*

• *Witnesses with positive energy exist: on DSS_H with declared $\Lambda < \Lambda_H$ and $\chi > 0$, $T_{\mathrm{tot}} = -a_0 g$ with $a_0 > 0$ obeys the WEC and (d) applies with vacuum-type pieces; on the host of Example every piece is positive dust.*

Proof. (a) Multiples of a conserved tensor are conserved and sum to T_{tot}; the energy conditions are cones, stable under multiplication by $s, 1-s \ge 0$. (b) $\|sT_{\mathrm{tot}}\|_K \le \varepsilon\|(1-s)T_{\mathrm{tot}}\|_K$ iff $s \le \varepsilon(1-s)$. (c) Linearity of $\mathscr{E}$. (d) $\rho_{\mathrm{b}} = s\rho_{\mathrm{tot}} < (1-s)\rho_{\mathrm{tot}}$ iff $s < \frac{1}{2}$. (e) Each target varies on one fibre; Lemma with d the discrete metric gives $\frac{1}{2}$, and for $\mathscr{R}$ take $s_0 = 1$, $s_1 \mathrm{downarrow} 0$. (f) Theorem (a) and Example .

par *Non-claim.* This does not forbid declaring a split (say $s = \frac{1}{4}$) by convention, and it does not show that no compatible physical law exists. A baryon-sensitive observation is additional data and may break the fibre. par

Proposition (Exact scalar-fibre minimax; from v0). *If a real target takes values with finite infimum m_- and supremum m_+ on one data fibre, the deterministic and randomized minimax absolute errors there equal $(m_+ - m_-)/2$, attained by the midpoint; if the range is unbounded, every randomized estimate has infinite worst-case expected error. With additional data J, exact identification is possible iff the target is constant on every joint fibre of (D, J); a Boolean predicate needs only constancy of the predicate.*

Proof. For fixed y the worst error is $\max(|y-m_-|, |y-m_+|)$, minimal at the midpoint. For random Y, $\mathbb{E}|Y-m_-| + \mathbb{E}|Y-m_+| \ge m_+ - m_-$ (with approximating values if the endpoints are not attained). If the range is unbounded, $\mathbb{E}|Y-v| \ge |v| - \mathbb{E}|Y|$. The last sentence is Lemma for (D, J).

par *Non-claim.* The risks are for the stated fibres only. par

Proposition (Boolean risk conventions; from the v2 draft). *Suppose a Boolean target takes both values on one data fibre. Then:*

• *estimating it by a number $p \in [0,1]$ under absolute loss has minimax risk $\frac{1}{2}$, attained by $p = \frac{1}{2}$;*

• *randomized binary decisions under zero–one loss have minimax risk $\frac{1}{2}$, attained by a fair coin;*

• *every deterministic decision with values in $\{0,1\}$ has worst-case zero–one loss 1.*

Proof. (a) The worst loss of p is $\max(p, 1-p)$, minimal at $p = \frac{1}{2}$. (b) If 1 is reported with probability p, the two error probabilities are $1-p$ and p. (c) A deterministic rule gives one answer on the fibre, and that answer is wrong at one of the two accounts.

par *Non-claim.* This makes precise the indicator risk $\frac{1}{2}$ of Theorem (e) (PC-21): the bound $\frac{1}{2}$ is sharp in the

conventions (a) and (b); a deterministic Boolean rule has worst case 1. Check C-Big05-35. par

Proposition (Strictly positive three-piece witnesses; from the v2 draft). *Let* $T_{\mathrm{tot}} = -a_0 g$ *with* $a_0 > 0$ *(for instance on* DSS_H *with declared* $\Lambda < \Lambda_H$ *and* $\chi > 0$*). For* $0 < \eta < 1$ *and* $0 < s < 1 - \eta$*, the split*

$$T_{\mathrm{b}} = -s\, a_0 g, \qquad T_{\mathrm{dm}} = -(1 - s - \eta) a_0 g, \qquad T_{\Lambda} = -\eta\, a_0 g$$

is compatible, every piece has strictly positive energy density for every unit timelike observer, and $\mathscr{R} = (1 - s)/s$*. For every declared suppression level* $\varepsilon \in (0, 1)$ *and ratio threshold* $A > 0$*, and for pointwise energy dominance,* η *can be chosen so that the predicate takes both values within this strictly positive family.*

Proof. All coefficients are positive and sum to a_0; constant multiples of g are conserved, and $-ag(v, v) = a > 0$ for unit timelike v. The predicates hold iff $s \le \varepsilon/(1 + \varepsilon)$, $s < 1/(1 + A)$ and $s < \frac{1}{2}$ respectively (Theorem (b)–(d)); each threshold lies in $(0, 1)$, so any η smaller than one minus the threshold leaves points on both sides in $(0, 1 - \eta)$.

par *Non-claim.* The pieces are of vacuum type, as Theorem (c) forces on DSS_H; positivity of every slot does not make the split a host functional. Check C-Big05-35. par

Proposition (Vacuum-ratio fibre; from v0). *Fix conserved* B, D_0 *with* $b = \mathscr{E}(B) > 0$*,* $d_0 = \mathscr{E}(D_0)$*, and put* $\sigma_v = (B, D_0, -vg)$*. Then* $\mathscr{R}(v) = (d_0 + v)/b$*. On an interval* $v \in [v_-, v_+]$ *the exact minimax error for* $\mathscr{R}$ *is* $(v_+ - v_-)/(2b)$*, and* $\mathscr{R} > A$ *is unidentified iff the interval meets both sides of* $v = Ab - d_0$*. The family is compatible only with the compensation of Theorem (b).*

Proof. $\mathscr{E}(-vg) = v \int w = v$ since $g(u, u) = -1$; apply Proposition .

par *Non-claim.* A vacuum shift need not move every dominance target; the statement concerns the displayed target and family. par

Corollary (Reorganization separation).

• *Big01-A accounts carry no split. Declared data in [Big01-A] (*source record; not a premise*) are registers, codes, encodings, circuits, tick rules, decoders, programs and calibration words. A ``relative weight of ordinary versus dark contributions'' is not a map on that account space, so the statement that [Big01-A] or [Big01-A] (*source record; not a premise*) ``leaves it invariant'' is vacuous.*

• *Extended accounts. Adjoin the split:* $\mathscr{A}^\sigma = \{(H, \Delta, \sigma)\}$*,* $\sigma \in \mathscr{S}(g_H, \Lambda, \chi)$*, and call a reorganization any map fixing* H*. A map on* $\mathscr{A}^\sigma$ *is invariant under all reorganizations iff it depends on H alone. Hence every non-constant dominance predicate of Theorem is changed by some reorganization, e.g.?*$\sigma_s \mapsto \sigma_{1-s}$*: on the extension, the plan's invariance claim is false.*

• *Spectator actions (from v0). A reorganization that changes only passive declarations, idle register factors or presentation and fixes* $(g, \Lambda, \chi, \sigma, u, w, K)$ *leaves every target of Definition unchanged; the D4 monoid* $(q, f) \mapsto (q + n, f + v)$ *is such an action. Split fibres are not spectator orbits.*

• *The junction radius is moved not by [Big01-A], where* $R_0 = c/H_2$ *is fixed, but across futures ([Big01-A], [Big02-A],* source record; not a premise*; Theorem); moving it selects no split.*

Proof. (a) is a reading of the definition. (b) If Q is invariant and a, a' share H, the map sending every account over H to a' and fixing all others is a reorganization, so $Q(a) = Q(a')$; the converse is immediate. The predicate takes two values on one fibre over H by Theorem (f) and (d). (c) Every argument of the targets is fixed. (d) Theorem (e).

par *Non-claim.* The local reproof in (b) parallels [Big01-A](b),(c) (source record; not a premise); no theorem is transferred. Check C-Big05-04. par

Identifiability on split fibres

This section and the next were added at the user's request t323u. They state, for an arbitrary account space, the inverse-problem facts used throughout, and then the central theorem of the sheet (Theorem). The plan's items #1–#6 are proved here in corrected form; the corrections are PC-29–PC-33 (Appendix).

Definition (Abstract accounts, data and targets). An *account space* is a set $\mathscr{A}$; a *data map* is a map $\pi : \mathscr{A} \to \mathscr{D}$;

a *target* is a map $F : \mathscr{A} \to Y$. For split accounts, $\mathscr{A}$ consists of tuples $x = (g, \Lambda, \chi, \Delta, \sigma)$ with $\sigma = (T_1, \dots, T_K) \in \mathscr{S}_K(g, \Lambda, \chi; U)$, $K \geq 2$, the K-slot analogue of Definition (symmetric, weakly conserved slots summing to T_{tot}); π forgets σ and keeps all split-independent data. F is *recoverable* from π if $F = \widetilde{F} \circ \pi$ for some $\widetilde{F}$. A *(randomized) estimator* is a map $d \mapsto Q_d$ to probability laws on Y; for $Y = \mathbb{R}$ its risk at x is $\mathbb{E}_{Q_{\pi(x)}} |y - F(x)|$.

Theorem (Quotient characterization of source attribution; plan item #1). *In Definition :*

• *F is recoverable from π iff F is constant on every fibre $\pi^{-1}(d)$; then $\widetilde{F}$ is unique on $\pi(\mathscr{A})$.*

• *Let $Y = \mathbb{R}$ and fix $d \in \pi(\mathscr{A})$ with $a_d = \inf F(\pi^{-1}(d))$ and $b_d = \sup F(\pi^{-1}(d))$ finite. Over deterministic and over randomized estimators, the minimax worst-case absolute risk on the fibre is exactly $(b_d - a_d)/2$; the midpoint $(a_d + b_d)/2$ attains this value, and its worst case is attained as a maximum iff a_d or b_d is a value of F on the fibre. If the fibre values merely contain an interval $[a, b]$, the risk is at least $(b - a)/2$, with equality iff $[a, b] = [a_d, b_d]$.*

• *If F is unbounded on $\pi^{-1}(d)$, every randomized estimator has infinite worst-case risk there.*

• *Over a set $\mathscr{D}_0 \subseteq \pi(\mathscr{A})$ of data values the minimax risk is $\sup_{d \in \mathscr{D}_0} (b_d - a_d)/2$. The statements hold for every $K \geq 2$ and every target: dominance predicates (as $\{0, 1\}$-valued), source ratios, vacuum fractions, equation-of-state labels attached to a slot, abundance assignments and any dictionary attached to σ after the fact.*

Proof. (a) Lemma ; uniqueness because π is onto its image. (b) For a law Q with finite first moment and values v, w of F on the fibre, $\max(\mathbb{E}_Q|y - v|, \mathbb{E}_Q|y - w|) \geq \frac{1}{2}\mathbb{E}_Q(|y - v| + |y - w|) \geq |w - v|/2$; taking $v$downarrow a_d, $w$uparrow b_d gives the lower bound, and a law without first moment has infinite risk. The midpoint has worst case $\sup_v |(a_d + b_d)/2 - v| = (b_d - a_d)/2$, a maximum iff an endpoint is a value. If only $[a, b] \subseteq F(\pi^{-1}(d))$, the same two-point argument gives $(b - a)/2$, and the exact value $(b_d - a_d)/2$ exceeds it unless $a = a_d$, $b = b_d$. (c) $\mathbb{E}_Q|y - v| \geq |v| - \mathbb{E}_Q|y|$ and $|v|$ is unbounded on the fibre. (d) Estimators may depend on d; take the fibrewise optimum. The K-slot form changes nothing in (a)–(d).

par *Non-claim.* This generalizes Lemma and Proposition to every account space and target; it decides nothing about which target is physically meaningful (PC-29). Check C-Big05-53. par

Theorem (Affine and convex source fibres; plan item #2). *Fix $g \in C^2$, Λ, $\chi \neq 0$ and a connected open U. Let $V(U)$ be the real vector space of symmetric, weakly conserved tensor fields on U (of a fixed regularity class), and $\mathscr{F}_K = \mathscr{S}_K(g, \Lambda, \chi; U)$.*

• *$\mathscr{F}_K$ is a nonempty affine space: $\mathscr{F}_K = \sigma_0 + W_K$ with $\sigma_0 = (T_{\mathrm{tot}}, 0, \dots, 0)$ and $W_K = \{(S_1, \dots, S_K) \in V^K : \sum S_i = 0\} \cong V^{K-1}$. Conservation of each slot is a linear constraint.*

• *$V(U)$ contains g, G, $E^{(1)}$, $E^{(2)}$. If g is smooth, every $p \in U$ has a neighbourhood U_p on which $V(U_p)$ is infinite-dimensional; so the fibre on U_p is an affine space of infinite dimension, for every metric.*

• *If $\mathscr{C}_1, \dots, \mathscr{C}_K$ are convex cones of symmetric tensor fields (for instance the NEC, WEC or DEC cones, or the vacuum-form cone $\{-\rho g : \rho \geq 0\text{constant}\}$), the admissible fibre $\mathscr{F}_K^{\mathscr{C}} = \mathscr{F}_K \cap \prod_i \mathscr{C}_i$ is convex; it is nonempty iff $T_{\mathrm{tot}} \in \sum_i (\mathscr{C}_i \cap V)$.*

• *For every affine functional ℓ on V^K, $\ell(\mathscr{F}_K^{\mathscr{C}})$ is an interval; it has more than one point iff ℓ is nonconstant on $\mathscr{F}_K^{\mathscr{C}}$. Nonconstancy on V^K is not enough: $\ell(\sigma) = \mathscr{E}(\sum_i T_i)$ is nonconstant on V^K and constant on $\mathscr{F}_K$.*

• *(Interior condition.) Suppose $\sigma_* \in \mathscr{F}_K^{\mathscr{C}}$ and a linear subspace $W_0 \subseteq W_K$ are such that $\sigma_* + w \in \mathscr{F}_K^{\mathscr{C}}$ for all w in some absorbing convex subset of W_0 (σ_* is a relative algebraic interior point along W_0). Then every affine ℓ whose linear part is nonzero on W_0 takes on $\mathscr{F}_K^{\mathscr{C}}$ an interval of values containing $\ell(\sigma_*)$ in its interior. If T_{tot} obeys the WEC on U ($K = 3$, WEC cones), the hypothesis holds with $\sigma_* = \frac{1}{3}(T_{\mathrm{tot}}, T_{\mathrm{tot}}, T_{\mathrm{tot}})$ and $W_0 = \{(aT_{\mathrm{tot}}, bT_{\mathrm{tot}}, -(a + b)T_{\mathrm{tot}})\}$*

; then $\ell = \mathscr{E}(T_{\mathrm{b}})$ varies iff $\mathscr{E}(T_{\mathrm{tot}}) \neq 0$.

Proof. (a) $T_{\mathrm{tot}} \in V$ by Lemma ; the difference of two compatible splits has conserved slots summing to 0, and conversely; the map $(S_1, \dots, S_{K-1}) \mapsto (S_1, \dots, S_{K-1}, -\sum S_i)$ is a linear bijection $V^{K-1} \to W_K$. (b) Lemma . For U_p take a Gaussian normal chart $(-\varepsilon, \varepsilon) \times B$, $g = -\mathrm{d}t^2 + h_{ij}\,\mathrm{d}x^i\,\mathrm{d}x^j$, in which $u = \partial_t$ is geodesic. For every smooth ρ_0 on B, $T = \rho_0(x)\,|h|^{-1/2} u \otimes u$ is conserved: $\nabla^a(\rho u_a u_b) = \nabla_a(\rho u^a) u_b$ for geodesic u, and $\nabla_a(\rho u^a) = |h|^{-1/2}\partial_t(\rho |h|^{1/2}) = 0$; the map $\rho_0 \mapsto T$ is linear and injective. (c) An intersection of an affine set with a product of convex cones is convex; nonemptiness is the definition of the Minkowski sum. (d) Along a segment ℓ is affine, so the image of a convex set is convex in $\mathbb{R}$; the counterexample is constant because $\sum T_i = T_{\mathrm{tot}}$. (e) If $\ell_L(w) \neq 0$ for some $w \in W_0$, then $\sigma_* \pm tw$ are admissible for small $t > 0$ and $\ell(\sigma_* \pm tw) = \ell(\sigma_*) \pm t\ell_L(w)$. For the example,

$\sigma_* + w = ((\frac{1}{3} + a)T_{\mathrm{tot}}, (\frac{1}{3} + b)T_{\mathrm{tot}}, (\frac{1}{3} - a - b)T_{\mathrm{tot}})$, with all coefficients positive when $|a|, |b| < \frac{1}{6}$, so each slot is a positive multiple of T_{tot} and obeys the WEC; and $\mathscr{E}(aT_{\mathrm{tot}}) = a\,\mathscr{E}(T_{\mathrm{tot}})$.

par *Non-claim.* The plan's ``interior of the Minkowski sum" needs a topology on V in which the cones have interior; the algebraic form (e) avoids this, and continuity of ℓ is not needed (PC-30). Nothing here makes a slot a species. Check C-Big05-54. par

Theorem (Observation-kernel criterion and measurement dimension; plan items #3, #5). *Let $\mathscr{F} = \sigma_0 + W$ be an affine fibre over a real vector space W, let $\mathscr{O} : \mathscr{F} \to \mathscr{Y}$ be an observation map and $F : \mathscr{F} \to Z$ a target.*

• F is identifiable from $\mathscr{O}$ iff F is constant on every fibre of $\mathscr{O}$.

• If $\mathscr{O}(\sigma_0 + w) = \mathscr{O}(\sigma_0) + O_L w$ and $F(\sigma_0 + w) = F(\sigma_0) + F_L w$ are affine, F is identifiable iff $\ker O_L \subseteq \ker F_L$*; then $F_L = A \circ O_L$ for a linear A on $O_L(W)$.*

• If $O_L : W \to \mathbb{R}^N$ and F_L has finite rank q, identification needs $\operatorname{rank} O_L \geq q$*, so at least q independent observations; q suffice (for example $\mathscr{O} = F$). Fewer than r observations fail for a target of rank r, but not for every target on an r-dimensional fibre: a rank-one target is identified by one observation however large* $\dim W$ *is.*

• If $W_r \subseteq W$ has dimension r and $F_L|_{W_r}$ has rank r, then no system with $N < r$ identifies F ($\ker O_L \cap W_r \neq 0$*). For $F_L : W_r \to \mathbb{R}^q$ this rank condition holds for an open dense set of linear maps iff $q \geq r$.*

Proof. (a) Lemma . (b) Fibres of $\mathscr{O}$ are the cosets of $\ker O_L$; F is constant on them iff F_L kills $\ker O_L$; then $A(O_L w) := F_L w$ is well defined and linear. (c) From (b), $q = \operatorname{rank} F_L \leq \operatorname{rank} O_L \leq N$. For a rank-one $F = \ell$, the system $\mathscr{O} = \ell$ has $\ker O_L = \ker F_L$. (d) $\dim \ker O_L|_{W_r} \geq r - N > 0$, and a nonzero w in it has $F_L w \neq 0$ by injectivity; maximal rank r is open and dense among $q \times r$ matrices iff $q \geq r$, and impossible if $q < r$.

par *Non-claim.* This is the experimental-design form of the fibre criterion: what an added experiment must separate. It names no experiment (PC-31). Check C-Big05-55. par

Corollary (Three slots, one sum; plan item #5). *Let $K = 3$, u, w and $\mathscr{E}$ be as in Definition , and $F(\sigma) = (\mathscr{E}(T_{\mathrm{b}}), \mathscr{E}(T_{\mathrm{dm}}), \mathscr{E}(T_\Lambda))$. Then F_L has rank exactly two on W_3; observing T_{tot}, or any split-insensitive quantity, identifies no nonconstant target; one scalar observation never identifies F; the two split-sensitive observations $\mathscr{E}(T_{\mathrm{b}}), \mathscr{E}(T_{\mathrm{dm}})$ identify F and the ratio $\mathscr{R}$ wherever $\mathscr{E}(T_{\mathrm{b}}) > 0$; no finite system identifies σ itself on a chart U_p of Theorem (b).*

Proof. $F_L(S_1, S_2, -S_1 - S_2) = (\mathscr{E}(S_1), \mathscr{E}(S_2), -\mathscr{E}(S_1) - \mathscr{E}(S_2))$, and $\mathscr{E}(g) = -1$, so the image is the plane $\{y_1 + y_2 + y_3 = 0\}$. A split-insensitive observation has $O_L = 0$. Given $\mathscr{E}(T_{\mathrm{tot}})$, the pair determines $\mathscr{E}(T_\Lambda)$ and $\mathscr{R} = (\mathscr{E}(T_{\mathrm{tot}}) - \mathscr{E}(T_{\mathrm{b}}))/\mathscr{E}(T_{\mathrm{b}})$. The last statement is Theorem (c) with rank $= \infty$.

par *Non-claim.* The two observations are split-coupled by construction; nothing says such detectors exist. Check C-Big05-55. par

Theorem (Two-point lower bounds under noisy observation; plan item #6). *Let two accounts σ_0, σ_1 induce*

observation laws P_0, P_1 *on a measurable space with* $\mathrm{TV}(P_0, P_1) \le \delta$.

• *If* $|F(\sigma_1) - F(\sigma_0)| = \Delta$, *every randomized estimator satisfies* $\max_i \mathbb{E}_i|\widehat{F} - F(\sigma_i)| \ge \frac{\Delta}{2}(1-\delta)$.

• *For a binary target with* $H_0 \ne H_1$, $\inf_{\widehat{H}} \max_i P_i(\widehat{H} \ne H_i) \ge \frac{1}{2}(1 - \mathrm{TV}(P_0, P_1))$.

• *Both bounds are sharp: for* $P_0 = \mathrm{Bern}(\frac{1-\delta}{2})$, $P_1 = \mathrm{Bern}(\frac{1+\delta}{2})$ *(so* TV $= \delta$*) the plug-in rules attain them.*

• *If the two accounts lie on one split fibre and the observations are split-independent, then* $\delta = 0$ *and (a), (b) give* $\Delta/2$ *and* $\frac{1}{2}$.

Proof. Let $\mu = P_0 + P_1$, $p_i = \mathrm{d}P_i/\mathrm{d}\mu$; then $\int \min(p_0, p_1)\,\mathrm{d}\mu = 1 - \mathrm{TV}$. (a) With $e_i(z) = \mathbb{E}[|\widehat{F} - F(\sigma_i)| \mid z]$, $e_0 + e_1 \ge \Delta$ pointwise, so $\max_i \mathbb{E}_i e_i \ge \frac{1}{2}\int (p_0 e_0 + p_1 e_1) \ge \frac{1}{2}\int \min(p_0, p_1)(e_0 + e_1) \ge \frac{\Delta}{2}(1 - \mathrm{TV})$. (b) Same with $e_0 + e_1 = 1$ for the error indicators. (c) The rule ``report the outcome'' (scaled by Δ) has errors $\Delta\frac{1-\delta}{2}$ and $\frac{1-\delta}{2}$ under both laws. (d) The laws coincide (Proposition).

par *Non-claim.* This sharpens Proposition by the binary form and sharpness (PC-33); approximate indistinguishability of laws is an assumption about a declared experiment, not a property of the hosts. Check C-Big05-56. par

The central theorem: geometric observables are split-blind

The results of this sheet are instances of one statement, made precise here (user request t323u, recommended flagship). The later sections supply its corollaries on specific hosts.

Definition (Geometric observation contracts). Fix a split account space as in Definition . A *geometric contract* is a set $\mathscr{C}$ of declarations chosen without reference to σ: observer fields or worldlines, clocks and their normalizations, image branches, reference metrics and endpoint identifications, boundary and initial data, domains, orderings and norms, calibration dictionaries, and declared finite generators and probes. A *geometric observable* is a map $J(x) = \widehat{J}(g, \Lambda, \chi, \Delta, \mathscr{C})$ for some $\widehat{J}$, possibly random, meaning that its law is a function of these arguments; it may use the metric and any finite or infinite set of its derivatives at any events, hence also $T_{\mathrm{tot}} = \chi^{-1}(G + \Lambda g)$. An observation is *split-coupled* if its law depends on σ through its response law; a *constitutive law* is a declared subset $\mathscr{L} \subseteq \mathscr{S}_K$ to which accounts are restricted.

Theorem (Geometric observables cannot identify a source decomposition). *Fix* g, *declared* Λ, $\chi \ne 0$, Δ *and a geometric contract* $\mathscr{C}$ *on a connected open* U.

• *Every geometric observable, every finite or infinite family of them, and the transcript law of every adaptive protocol whose rules and outcome laws are geometric observables, is constant on the compatible split fibre* $\mathscr{S}_K(g, \Lambda, \chi; U)$.

• *Consequently a target* F *of the split is identifiable from such data iff* F *is constant on the fibre. Every target that varies on the fibre is unidentifiable, with the minimax risks of Theorem and Theorem (d), however many geometric observables are added.*

• *Ordinary/dark/vacuum attribution (any target varying on the fibre, in particular those of Theorem) is identifiable only if either an added observation is split-coupled and separates the fibre in the sense of Theorem , or a constitutive law* $\mathscr{L}$ *is declared on whose intersection with the fibre the target is constant.*

• *Both supplies suffice in examples: the constitutive law* $\mathscr{L}_\beta = \{(\mathrm{beta}T_{\mathrm{tot}}, (1-\beta)T_{\mathrm{tot}}, 0)\}$ *with declared* $\beta \in [0, 1]$ *leaves one split; the split-coupled pair of Corollary identifies the averaged energies and* $\mathscr{R}$.

Proof. (a) The arguments of $\widehat{J}$ are the same at all points of the fibre; for adaptive protocols, induction on depth as in Proposition . (b) Theorem (a) applied to the joint data map, and Theorem (b),(c), Theorem (d) for the risks. (c) If neither supply is present, the data are geometric and (b) applies; a constitutive law changes the account space to $\mathscr{L} \cap \mathscr{S}_K$, and (b) applies to the restricted fibre. (d) $\mathscr{L}_\beta \cap \mathscr{S}_3$ is a single point since T_{tot} is conserved; Corollary .

par *Non-claim.* Part (a) is a consequence of the definitions, and its content is the scope: the list in Definition is what counts as geometric, and T_{tot} is geometric. No split-coupled detector and no constitutive law is supplied or derived here; the hypothesis of Section is neither proved nor refuted (PC-44). Check C-Big05-57. par

Corollary (Curvature-scalar blindness). *Every scalar curvature invariant (R, $R_{ab}R^{ab}$, $\mathcal{K}$, $\mathscr{C}^2$, every polynomial in the curvature and its covariant derivatives) and every functional of the jets of g at finitely many events is constant on split fibres. On the hosts of Theorems , , and , where $T_{\mathrm{tot}} \equiv 0$, none of them decides energy dominance, norm suppression, the ratio predicate, s or $\mathscr{R}$.*

Proof. They are geometric observables; Theorem (b) and Theorem (b)–(e).

par *Non-claim.* Curvature scalars do decide metric labels (H-geom), e.g. $\mathscr{C}^2$ gives m on Kottler hosts; that is not split attribution. Check C-Big05-57. par

Corollary (Lensing and radar blindness). *The finite-distance angles, the bending angle α_{fin}, the radar interval τ_{rad} and the radar comparison $\Delta\tau$ of Theorems , , and Corollary , for every declared optical contract, are constant on split fibres; so are their calibrated versions.*

Proof. Every ingredient is in Definition ; Theorem (a).

par *Non-claim.* Optical readings decide (m, Λ) under calibration (Theorem); they never decide a split. Check C-Big05-57. par

Corollary (Orbital and tidal blindness). *Kepler readings, circular-orbit data and their stability (Proposition , Theorem), tidal eigenvalues for every declared observer, the dominance functions $\mathscr{D}_{\mathrm{M}}$, $\mathscr{D}_{\mathrm{K}}$ (Theorems ,), perihelion advances (Theorem) and halo crossover radii (Corollary) are constant on split fibres.*

Proof. Theorem (a).

par *Non-claim.* The readings are observer- and contract-dependent (Theorem); contract dependence is not split dependence. Check C-Big05-57. par

Corollary (Minimax lower bounds for split-dependent targets). *On a fibre where $T_{\mathrm{tot}} \equiv 0$ on a compact K, with any geometric data: the minimax absolute risk is $\frac{1}{2}$ for $s \in [0,1]$ and for each of the three indicators of Definition (under the hypotheses of Theorem (b)–(d)), and 1 for deterministic Boolean rules (Proposition); it is infinite for $\mathscr{R}$ and for every affine target whose linear part is nonzero on W_3. If added split-coupled data give any two accounts of the fibre laws within total variation δ, the finite bounds remain valid multiplied by $1 - \delta$.*

Proof. Theorem gives the ranges $[0,1]$, $\{0,1\}$ and $[0,\infty)$; Theorem (b),(c); an affine map with nonzero linear part is unbounded on a line of W_3; Theorem (a),(b).

par *Non-claim.* The bounds are worst-case over a fibre, not probabilities over cosmologies. Check C-Big05-57. par

The vacuum fibre, FLRW ranks and linear supply

For a smooth metric define

$$E^{(1)}_{ab} = 2RR_{ab} - \tfrac{1}{2}R^2 g_{ab} + 2g_{ab}\mathrm{Box}\,R - 2\nabla_a\nabla_b R,$$
$$E^{(2)}_{ab} = 2R_{acbd}R^{cd} - \tfrac{1}{2}g_{ab}R_{cd}R^{cd} + \mathrm{Box}\,R_{ab} + \tfrac{1}{2}g_{ab}\mathrm{Box}\,R - \nabla_a\nabla_b R,$$

the Euler tensors of the densities R^2 and $R_{ab}R^{ab}$ in the conventions of Section (from v0; these formulas fix the signs used here).

Lemma (Conservation and Einstein-region reduction; from v0). *The tensors $g, G, E^{(1)}, E^{(2)}$ are symmetric and conserved. On a connected four-dimensional region with $\mathrm{Ric} = \frac{R}{4}g$, R is constant, $G = -\frac{R}{4}g$ and $E^{(1)} = E^{(2)} = 0$. Hence for conserved T_0 the family $\mathscr{F}_g = \{T_0 + c_0 g + c_G G + c_1 E^{(1)} + c_2 E^{(2)}\}$ reduces there to $T_0 + \lambda g$, $\lambda = c_0 - \frac{R}{4}c_G$, and λ ranges over $\mathbb{R}$.*

Proof. Euler tensors of diffeomorphism-invariant local densities are conserved (Noether identity: the variation

along $\mathscr{L}_\xi g$ with compactly supported ξ vanishes, and integration by parts gives $\nabla^a E_{ab} = 0$); conservation of the displayed formulas is checked directly on generic FLRW and generic static spherical metrics (C-Big05-12). On an Einstein region the contracted Bianchi identity gives $\frac{1}{4}\nabla R = \frac{1}{2}\nabla R$, so R is constant; the derivative terms vanish, and the algebraic terms cancel because $R_{acbd}g^{cd} = R_{ab}$ and $R_{cd}R^{cd} = R^2/4$.

par *Non-claim.* This parallels the Einstein-region records [VC-OB-1-CERT], [VC-OB-1-CERT] and [DS-OB-1-fibre] (source record; not a premise). It is not the renormalization ambiguity of any quantum theory. par

Corollary (Vacuum-coordinate non-identification; from v0). *On a split-blind family $\mathscr{F}_g$ over a fixed Einstein region, no function of the metric recovers λ; the unrestricted minimax error is infinite, and all null contractions $X(k,k)$ agree with $T_0(k,k)$.*

Proof. Lemma , Proposition and $g(k,k) = 0$.

par *Non-claim.* At fixed (g, Λ, χ) the compatible total is unique (Theorem); the vacuum coordinate is a split or label freedom, not a freedom of the total. par

Theorem (FLRW invisible direction and attained ranks $1, 2, 3$; from v0). *Let $L_g(c) = c_0 g + c_G G + c_1 E^{(1)} + c_2 E^{(2)}$, and let its effective rank be the dimension of its image as a space of tensor fields on the whole region.*

• *On every conformally flat region $E^{(2)} = \frac{1}{3}E^{(1)}$, so $(0, 0, -\frac{1}{3}, 1) \in \ker L_g$ and the rank is at most three; flat-slicing FLRW regions are conformally flat.*

• *On a de Sitter region the rank is one, with kernel $\{c_0 - \frac{R}{4}c_G = 0\}$.*

• *With $c = 1$, $a = t^{1/2}$ on any open interval of $t > 0$ has rank two.*

• *With $c = 1$, $a = t^p$, $p > 0$, $p \neq \frac{1}{2}$, has rank three, with $E^{(1)}_{tt} = -54p^2(2p-1)t^{-4}$.*

Proof. (a) In four dimensions $C_{abcd}C^{abcd} = \mathscr{G} + 2R_{ab}R^{ab} - \frac{2}{3}R^2$ with $\mathscr{G}$ the Gauss–Bonnet density, whose Euler tensor vanishes in four dimensions. The first variation of C^2 is linear in the background Weyl tensor, so it vanishes at conformally flat metrics; taking Euler tensors gives $0 = 2E^{(2)} - \frac{2}{3}E^{(1)}$. (b) Lemma . (c),(d) With $a = t^p$: $R = 6p(2p-1)t^{-2}$, $G_{tt} = 3p^2t^{-2}$, and substitution gives $E^{(1)}_{tt}$ as stated (C-Big05-13). For $p = \frac{1}{2}$, $R = 0$, so $E^{(1)} = 0$ and $E^{(2)} = \frac{1}{3}E^{(1)} = 0$, while $g_{tt} = -1$ and $G_{tt} = \frac{3}{4}t^{-2}$ are independent. For $p \neq \frac{1}{2}$ the tt components of $g, G, E^{(1)}$ are non-zero multiples of $1, t^{-2}, t^{-4}$, independent on every interval; (a) gives the upper bound.

par *Non-claim.* Ranks are ranks of tensor fields on intervals; at one event an isotropic tensor has two components. A rank fixes no coefficient. The plan's ``effective ranks 1/2/3" omits the bound four for arbitrary metrics, attained and generic in [DS-OB-1-fibre], [DS-OB-1-fibre] (source record; not a premise; PC-7); (d) adds the power-law family to that table. par

Proposition (Necessary and sufficient linear supply; from v0). *Let $L : \mathbb{R}^n \to V$ be linear of rank r and let the only additional data be Ac, $A : \mathbb{R}^n \to \mathbb{R}^k$ linear. Then Lc is identified from Ac for all c iff $\ker A \subseteq \ker L$; at least r independent readings are necessary and r suitable ones suffice.*

Proof. $Ac = Ac'$ implies $Lc = Lc'$ for all pairs iff $\ker A \subseteq \ker L$; then $n - \operatorname{rank} A \leq n - r$. Coordinates on $\operatorname{im} L$ composed with L give sufficiency.

par *Non-claim.* The readings are supplied, not furnished by the metric. On an Einstein region one exact reading, e.g. $\lambda = \frac{1}{4}g^{ab}(X - T_0)_{ab}$, suffices; supplying it is not deriving it. par

Proposition (An explicit rank-four metric; from the v2 draft). *With $c = 1$, on $\Omega_\star = (-\frac{1}{4}, \frac{5}{4}) \times (\frac{1}{2}, \frac{3}{2}) \times \mathbb{R}^2$ the analytic metric*

$$g_\star = -\,\mathrm{d}t^2 + (1 + tx)\,\mathrm{d}x^2 + \mathrm{d}y^2 + \mathrm{d}z^2$$

has effective rank four. With $A = 1 + tx$ ($\geq \frac{5}{8}$ *on* $\Omega_\star$), $R = -x^2/(2A^2)$, $\operatorname{Box} R = (5x^4A - 2 + 5tx)/(2A^5)$, *and the only nonzero components of G are* $G_{yy} = G_{zz} = x^2/(4A^2)$. *The components* $(tt), (tx), (yy)$ *at* $p_0 = (0, 1, 0, 0)$ *and* (yy) *at* $p_1 = (1, 1, 0, 0)$ *of* $g, G, E^{(1)}, E^{(2)}$ *form the matrix*

$$M_\star = \begin{pmatrix} -1 & 0 & 23/8 & 23/16 \\ 0 & 0 & -7 & -7/2 \\ 1 & 1/4 & 23/8 & 11/16 \\ 1 & 1/16 & 51/128 & 25/256 \end{pmatrix}, \qquad \det M_\star = -\frac{77}{512} \neq 0.$$

Proof. The metric is a product of the Lorentzian surface $-\mathrm{d}t^2 + A\,\mathrm{d}x^2$ with a flat plane. Its nonzero Christoffel symbols are $\Gamma^t_{xx} = x/2$, $\Gamma^x_{tx} = x/(2A)$, $\Gamma^x_{xx} = t/(2A)$; exact differentiation of the rational components gives R, $\operatorname{Box} R$, G and the entries of $M_\star$ (C-Big05-36). A relation $ug_\star + vG + wE^{(1)} + sE^{(2)} = 0$ with constant coefficients would give $M_\star(u, v, w, s)^{\mathrm{T}} = 0$, so $u = v = w = s = 0$.

par *Non-claim.* This is an independent calculation, not a transfer of [DS-OB-1-fibre] (source record; not a premise), which uses the same metric on $\{0 < t < 2,\ 0 < x < 2\} \times \mathbb{R}^2$ with another evaluation pattern; that pattern reproduces the determinant 27621/6588344 printed there (C-Big05-36). A rank fixes no coefficient. par

Theorem (Rank four is generic and is not selection). *Let* $\Omega \subset \mathbb{R}^4$ *be a nonempty connected open coordinate region and give Lorentzian* C^k *metrics,* $4 \leq k \leq \infty$, *the compact-open* C^k *topology. Let* L_g *be as in Theorem .*

- *Effective rank four is open in the* C^4 *topology and dense in each of these* C^k *spaces; it is attained by* $g_\star$ *(Proposition).*
- *For every rank-four metric and every declared* Λ *and* $\chi \neq 0$, T_{tot} *is not of the form* φg *on* Ω *for any locally integrable* φ. *In particular* $T_{\mathrm{tot}} \equiv 0$, *and there is a point p at which every compatible split has a piece that is not of vacuum type; the vacuum-type rigidity of Theorem (c) therefore fails on every rank-four host.*
- *On every rank-four metric, for every compact K on which* $T_{\mathrm{tot}} \equiv 0$, *the split fibre* $\{\sigma_s\}$ *of Theorem contains splits that are and splits that are not norm-suppressed at each level* ε. *Energy dominance and the ratio predicate take both values on the fibre wherever* $\rho_{\mathrm{tot}} > 0$, *respectively* $\mathscr{E}(T_{\mathrm{tot}}) > 0$. *There are nonempty* C^4*-open families of rank-four metrics on compact cylinders on which* T_{tot} *obeys the WEC with strictly positive observer energy density, so all three targets are non-selected there, with every piece obeying the WEC.*
- *Rank is not selection: the effective rank and every evaluation matrix are functions of g alone, hence constant on split fibres, and no rank datum identifies s,* $\mathscr{R}$ *or any dominance predicate.*

Proof. (a) Four continuous tensor sections are linearly independent iff some four component evaluations, at finitely many events, form an invertible matrix: otherwise all evaluation vectors lie in a hyperplane and its normal is a nonzero kernel vector. The entries are continuous in the metric four-jets at those events, so rank four is C^4 -open. For density, fix two distinct events q_0, q_1 and the evaluation pattern of Proposition . The determinant is a rational function of the four-jets at q_0, q_1 whose denominators are powers of the metric determinants; its numerator is a polynomial in the jet coordinates, and it is not the zero polynomial, since jets at distinct events are independent and the jets of $g_\star$ at p_0, p_1, placed at q_0, q_1, make it nonzero. Its zero set therefore has empty interior. Add to a given metric degree-four polynomials times smooth cut-offs supported in disjoint small balls around q_0, q_1; jets can be changed by arbitrarily small amounts in any finite C^k seminorm, signature is kept by a small C^0 change, and a basic C^∞ neighbourhood controls finitely many seminorms. (b) If $T_{\mathrm{tot}} = \varphi g$, then $\nabla^a T_{\mathrm{tot}ab} = 0$ and Lemma (c) make φ constant, so $G = (\chi\varphi - \Lambda)g$: the metric is Einstein, $E^{(1)} = E^{(2)} = 0$ and G is a multiple of g (Lemma), so the rank is at most one. Hence $T_{\mathrm{tot}}(p) \notin \mathbb{R}g(p)$ at some p; if all three pieces were multiples of g at p, so would be their sum. (c) The first sentence is Theorem (b), which needs only $T_{\mathrm{tot}} \equiv 0$ on K; the second is Theorem (c),(d). For the

families, take a compact cylinder in $t > 0$ and the dust metric $g_{\mathrm{d}} = -\mathrm{d}t^2 + t^{4/3}\,\mathrm{d}\mathbf{x}^2$ with $\Lambda = 0$, $\chi > 0$, for which $T_{\mathrm{tot}} = \frac{4}{3\chi t^2}\,\mathrm{d}t^2$ (Example). For $e_0 + v$, $|v| \le 1$, in its orthonormal frame, $T_{\mathrm{tot}}(e_0 + v, e_0 + v) = \frac{4}{3\chi t^2}$, bounded below on the cylinder. Since T_{tot} depends continuously on two-jets and the normalized causal directions form a compact set, a C^2-neighbourhood keeps the WEC with a positive lower bound; by (a) it contains rank-four metrics, and the intersection of the two open conditions is C^4-open. Every piece of σ_s, $s \in [0,1]$, then obeys the WEC (Theorem (a)). (d) The fibre varies only σ; Lemma .

par *Non-claim.* Rank four counts independent curvature directions; it supplies no point of a split fibre and no curvature coefficient (parallel [DS-OB-1-fibre], [DS-OB-1-fibre], source record; not a premise). The compensation sign of [DS-OB-1-fibre] (source record; not a premise) concerns a change of the declared Λ ($T \mapsto T - cg$ with $\Lambda \mapsto \Lambda - \chi c$); at fixed declared Λ it is not a fibre direction (PC-25). Lower regularity is treated separately in Appendix . Checks C-Big05-36, C-Big05-37. par

Proposition (A radiation prefix with a curved tail has rank three; from the v2 draft). *With $c = 1$ let $g = -\mathrm{d}t^2 + a(t)^2\,\mathrm{d}\mathbf{x}^2$ on $(t_1, t_2) \times \mathbb{R}^3$, smooth, with $R \equiv 0$ and $\dot{a} \equiv 0$ on a subinterval (t_1, t_3) and $R \equiv 0$ on (t_1, t_2) (for instance a radiation prefix followed by a positive-rate de Sitter tail). Then the effective rank is exactly three.*

Proof. By Theorem (a) the rank is at most three and a relation reduces to $ug + vG + wE^{(1)} = 0$. On the prefix $R = \frac{3}{a^2}(a^2)^{\cdot\cdot} = 0$ forces $E^{(1)} = 0$ and $a^2 = \alpha(t - t_0)$ with $\alpha \neq 0$ (as $\dot{a} \equiv 0$), and $g_{tt} = -1$, $G_{tt} = 3H^2$ with $H = 1/(2(t - t_0))$ there, so $u = v = 0$. The trace of $E^{(1)}$ is $6\Box R$, and for functions of t, $\Box R = -a^{-3}(a^3\dot{R})^{\cdot}$. If $w \neq 0$ then $a^3\dot{R}$ is constant, equal to its prefix value 0, so R is constant, equal to 0: a contradiction. Hence $w = 0$.

par *Non-claim.* The rank is of tensor fields on the whole interval; on the prefix alone it is two (Theorem (c)). No junction law or field equation is used. Check C-Big05-37. par

Curvature directions against source splits (t323u, Package B)

Theorem (Rank does not identify a split; plan item #7). *Fix $g, \Lambda, \chi \neq 0$, U, and let L_g be as in Theorem . Consider the effective-gravity accounts $\mathscr{A}_g = \{(c, \sigma) : c \in \mathbb{R}^4,\ \sigma \in \mathscr{S}_3(T_c)\}$, where $T_c = \chi^{-1}(G + \Lambda g + L_g(c))$ and $\mathscr{S}_3(T)$ is the set of conserved three-slot splits of T.*

• $(c, \sigma) \mapsto (c, \sigma - (T_c, 0, 0))$ is a bijection $\mathscr{A}_g \to \mathbb{R}^4 \times W_3$: coefficients and split directions are independent coordinates, and the split-direction space $W_3 \cong V^2$ contains $(\operatorname{im} L_g)^2$, of dimension $2\operatorname{rank} L_g$.

• From $D(c, \sigma) = (g, \Lambda, \chi, T_c)$, c is identifiable iff $\operatorname{rank} L_g = 4$, and no target varying on W_3 is identifiable, for every rank.

• From $D'(c, \sigma) = (g, \Lambda, \chi, T_c, \sigma)$ the split is identified and c is identifiable iff $\operatorname{rank} L_g = 4$. Hence all four combinations of (coefficient identified or not)×(split identified or not) occur: rank four with D; rank ≤ 3 with D; rank four with D'; rank ≤ 3 with D'.

• In particular $\operatorname{rank} L_g = r \Rightarrow \dim \mathscr{S}_3 = 0$; raising the rank enlarges, never shrinks, the split fibre.

Proof. $L_g(c)$ is conserved (Lemma), so T_c is conserved and $\mathscr{S}_3(T_c) = (T_c, 0, 0) + W_3$ with W_3 independent of c (Theorem (a)): (a); $\operatorname{im} L_g \subseteq V$ gives the dimension. (b) T_c determines $L_g(c)$, hence c iff L_g is injective; at fixed c the data are constant on W_3. (c) σ is part of D' and T_c is its sum. The ranks four and ≤ 3 occur (Proposition , Theorem). (d) From (a).

par *Non-claim.* Coefficient identification and split identification are separate inverse problems; the effective-gravity accounts are a device, not a proposed field equation, and no coefficient value is admitted ([DS-OB-1-fibre], source record; not a premise; PC-34). Check C-Big05-58. par

Theorem (Jet-generic rank four; plan item #8). *Let $\Omega \subseteq \mathbb{R}^4$ be a connected open set.*

• *The components of* $g, G, E^{(1)}, E^{(2)}$ *at an event p are rational functions of the four-jet* $j^4_p g$ *(of order* $0, 2, 4, 4$ *respectively), with denominators powers of* $\det g(p)$*. Four-jets are the minimal order:* $E^{(1)}$ *contains* $\nabla_a \nabla_b R$*.*

• *At one event q, let* $M(q)$ *be the* 10×4 *matrix of the ten components of the four tensors. If* L_g *has rank* ≤ 3 *on* Ω*, all* $\frac{10}{4} = 210$ *minors of* $M(q)$ *vanish at every event. After multiplication by a power of* $\det g(q)$ *they are polynomials* P_α *in the jet coordinates* $j^4_q g$*, and they do not all vanish identically: for* $g_1 = -\mathrm{d}t^2 + (1+tx)\,\mathrm{d}x^2 + (1+ty)\,\mathrm{d}y^2 + (1+xy)\,\mathrm{d}z^2$*,* $M(q_1)$ *has rank four at* $q_1 = (\frac{1}{3}, \frac{1}{2}, \frac{1}{5}, 0)$*.*

• *Hence a rank-deficient metric has, at every event q, its four-jet in* $Z_q = \{P_\alpha = 0\ \forall \alpha\}$*, a proper real algebraic subset of the four-jet space at q, of codimension at least one. The same holds at two events with the* $\frac{20}{4} = 4845$ *minors of the stacked matrix* $M(q_0, q_1)$*. The set of* C^k *Lorentzian metrics of rank four is open and dense in the compact-open* C^k *topology for every* $4 \le k \le \infty$*; the dense set may be taken to have pointwise rank four at a prescribed event.*

• *{[}Open.{]} Sharper codimension bounds for the rank-* ≤ 3 *locus are not decided here. The pointwise rank can be lower than the effective rank: for* $g_\star$ *it is three at the events checked, while the effective rank is four.*

Proof. (a) Christoffel symbols are rational in $j^1 g$, curvature in $j^2 g$, and $E^{(1)}$, $E^{(2)}$ contain second covariant derivatives of curvature. (b) A nontrivial constant relation $\sum c_i T_i = 0$ gives $M(q)c = 0$, so the rank of $M(q)$ is at most three; for g_1 the rank at q_1 is computed exactly from the four-jet (C-Big05-59), and the components at q depend only on $j^4_q g$ by (a). (c) A nonzero polynomial does not vanish on an open set; a proper algebraic subset of $\mathbb{R}^N$ has dimension at most $N-1$. For the two-event form, the minor formed by the rows of Proposition at the jets of $g_\star$ is $-\frac{77}{512} \neq 0$. Openness is Theorem (a); for density add to a given metric ε times a cut-off times the polynomial $j^4_{q_1} g_1 - j^4_q g$ translated to q: the minors are polynomial in ε and nonzero at $\varepsilon = 1$ after the jets are matched, hence nonzero for all but finitely many ε, in particular for arbitrarily small ε (with the signature kept for small ε). (d) The pointwise ranks are computed in C-Big05-59.

par *Non-claim.* This sharpens Theorem (a) to a finite-jet statement; it is not a transversality theorem in the sense of Thom, and [DS-OB-1-fibre] (source record; not a premise) is a source record, not a premise (PC-35). Check C-Big05-59. par

Proposition (Einstein-region collapse; plan item #9). *On a connected four-dimensional region with* $\mathrm{Ric} = \frac{R}{4} g$*: R is constant,* $G = -\frac{R}{4} g$*,* $E^{(1)} = E^{(2)} = 0$*, so* $\operatorname{im} L_g = \mathbb{R} g$*,* $\operatorname{rank} L_g = 1$ *exactly, and* $\ker L_g = \{c : c_0 - \frac{R}{4} c_G = 0\}$ *has dimension three. This holds for every value of R, including* $R = 0$*, and needs neither conformal flatness nor an assumption that R is constant. No measurement depending only on* $L_g(c)$ *distinguishes c within a coset of* $\ker L_g$*; readings built from the Weyl tensor (for instance the tides of Theorem on the Einstein hosts* $K_{m,\Lambda}$*) are not of this kind and do depend on m.*

Proof. Lemma ; $g \neq 0$, so the rank is one; the kernel is the solution set of one nontrivial linear equation in $\mathbb{R}^4$. Kottler hosts are Einstein (Theorem (a)) with Weyl part $48m^2/r^6$.

par *Non-claim.* In dimension $n \neq 4$, $E^{(1)}$ and $E^{(2)}$ are nonzero multiples of g on Einstein regions with $R \neq 0$; the rank is still one. The plan's ``rank one unless the coefficients vanish'' does not arise, since g itself is a direction (PC-36). Check C-Big05-60. par

Blind experiments, external coordinates and epochs

Proposition (Adaptive blindness and a robust two-point bound; from v0). *For a finite-depth adaptive experiment on two accounts with equal initial data laws, equal decision rules at every common history, and equal conditional laws of the next outcome (failures and stops included), the complete transcript laws, and the law of*

any estimator, coincide. If instead the transcript laws satisfy $\mathrm{TV}(P_0, P_1) \le \delta$ *and the targets differ by* Δ*, every randomized estimator has* $\max_i \mathbb{E}_i|\hat{\tau} - \tau_i| \ge \frac{\Delta}{2}(1-\delta)$.

Proof. Induction on depth gives equal history laws. For the bound, the common part of P_0, P_1 has mass $1 - \mathrm{TV}$, and $|\hat{\tau} - \tau_0| + |\hat{\tau} - \tau_1| \ge \Delta$ pointwise.

par *Non-claim.* The hypotheses concern complete joint laws; a split-sensitive experiment need not satisfy them. Parallel: [Big04-A-coeff] (source record; not a premise). par

Proposition (Independent external coordinates; from v0). *If accounts have product coordinates* (d, q, v)*, with* $q > 0$ *a formal label coefficient and v a vacuum coordinate, then on a non-trivial product fibre neither is identified from d, and refining the data to* (d, q) *does not identify v.*

Proof. At fixed (d, q) two values of v share the data; Lemma .

par *Non-claim.* Big01-A's labels depend on the coefficient q in the slot of $\hbar$ as $T_{\mathrm{GH}}^{(q)} = qH/(2\pi k_B)$ and $S_{\mathrm{GH}}^{(q)} = \pi k_B c^5/(qGH^2)$ ([Big01-A], [Big01-A], source record; not a premise); q is not the coupling χ, and no value of q is admitted. Unit covariance fixes exponents, not normalizations; parallel [Big04-A-coeff] (source record; not a premise). par

Theorem (Two-epoch horizon fibre without split selection; from v0). *Fix* $H_{\mathrm{E}} > 0$, $a_* > 0$, $\tau > 0$, *and a smooth non-decreasing* η *with* $\eta = 0$ *on* $t \le 0$, $\eta = 1$ *on* $t \ge \tau$, $0 < \eta < 1$ *on* $(0, \tau)$*. Put* $h_K = H_{\mathrm{E}}(1-\eta) + K\eta$ *and* $a_K(t) = a_* \exp \int_0^t h_K$, $K > 0$*. Then:*

- *all members share the past* $a_K(t) = a_* e^{H_{\mathrm{E}} t}$, $t \le 0$*, and have late rate K;*
- $R_*(K) = a_* c \int_0^\infty \mathrm{d}s/a_K(s)$ *is continuous, strictly decreasing, with range* $(0, \infty)$*;*
- *for* $t \le 0$, $R_e^{(K)}(t) = \frac{c}{H_{\mathrm{E}}}(1 - e^{H_{\mathrm{E}} t}) + e^{H_{\mathrm{E}} t} R_*(K)$*;*
- *a fixed past event is visible for one member and beyond the event horizon for another;*
- *every split on the common past can be kept identical across members.*

Proof. (a) is the construction. (b) With $X(t) = \int_0^t \eta > 0$ for $t > 0$, $a_K = a_* \exp\left(H_{\mathrm{E}}(t - X) + KX\right)$, so the integrand is strictly decreasing in K; dominated convergence gives continuity and $R_* \to 0$ as $K \to \infty$; for $t \ge \tau$, $X = t - C_\tau$ with $C_\tau = \tau - X(\tau)$, and the tail equals $c\, e^{-(H_{\mathrm{E}} - K)C_\tau} e^{-K\tau}/K \to \infty$ as Kdownarrow0. (c) Split the horizon integral at 0: $e^{H_{\mathrm{E}} t} c \int_t^0 e^{-H_{\mathrm{E}} s}\, \mathrm{d}s = \frac{c}{H_{\mathrm{E}}}(1 - e^{H_{\mathrm{E}} t})$. (d) A comoving source radius exceeding $c\int_{t_s}^0 \mathrm{d}s/a_K$ by an amount between two values of R_*/a_* is reached by radial null rays for one member and not the other. (e) On $t \le 0$ the metrics, hence T_{tot}, agree.

par *Non-claim.* Parallels [Big01-A], [Big02-A](b),(c) and [nuADaM01-A] (source record; not a premise). No phase transition or dark recombination is claimed to generate the family. par

Corollary (Future-dependent access errors; from the v2 draft). *In Theorem (d) let p be visible for* g_{K_1} *and not for* g_{K_2}*, and declare a finite access model: a d-dimensional code sent from p reaches the central future worldline through the identity channel if* $p \in \bar{J^-}(\gamma)$ *and through the replacement channel* $X \mapsto \mathrm{Tr}(X)\,\tau$ *otherwise. The optimal half-diamond recovery errors are* $\varepsilon_{\min}(p) = 0$ *and* $1 - d^{-2}$ *respectively, and every rule of the common early data (metric on* $t \le 0$*,* T_{tot}*, every split there, and early labels) has worst-case absolute error at least* $\frac{1}{2}(1 - d^{-2})$ *on* $\varepsilon_{\min}(p)$*, attained by the midpoint.*

Proof. The identity channel needs no decoding. Any decoder $\mathscr{D}$ turns a replacement channel into the replacement channel with output $\mathscr{D}(\tau)$; applied to a maximally entangled input Φ it gives $\mathscr{D}(\tau) \otimes I/d$, whose overlap with Φ is d^{-2}, so the half trace distance is at least $1 - d^{-2}$. The output I/d is the uniform average of the d^2 Weyl conjugations, one of which is the identity, so the triangle inequality bounds its half-diamond distance from the identity by $1 - d^{-2}$

. The early data coincide on the two members (Theorem (a),(e)); Lemma and Proposition give the bound and the midpoint.

par *Non-claim.* The access model is a separately declared contract, not a consequence of the geometry. Future-dependent darkness is a causal-access predicate, not a density or a species; it selects no T_{dm}. Parallels [nuADaM01-A], [Big02-A] and [Big04-A] (source record; not a premise). Check C-Big05-46. par

Past geometry does not determine the cosmic future

Theorem varies the future of a de Sitter past through de Sitter futures of rate $K > 0$. Its members with $K > H_{\mathrm{E}}$ have $\dot{H} > 0$ somewhere, so their totals violate the null energy condition, and none of them is free of an event horizon. The next theorem keeps the energy conditions of the effective total, reaches the horizon-free case, and shows that the restriction to smooth, non-analytic futures is necessary. In this subsection $\eta(t) = f(t)/(f(t) + f(1-t))$ with $f(u) = e^{-1/u}$ for $u > 0$ and $f(u) = 0$ otherwise, and $S(t) = \int_0^t \eta$. Then S is C^∞, $S = 0$ on $(-\infty, 0]$, $0 \le S' = \eta \le 1$, and $S(t) = t - \frac{1}{2}$ for $t \ge 1$, because $\eta(t) + \eta(1-t) = 1$ gives $\int_0^1 \eta = \frac{1}{2}$.

Theorem (Past geometry does not determine the future; plan P1). *Fix $H_{\mathrm{E}} > 0$ and $a_* > 0$. Let $\mathscr{F}$ be the set of C^∞ functions $a > 0$ on $\mathbb{R}$ with $a(t) = a_* e^{H_{\mathrm{E}} t}$ for $t \le 0$ and $H = \dot{a}/a > 0$ everywhere, each prescribing the flat host $-c^2\,\mathrm{d}t^2 + a(t)^2\,\mathrm{d}\mathbf{x}^2$. Put $R_*(a) = a_* c \int_0^\infty \mathrm{d}s/a(s) \in (0, \infty]$: the proper radius at $t = 0$ of the event horizon of a comoving observer, and $R_* = \infty$ iff no comoving observer has an event horizon at any time. Declare $\chi > 0$, and $\Lambda = 0$ where a value is needed.*

• *In the comoving orthonormal frame the effective total $\chi^{-1}G$ has $\chi\rho = 3H^2/c^2$ and $\chi p = -(2\dot{H} + 3H^2)/c^2$. It obeys the NEC iff $\dot{H} \le 0$, and then also the WEC; it obeys the DEC iff $-3H^2 \le \dot{H} \le 0$. The NEC part holds for every declared Λ.*

• *NEC bound. If $\dot{H} \le 0$ on $[0, \infty)$, then $R_* \ge c/H_{\mathrm{E}}$, with equality iff $a = a_* e^{H_{\mathrm{E}} t}$ on $\mathbb{R}$. Every future with $R_* < c/H_{\mathrm{E}}$, in particular every member of Theorem with $K > H_{\mathrm{E}}$, violates the NEC at some $t > 0$.*

• *Analytic rigidity. If $a \in \mathscr{F}$ is real analytic on $\mathbb{R}$, then $a = a_* e^{H_{\mathrm{E}} t}$ and $R_* = c/H_{\mathrm{E}}$.*

• *Realization. For $p \in (0, \infty)$ put $H_p = H_{\mathrm{E}}/(1 + H_{\mathrm{E}} S/p)$ and $a_p(t) = a_* \exp \int_0^t H_p$. Then $a_p \in \mathscr{F}$; a_p and $a_* e^{H_{\mathrm{E}} t}$ agree on $t \le 0$ and in every derivative at $t = 0$; $\dot{H}_p = -H_p^2 \eta/p \le 0$, so the NEC and WEC hold, and the DEC holds iff $p \ge \frac{1}{3}$. For $t \ge 1$,*

$$a_p(t) = a_p(1)\Big(\frac{t - \frac{1}{2} + p/H_{\mathrm{E}}}{\frac{1}{2} + p/H_{\mathrm{E}}}\Big)^p, \qquad \frac{\ddot{a}_p}{a_p} = \frac{p(p-1)}{(t - \frac{1}{2} + p/H_{\mathrm{E}})^2}.$$

*$R_*(a_p) = \infty$ iff $p \le 1$. On $(1, \infty)$, $p \mapsto R_*(a_p)$ is continuous and strictly decreasing, with limit ∞ as p*downarrow *1 and c/H_{E} as $p \to \infty$.*

• *Hence $\{R_*(a) : a \in \mathscr{F},\ \dot{H} \le 0\} = [c/H_{\mathrm{E}}, \infty]$, and every value is attained by a future that agrees with the de Sitter past to all orders at $t = 0$. Apart from $a_* e^{H_{\mathrm{E}} t}$, none of these futures is analytic.*

• *Non-determination. Let Φ be any rule of the metric on $t \le 0$ (which fixes every jet at $t = 0$, the curvature there and every split there). Over the NEC futures in $\mathscr{F}$, the worst-case error of Φ for R_* is infinite. For the predicate ``a comoving event horizon exists'' it is $\frac{1}{2}$ under absolute loss or randomized decisions, and 1 for deterministic Boolean rules. Over the NEC futures with $R_* \in [R_-, R_+] \subset [c/H_{\mathrm{E}}, \infty)$, the minimax error is $\frac{1}{2}(R_+ - R_-)$, attained by the midpoint.*

• *Every split on $t \le 0$ can be kept identical across all members, and R_* and the existence of a horizon are functions of g, so they are constant on split fibres.*

Proof. (a) For the flat FLRW metric, $G_{00}^{\wedge\wedge} = 3H^2/c^2$ and $G_{ii}^{\wedge\wedge} = -(2\dot{H} + 3H^2)/c^2$. The NEC for a diagonal isotropic tensor is $\rho + p \geq 0$, here $-2\dot{H}/(\chi c^2) \geq 0$. The WEC adds $\rho \geq 0$. The DEC is $\rho \geq |p|$, i.e. $|2\dot{H} + 3H^2| \leq 3H^2$. A term Λg adds nothing to $T(k,k)$ for null k. (b) $\dot{H} \leq 0$ gives $H \leq H_{\mathrm{E}}$ on $[0,\infty)$, so $a(t) \leq a_* e^{H_{\mathrm{E}} t}$ and $R_* \geq c\int_0^\infty e^{-H_{\mathrm{E}} s}\,\mathrm{d}s = c/H_{\mathrm{E}}$. Equality forces $1/a = e^{-H_{\mathrm{E}} t}/a_*$ almost everywhere, hence everywhere by continuity. The second sentence is the contrapositive; for Theorem , $\dot{h}_K = (K - H_{\mathrm{E}})\dot{\eta}$. (c) $a - a_* e^{H_{\mathrm{E}} t}$ is analytic and vanishes on $(-\infty, 0]$, so it vanishes identically (the identity theorem); this parallels [Big01-A] (source record; not a premise). (d) Every derivative of S is continuous and vanishes on $(-\infty, 0)$, so it vanishes at 0; hence H_p has the jet of the constant H_{E} at 0, and so does a_p of $a_* e^{H_{\mathrm{E}} t}$. Differentiation gives $\dot{H}_p = -(H_{\mathrm{E}}^2/p)\eta/(1 + H_{\mathrm{E}} S/p)^2 = -H_p^2\eta/p$, and the DEC condition $\eta/p \leq 3$ holds for all t iff $p \geq \frac{1}{3}$, because $\max \eta = 1$. For $t \geq 1$, $1 + H_{\mathrm{E}} S/p = (H_{\mathrm{E}}/p)(t - \frac{1}{2} + p/H_{\mathrm{E}})$, so $H_p = p/(t - \frac{1}{2} + p/H_{\mathrm{E}})$, and integration gives the power law. The tail $\int^\infty (t + \mathrm{const})^{-p}\,\mathrm{d}t$ is finite iff $p > 1$. For $t > 0$, $S(t) > 0$, so $H_p(t)$ and $a_p(t)$ are strictly increasing in p, and $1/a_p$ is strictly decreasing. Dominated convergence on $[p_0, \infty)$ with dominator $1/a_{p_0}$, for $p_0 > 1$, gives continuity. Monotone convergence gives the limit $\int_0^\infty 1/a_1 = \infty$ as $p$downarrow 1 and c/H_{E} as $p \to \infty$, since $a_p$uparrow $a_* e^{H_{\mathrm{E}} t}$. (e) (b), (d) and the intermediate value theorem. Non-analyticity follows from (c). (f) All members share the data of Φ. Lemma , Proposition and Proposition then apply to the range $[c/H_{\mathrm{E}}, \infty]$ of (e) and to the two values of the predicate ($p = 2$ and $p = 1$). (g) As in Theorem (e). Theorem (a) gives the constancy. par *Non-claim.* This does not prevent prediction inside a declared dynamical theory or under a continuation restriction: real analyticity (part (c), [Big01-A]) or a declared evolution law such as Hypothesis restores determination. The theorem names the added supply that a forecast of the future horizon needs. It extends [Big01-A] and [Big01-A] (source record; not a premise) by the energy conditions and the horizon-free member. Theorem is kept unchanged. No dynamics is derived. Checks C-Big05-69, C-Big05-70. par

Coefficient labels and clocks against the split

Proposition (The coefficient orbit and the split are independent coordinates). *Fix a host with declared (Λ, χ), a prescribed radiation profile $a_{\mathrm{r}}(t) > 0$, positive dictionary constants U, α, V_c, k_B, c and a formal coefficient $\kappa > 0$, and enlarge accounts to $(g, \Lambda, \chi, \Delta, \sigma; U, \kappa, \alpha)$. Define the labels*

$$T_{\mathrm{r}}(t) = \frac{(U\kappa^3 c^3/\alpha)^{1/4}}{k_B a_{\mathrm{r}}(t)}, \qquad S_{\mathrm{r}}(t) = \frac{4UV_c}{3a_{\mathrm{r}}(t)T_{\mathrm{r}}(t)}.$$

• *The label map depends on (κ, α) only through κ^3/α and on no split coordinate; it is unchanged by $(U, \kappa, \alpha) \mapsto (U, q\kappa, q^3\alpha)$, $q > 0$, and by every change of σ within $\mathscr{I}(g, \Lambda, \chi)$.*

• *The fibres of $(D_{\mathrm{tot}}, T_{\mathrm{r}}, S_{\mathrm{r}})$ are products of a split fibre and a coefficient orbit. Adjoining the labels identifies no split target (the risks of Theorem and Proposition are unchanged), and adjoining a split identifies no point of the orbit.*

• *If U and α are supplied, an exact value of T_{r} gives $\kappa = (k_B a_{\mathrm{r}} T_{\mathrm{r}})^{4/3}\alpha^{1/3}/(cU^{1/3})$. This is calibration by added supply; the calibrated value is still constant on split fibres.*

• *A separately supplied late label $T_{\mathrm{late}} = \kappa K/(2\pi k_B)$, $K > 0$, is split-independent but injective in κ; blindness of does not extend to arbitrary coefficient-dependent metadata.*

Proof. (a) $T_{\mathrm{r}}^4 = U\kappa^3 c^3/(\alpha k_B^4 a_{\mathrm{r}}^4)$ and $S_{\mathrm{r}} \propto (U^3\alpha/\kappa^3)^{1/4}$; no slot of σ occurs. (b) By (a) the joint map is constant on the product of $\{\sigma\} \times \{(U, q\kappa, q^3\alpha)\}$; Lemma applied on each factor. (c) Take fourth powers in . (d) T_{late} is linear in κ. par *Non-claim.* Calibrating κ and declaring a split are both added supplies; neither is a host functional. No value of κ is admitted and no quantum coefficient is admitted ([Big01-A], source record; not a premise). Parallels [Big04-A-coeff], [Big04-A-coeff], [Big04-A-coeff], [Big04-A] and [Big03-A] (source record; not a premise). Check C-Big05-45. par

Proposition (Declared clocks do not select a split). *A declared clock is a worldline γ together with a reading* T *on it that is a function of the metric and of split-independent declarations (a prescribed lapse, observer field, calibration dictionary, or a declared finite generator and probe).*

• *Every clock reading and its rate* $\mathrm{d}T/\mathrm{d}\tau$ *is constant on split fibres; adjoining clock data leaves every split risk of Theorem unchanged.*

• *For every strictly increasing* ψ*, the clock* $\psi \circ T$ *is compatible with the same* $(g, \Lambda, \chi, \sigma)$*; host data do not select the unit or origin of the clock parameter.*

• *For a Hermitian generator* $A = \sum_j a_j P_j$ *and a probe* ρ*, put* $\Lambda_\rho = \{s : (a_j - a_\ell)s \in 2\pi\mathbb{Z} \text{whenever} P_j \rho P_\ell \neq 0\}$*. If* $\rho_k = e^{-iAt_k}\rho e^{iAt_k}$*, the parameters reproducing* ρ_k *form* $t_k + \Lambda_\rho$*; and* $(A, t) \mapsto (A/b, bt)$*,* $b > 0$*, preserves the evolution. The reconstruction returns a class of the external parameter of the declared one-parameter group, in units fixed by A; it neither removes that parameter nor supplies a split.*

Proof. (a) A split-independent function of split-independent data is constant on fibres; Lemma and Proposition . (b) $\psi \circ T$ uses no split and no further host datum. (c) The (j, ℓ) block of $e^{-iAs}\rho e^{iAs}$ is multiplied by $e^{-i(a_j - a_\ell)s}$, so $e^{-iAt}\rho e^{iAt} = \rho_k$ iff $t - t_k \in \Lambda_\rho$; only the products At occur.

par *Non-claim.* This concerns the displayed constructions; it is not a universal theorem on relational time. The relational lapse of [Em02-E] is built on the declared background of [Em02-E], and the phase reconstruction of [En09-C] returns classes modulo a stabilizer (source record; not a premise; PC-19); neither is used as a premise, treated as a matter law, or read as removing the external parameter. Check C-Big05-45. par

Local scales: Kottler hosts and what readings see

Theorem (Exact curvature split and crossover radii on Kottler hosts). *On* $K_{m,\Lambda}$*:*

• $\mathrm{Ric} = \Lambda g$*,* $R = 4\Lambda$*,* $\mathscr{C}^2 = 48m^2/r^6$ *and* $\mathscr{K} = 48m^2/r^6 + \frac{8}{3}\Lambda^2$*. The Ricci part is a function of* Λ *alone and the Weyl part of m alone. With declared* Λ *equal to the metric parameter,* $T_{\mathrm{tot}} = 0$*; with declared* $\Lambda = 0$*,* $T_{\mathrm{tot}} = -(\Lambda/\chi)g$*.*

• *Kretschmann reading:* $\mathscr{C}^2 > \frac{8}{3}\Lambda^2$ *iff* $r < r_K := (18m^2/\Lambda^2)^{1/6}$*.*

• *Tidal readings for static observers:* $\mathrm{t}_r = c^2(\frac{2m}{r^3} + \frac{\Lambda}{3})$ *and* $\mathrm{t}_\perp = -c^2(\frac{m}{r^3} - \frac{\Lambda}{3})$*. The mass term of* t_r *exceeds the* Λ *term iff* $r < r_t := (6m/\Lambda)^{1/3}$*; that of* $\mathrm{t}_\perp$ *iff* $r < r_s$*, where* $\mathrm{t}_\perp$ *changes sign.*

• *Kepler reading:* $\Omega^2(r) = c^2(\frac{m}{r^3} - \frac{\Lambda}{3}) = \frac{GM}{r^3} - \frac{\Lambda c^2}{3}$*; the mass term dominates iff* $r < r_s := (3m/\Lambda)^{1/3}$*, and circular geodesics require* $r < r_s$*.*

• $r_s < r_K < r_t$*, with ratios* $3^{1/3} : 18^{1/6} : 6^{1/3}$ *to* $(m/\Lambda)^{1/3}$*. The static readings at* $r_\alpha = \alpha(m/\Lambda)^{1/3}$ *are defined iff* $f(r_\alpha) > 0$*, i.e. iff* $c_\alpha(m^2\Lambda)^{1/3} < 1$ *with* $c_\alpha = 2/\alpha + \alpha^2/3$*:* $c_s = 9^{1/3}$*,* $c_K = 2 \cdot 18^{-1/6} + 18^{1/3}/3$*,* $c_t = 4 \cdot 6^{-1/3}$*.*

• *In each reading, dominance of the* Λ *piece holds exactly beyond the crossover radius and fails inside; at* $m = 0$ *(the static patch of* DSS_H*,* $\Lambda = \Lambda_H$*) every reading is pure* Λ*.*

Proof. (a) A direct computation (C-Big05-05) gives $\mathrm{Ric} = \Lambda g$ and $\mathscr{K}$. For an Einstein metric in four dimensions $\mathscr{C}^2 = \mathscr{K} - R^2/6$, so $\mathscr{C}^2 = \mathscr{K} - \frac{8}{3}\Lambda^2$. Then $G = -\Lambda g$ gives T_{tot}. (b) $48m^2/r^6 > \frac{8}{3}\Lambda^2 \Leftrightarrow r^6 < 18m^2/\Lambda^2$. (c) In the static orthonormal frame, $R_{\wwtrtr} = -(\frac{2m}{r^3} + \frac{\Lambda}{3})$ and $R_{\wwt\theta t\theta} = \frac{m}{r^3} - \frac{\Lambda}{3}$ (C-Big05-06); geodesic deviation gives $\mathrm{t}_r, \mathrm{t}_\perp$, and the comparisons are $2m/r^3 > \Lambda/3 \Leftrightarrow r^3 < 6m/\Lambda$ and $m/r^3 > \Lambda/3 \Leftrightarrow r^3 < 3m/\Lambda$. (d) For circular geodesics of a static metric $-c^2 f\,\mathrm{d}t^2 + \ldots + r^2\,\mathrm{d}\varphi^2$ in the equatorial plane, $\Omega^2 = c^2 f'(r)/(2r)$; $\Omega^2 > 0 \Leftrightarrow r < r_s$. (e) $(3^{1/3})^6 = 9 < 18 < 36 = (6^{1/3})^6$; $f(r_\alpha) = 1 - c_\alpha(m^2\Lambda)^{1/3}$. (f) restates (b)–(d).

par *Non-claim.* The radii are expressed in declared labels only. Kottler hosts are prescribed comparison metrics; no central source, interior or matching is constructed, and no McVittie-type metric is treated (t315u item (c) is partial on that point). par

Remark (Version-2 erratum to Theorem ; found in the v2 draft). (E-1) The strict ordering $r_s < r_K < r_t$ of part (e) is asserted for $m > 0$; at $m = 0$ the three radii are 0 and part (f) applies. (E-2) In part (d), $r < r_s$ is necessary for a circular geodesic with $\Omega^2 > 0$; the exact domain of timelike circular geodesics with nonzero angular velocity is $3m < r < r_s$ (Proposition). The version-1 text is kept unchanged.

Theorem (What the orbit readings see). *On $K_{m,\Lambda}$, with $c = 1$, proper length τ, $u = 1/r$ and $' = \mathrm{d}/\mathrm{d}\varphi$ in the equatorial plane:*

• *Light. Null geodesics satisfy $(u')^2 = b^{-2} - u^2(1 - 2mu)$ with $b^{-2} = E^2/L^2 + \Lambda/3$, hence $u'' + u = 3mu^2$, exactly independent of Λ. At $m = 0$ every null orbit is a straight line $r\sin(\varphi - \varphi_0) = b$.*

• *Massive bodies. Timelike geodesics with $\ell = r^2\,\mathrm{d}\varphi/\mathrm{d}\tau \neq 0$ satisfy $u'' + u = m/\ell^2 + 3mu^2 - \Lambda/(3\ell^2u^3)$. With $w = \ell^2u/m$, $w'' + w = 1 + \varepsilon_1 w^2 - \varepsilon_2 w^{-3}$, where $\varepsilon_1 = 3m/p$, $\varepsilon_2 = \Lambda p^3/(3m)$, $p = \ell^2/m$.*

• *No orbits without mass. If $m = 0$, the effective potential $V = f(1 + \ell^2/r^2)$ is strictly decreasing on $r > 0$: there are no circular and no bound (radially oscillating) timelike geodesics. Every bound orbit needs $m > 0$.*

• *Perihelion. For the solution with $w(0) = 1 + e$, $w'(0) = 0$, $e \in (0, 1)$, the angle Φ of the next periapsis satisfies $\Phi - 2\pi = 2\pi\varepsilon_1 + 3\pi\varepsilon_2(1 - e^2)^{-5/2} + O(\varepsilon^2)$, i.e.?$\Phi - 2\pi = \frac{6\pi m}{p} + \frac{\pi\Lambda a^3\sqrt{1-e^2}}{m} + O(\varepsilon^2)$ with $a = p/(1 - e^2)$.*

Proof. The conserved quantities are $E = f\,\mathrm{d}t/\mathrm{d}\tau$, L or $\ell = r^2\,\mathrm{d}\varphi/\mathrm{d}\tau$. (a) For null curves $(\mathrm{d}r/\mathrm{d}\lambda)^2 = E^2 - fL^2/r^2$; divide by $(\mathrm{d}\varphi/\mathrm{d}\lambda)^2 = L^2u^4$ and expand $fu^2 = u^2 - 2mu^3 - \Lambda/3$. Differentiating gives $u'' + u = 3mu^2$. (b) For timelike curves $(\mathrm{d}r/\mathrm{d}\tau)^2 = E^2 - f(1 + \ell^2u^2)$, so $(u')^2 = E^2/\ell^2 - f(u)(\ell^{-2} + u^2)$; differentiate and divide by $2u'$ (on arcs with $u' \neq 0$, and by continuity at turning points), see C-Big05-07; the rescaling is direct. (c) $V'(r) = -2\ell^2/r^3 - 2\Lambda r/3 < 0$, so $E^2 - V$ has at most one zero on each orbit and r cannot oscillate. (d) For $\varepsilon = 0$ the solution is $w_0 = 1 + e\cos\varphi$, with periapsis at 2π and $w_0''(2\pi) = -e \neq 0$. By smooth dependence and the implicit function theorem, Φ is smooth near $\varepsilon = 0$ with $\partial\Phi/\partial\varepsilon_i = -\partial_{\varepsilon_i} w'(2\pi)/w_0''(2\pi)$. The variation w_i solves $w_i'' + w_i = h_i(w_0)$, $w_i(0) = w_i'(0) = 0$, so $w_i'(2\pi) = \int_0^{2\pi} \cos s\, h_i(w_0(s))\,\mathrm{d}s$, with $h_1 = w^2$, $h_2 = -w^{-3}$. The integrals are $2\pi e$ and $3\pi e(1 - e^2)^{-5/2}$ (C-Big05-08), and $\varepsilon_2(1 - e^2)^{-5/2} \cdot 3\pi = \pi\Lambda a^3\sqrt{1 - e^2}/m$.

par *Non-claim.* The light statement concerns the orbit shape; the measured deflection angle and the Shapiro delay involve observer and coordinate choices that are not treated (t315u item (d) is partial there). Cavendish experiments are outside these hosts. Nothing is fitted. par

Proposition (Kepler balance versus circular motion; from the v2 draft). *On $K_{m,\Lambda}$ with $m > 0$ and $c = 1$, put $\mathscr{B}(r) = f'(r)/(2r) = m/r^3 - \Lambda/3$, the Kepler reading of Theorem (d). A timelike circular geodesic with nonzero angular velocity exists at r iff $3m < r < r_s$; there $\Omega^2 = \mathscr{B}(r)$, and its specific angular momentum and energy are*

$$\ell^2 = \frac{mr - \Lambda r^4/3}{1 - 3m/r}, \qquad E^2 = \frac{f(r)^2}{1 - 3m/r}.$$

At $r = r_s$ the static worldline is a geodesic. For $r > r_s$, $\mathscr{B}(r) < 0$ is a derivative reading of the metric, not the square of an orbital frequency.

Proof. With $V = f(1 + \ell^2/r^2)$, circular orbits solve $V'(r) = 0$, $E^2 = V(r)$. Since $2f - rf' = 2 - 6m/r$, $V' = 0$ gives $\ell^2(2 - 6m/r) = r^3f' = 2mr - \frac{2}{3}\Lambda r^4$, and then $E^2 = f \cdot f/(1 - 3m/r)$; $\Omega = f\ell/(Er^2)$ gives $\Omega^2 = \mathscr{B}$. A timelike orbit needs $1 - 3m/r > 0$, and $\ell^2 > 0$ then needs $r < r_s$. The interval $(3m, r_s)$ is nonempty iff $9m^2\Lambda < 1$, and lies in the static region because $f(3m) = \frac{1}{3} - 3m^2\Lambda > 0$ and f increases on $(0, r_s)$. At r_s, $f' = 0$, so $\nabla_U U = 0$ for the static observer.

par *Non-claim.* The Kepler readings at two radii still identify (m, Λ) (Theorem (c)); reading them as orbital frequencies needs both radii in $(3m, r_s)$. Nothing is fitted. Check C-Big05-38. par

Theorem (Relabel or re-metric: the local dichotomy).

• *Every reading of Definition and Theorem is constant on split fibres: two compatible splits of the same metric give identical readings.*

• *On the exterior $K_{m,\Lambda}$ with declared $\Lambda = 0$ and $\chi > 0$, every compatible split with NEC pieces is of vacuum type; the natural declaration $T_{\mathrm{b}} = 0$, $T_{\Lambda} = -(\Lambda/\chi)g$ has pointwise energy dominance of the dark and vacuum pieces at every point, for every m, including inside r_s, r_K, r_t, where every metric reading is dominated by the mass label. So H-split does not imply H-geom.*

• *In the Kottler family the Kepler readings at two radii $r_1 \neq r_2$ determine (m,Λ). H-geom in the reading $X \in \{s,K,t\}$ at r holds iff $r > r_X(m,\Lambda)$. To make it hold at $r \leq r_X(m,\Lambda)$ one must replace (m,Λ) by labels with $r > r_X(m',\Lambda')$; this changes the metric (it is not a reorganization) and changes the pair $(\Omega^2(r_1), \Omega^2(r_2))$ for every $r_1 \neq r_2$; for $m' < m, \Lambda' \geq \Lambda$ it lowers $\Omega^2(r)$ at every r by $c^2((m-m')/r^3 + (\Lambda' - \Lambda)/3) > 0$.*

• *Hence local dominance of dark and expansion pieces is either a relabelling of the split, invisible to every reading and not decided by host data (Theorem), or a change of metric labels, decided by the readings. Neither is supplied by [Big01-A], [Big01-A], [Big01-A], [Big01-A] or [Big01-A] (*source record; not a premise*).*

Proof. (a) Readings are functions of the metric and declared observer data. (b) $T_{\mathrm{tot}} = -(\Lambda/\chi)g$ by Theorem (a); Lemma gives vacuum type. For the natural declaration $\rho_{\mathrm{b}} = 0 < \Lambda/\chi = \rho_{\mathrm{dm}} + \rho_{\Lambda}$; the readings are those of Theorem . (c) $\Omega^2(r_i) = c^2(m/r_i^3 - \Lambda/3)$ is an invertible linear system in (m,Λ) for $r_1 \neq r_2$ (determinant $c^4(r_2^{-3} - r_1^{-3})/3 \neq 0$), so distinct labels give distinct pairs. The radii are increasing in m and decreasing in Λ; a reorganization fixes the host, hence the labels. (d) Combine (a)–(c). The cited theorems concern declared data, coefficients, causal boxes and ticks; none acts on a split or on the metric labels.

par *Non-claim.* A small or zero ordinary stress in an exterior region is not suppressed coupling: the exterior Weyl field carries the mass label (D7 of v0). An exact de Sitter metric is not a Solar-System exterior with its mass term relabelled, because the Weyl invariants differ (Theorem (b); v0 prop:weyl). par

Observer contracts on Kottler hosts: angles and radar

An orbit equation is not an observer angle, and finite-distance bending and radar timing require declared observers, image branches, clocks and a reference [RindlerIshak2007,Ishihara2016,Butcher2016,Shapiro1964] (source record; not a premise). In this section $c = 1$ and $K_{m,\Lambda}$ is the Kottler host of Definition .

Definition (Static finite-distance optical contract; from the v2 draft). Declare two static worldlines at areal radii r_S, r_R, an equatorial null geodesic branch from *S* to *R* with exactly one radial turning point r_0, and the static orthonormal tetrads. Require $f > 0$ on $[r_0, \max(r_S, r_R)]$ and $r_S, r_R > r_0 > 3m$ (for $m = 0$: $r_0 > 0$). Put

$$\beta = \frac{r_0}{\sqrt{f(r_0)}}, \qquad Q(r) = 1 - \frac{\beta^2 f(r)}{r^2},$$

and require $Q > 0$ on the open legs. For fixed endpoint angular positions the contract includes the selected root r_0 of the angular boundary equation; no uniqueness across images or windings is assumed. The emitter's clock is its proper time, and an ideal reflector at *R* returns the ray along its reversed spatial path.

Theorem (Observer angles and radar intervals on Kottler hosts). *Under Definition , put*

$$\Phi_{SR} = \sum_{i=S,R} \int_{r_0}^{r_i} \frac{\beta \, \mathrm{d}r}{r^2\sqrt{Q(r)}},$$

$$T_{SR} = \sum_{i=S,R} \int_{r_0}^{r_i} \frac{\mathrm{d}r}{f(r)\sqrt{Q(r)}}.$$

• *Angles and radar. The angle Ψ of the photon direction from the outward radial direction in a static rest frame satisfies* $\sin\Psi_i = \beta\sqrt{f(r_i)}/r_i$, $\cos\Psi_S = -\sqrt{Q(r_S)}$, $\cos\Psi_R = \sqrt{Q(r_R)}$. *The declared finite-distance bending angle*

$$\alpha_{\mathrm{fin}} = \Psi_R - \Psi_S + \Phi_{SR}$$

vanishes for the direct Minkowski ray, and the emitter's proper radar interval is

$$\tau_{\mathrm{rad}} = 2\sqrt{f(r_S)}\, T_{SR}.$$

• *Λ in the angle. With $u = 1/r$,*

$$\sin^2\Psi = \frac{u^2(1-2mu) - \Lambda/3}{u_0^2(1-2mu_0) - \Lambda/3},$$

and to first order in (m,Λ)

$$\sin\Psi = \frac{r_0}{r}\left(1 + \frac{m}{r_0} - \frac{m}{r}\right) - \frac{\Lambda r_0 r}{6} + \frac{\Lambda r_0^3}{6r} + O(m^2 + |m\Lambda| + \Lambda^2).$$

So the static-observer angle depends on Λ, although the orbit equation of Theorem (a) does not.

• *Radar quadrature. Each leg contributes $T(r) = \sqrt{f(r_0)}\int_{r_0}^{r} \frac{s\,\mathrm{d}s}{f(s)\sqrt{N(s)}}$ with the Λ-free shape function*

$N(s) = s^2 - r_0^2 - 2m(s^2/r_0 - r_0^2/s)$. With $w = \sqrt{r^2 - r_0^2}$: at $m = 0$,

$T = \sqrt{3/\Lambda}\,\operatorname{artanh}\sqrt{\Lambda(r^2 - r_0^2)/(3 - \Lambda r_0^2)} = w + \Lambda\left(\frac{r_0^2 w}{6} + \frac{w^3}{9}\right) + O(\Lambda^2)$; at $\Lambda = 0$, $T = w + 2m\ln\frac{r+w}{r_0} + m\sqrt{\frac{r-r_0}{r+r_0}} + O(m^2)$.

• *Observer dependence. A radially moving observer at speed v relative to the static one measures $\cos\Psi' = (\cos\Psi - v)/(1 - v\cos\Psi)$; as v ranges over $(-1,1)$ every $\Psi' \in (0,\pi)$ occurs. An angle is a function of the metric and the declared observer.*

• *Split blindness. Every quantity in (a)–(d) is a function of g and the contract; it is constant on split fibres, and adjoining it leaves the risks of Theorem and Proposition unchanged.*

• *Deciding H-geom. With r_0 known, two static angles of one ray at distinct radii r_1, r_2 satisfy the linear system $r_i^2 \sin^2\Psi_i\, f(r_0) = r_0^2 f(r_i)$ in (m,Λ); where its determinant is nonzero (for instance at $m = 1$, $\Lambda = 10^{-3}$, $r_0 = 5$, $r_1 = 10$, $r_2 = 20$) they determine (m,Λ), hence every Kottler crossover predicate of Theorem .*

Proof. With $E = f\dot{t}$, $L = r^2\dot{\varphi}$ and $\beta = L/E$, the null condition is $\dot{r}^2 = E^2 Q$, so $\mathrm{d}\varphi/\mathrm{d}r = \beta/(r^2\sqrt{Q})$ and $\mathrm{d}t/\mathrm{d}r = 1/(f\sqrt{Q})$, giving , . Since $2f - rf' = 2 - 6m/r$, $Q'(r_0) = 2(1 - 3m/r_0)/(r_0 f(r_0)) > 0$, so the endpoint singularities are integrable square roots. In the static tetrad the photon has temporal, radial and angular components $E/\sqrt{f}$, $\pm E\sqrt{Q}/\sqrt{f}$ and L/r, which give the angles (inward at S, outward at R). In Minkowski space $\Phi_{SR} = \pi - \arcsin(r_0/r_S) - \arcsin(r_0/r_R)$, $\Psi_S = \pi - \arcsin(r_0/r_S)$, $\Psi_R = \arcsin(r_0/r_R)$, so $\alpha_{\mathrm{fin}} = 0$. The static emitter has $\mathrm{d}\tau = \sqrt{f(r_S)}\,\mathrm{d}t$, and time-reflection symmetry gives two equal travel times: (a). (b) $\sin^2\Psi = \beta^2 f(r)/r^2$ and $\beta^{-2} = f(r_0)/r_0^2 = u_0^2(1 - 2mu_0) - \Lambda/3$; expand $\sqrt{f(r)/f(r_0)}$. (c) $r^2 f(r_0)Q(r) = r^2 f(r_0) - r_0^2 f(r) = N(r)$, in which Λ cancels; hence $1/(f\sqrt{Q}) = r\sqrt{f(r_0)}/(f\sqrt{N})$. At $m = 0$ the integral is elementary, and the two expansions follow from $\operatorname{artanh} x = x + x^3/3 + O(x^5)$ and from expanding the integrand to first order in m (C-Big05-39). (d) Lorentz aberration for a boost along the radial direction; for fixed $\Psi \in (0,\pi)$ the map $v \mapsto (\cos\Psi - v)/(1 - v\cos\Psi)$ is a decreasing bijection of $(-1,1)$ onto itself. (e) No formula uses a split; Lemma . (f) Each equation is affine in (m,Λ) because f is; the witness determinant is computed exactly (C-Big05-39); then Theorem (c).

par *Non-claim.* The angle and the radar interval are readings under a declared contract: different observers, image branches, references or bending conventions give different numbers, and no convention is preferred. The readings decide H-geom only where the predicate is constant on their fibres (Corollary); they never decide H-split. OpenAI Family 212 concerns first-passage-percolation geodesics, not Lorentzian null geodesics ([OpenAI], source record; not a premise). Checks C-Big05-39, C-Big05-40. par

Definition (Reference-dependent radar comparison; from the v2 draft). Declare a reference metric, a correspondence of emitter and reflector worldlines, the image branch and a clock normalization; for instance keep

(r_S, r_R, Φ_{SR}), take the reference $K_{0,\Lambda}$, and assume the selected connecting ray exists there, with its own turning point. Put $\Delta\tau = \tau_{\mathrm{rad}} - \tau^{\mathrm{ref}}_{\mathrm{rad}}$. A Minkowski reference is a different contract.

Corollary (What a delay decides; from the v2 draft). *Equations –, applied to the tested and the reference metric, evaluate $\Delta\tau$ exactly by quadrature, and $\Delta\tau$ is split-blind. A record $J(m,\Lambda)$ decides an H-geom predicate exactly when the predicate is constant on the fibres of J.*

Proof. Theorem (a),(e) for both metrics, and Lemma .

par *Non-claim.* No observer-independent sign of $\Delta\tau$ and no universal mass/Λ decomposition of it is asserted; a single angle or delay is not guaranteed to identify both labels (PC-23). par

Proposition (A calibrated optical determination; from the v2 draft). *If $\beta > 0$ is independently calibrated, two static angles of one ray at distinct known radii give $f(r_i) = r_i^2 \sin^2\Psi_i/\beta^2$, hence (m,Λ): the system $1 - f(r_i) = 2m/r_i + \Lambda r_i^2/3$ has determinant $\frac{2}{3}(r_2^2/r_1 - r_1^2/r_2) \neq 0$.*

Proof. Theorem (a) and Cramer's rule.

par *Non-claim.* This is a sufficient calibration contract, not a consequence of an uncalibrated bending angle; the calibration of β is added supply. Check C-Big05-39. par

Proposition (First-order Shapiro check; from the v2 draft). *Let $\Lambda = 0$, use isotropic coordinates $g = -(1 - 2m/\rho)\,\mathrm{d}t^2 + (1 + 2m/\rho)\,\mathrm{d}\mathbf{x}^2 + O(m^2)$, fix distinct endpoints $\mathbf{x}_S, \mathbf{x}_R$ whose segment stays a positive distance from the origin, and select the direct weak-field ray. With $\rho_i = |\mathbf{x}_i|$ and $D = |\mathbf{x}_R - \mathbf{x}_S|$, as $m \to 0$,*

$$T_{SR} - D = 2m \ln \frac{\rho_S + \rho_R + D}{\rho_S + \rho_R - D} + O(m^2).$$

Proof. The coordinate travel time is the optical length $\int (1 + 2m/\rho)\,\mathrm{d}l + O(m^2)$. The first variation of Euclidean length vanishes at the straight segment, so the first-order term is its integral along the segment, which is the logarithm. Smooth dependence of the nondegenerate direct ray on m gives the remainder.

par *Non-claim.* This is a check of the quadrature of Theorem against the standard first-order form [Shapiro1964] (source record; not a premise); the exact areal-radius quadrature and agree to $O(m^2)$ on a numerical example (C-Big05-40). It is not a Solar-System fit. par

Theorem (Calibration of (m,Λ) by two angles, and the uncalibrated degeneracy; plan item #14). *On Kottler hosts ($c = 1$) let one ray of Definition be read by static observers at distinct known radii r_1, r_2, with angles Ψ_1, Ψ_2 and $\sigma_i = \sin^2\Psi_i \in (0,1]$.*

• If $\beta > 0$ is calibrated, $f(r_i) = r_i^2\sigma_i/\beta^2$, and (m,Λ) is the unique solution of $2m/r_i + \Lambda r_i^2/3 = 1 - r_i^2\sigma_i/\beta^2$, whose determinant is $\frac{2}{3}(r_2^2/r_1 - r_1^2/r_2) = \frac{2(r_2^3 - r_1^3)}{3r_1r_2} \neq 0$.

• If neither β nor r_0 is known, the angle pair determines (m,Λ,β) only up to the curve $u \mapsto (m(u),\Lambda(u),u^{-1/2})$, $u = \beta^{-2} > 0$, where $(m(u),\Lambda(u))$ is the solution of (a) with $\beta^{-2} = u$; m and Λ are affine in u, and $\partial_u(m,\Lambda) \neq 0$. Through every admissible parameter triple passes an open arc of admissible triples (each with a ray of the contract) with the same angle pair: the degeneracy is exactly one-dimensional.

• If r_0 is known (but β is not), $\beta^2 = r_0^2/f(r_0)$ and (a) becomes the system of Theorem (f).

Proof. (a) Theorem (a) and Cramer's rule. (b) For each u the system $2m/r_i + \Lambda r_i^2/3 = 1 - ur_i^2\sigma_i$ is linear with the nonzero determinant of (a), so the solution is unique and affine in u, with $\partial_u(m,\Lambda) = -M^{-1}(r_1^2\sigma_1, r_2^2\sigma_2)^{\mathrm{T}} \neq 0$. The angle pair is $\sigma_i = uf_{m(u),\Lambda(u)}(r_i)r_i^{-2}$ along the curve. Admissibility (a turning point $r_0 > 3m$ with $r_0^2/f(r_0) = 1/u$, $Q > 0$ on the legs, $f > 0$, $9m^2\Lambda < 1$) is an open condition satisfied at the true triple, with r_0 depending continuously on u by the implicit function theorem since $\frac{\mathrm{d}}{\mathrm{d}r}(r^2/f) \neq 0$ at $r_0 > 3m$. (c) Direct.

par *Non-claim.* The plan's ``generically two combinations'' is here exact and everywhere: the linear part has rank two. A third independent datum (β, r_0, a third angle or a radar interval) is needed (PC-41). Check C-Big05-65. par

Theorem (Radar excess depends on the reference contract; plan item #15). *For a fixed metric $g = K_{m,\Lambda}$ of the family $f = 1 - 2m/r - \Lambda r^2/3$, $\Lambda \geq 0$ ($\Lambda = 0$ is Schwarzschild, outside Definition ; the quadratures of Theorem apply verbatim), let $\Delta\tau[g; g_{\mathrm{ref}}, \mathscr{C}] = \tau_{\mathrm{rad}}[g, \mathscr{C}] - \tau_{\mathrm{rad}}[g_{\mathrm{ref}}, \mathscr{C}_{\mathrm{ref}}]$ (Definition). It is a function of the augmented contract $(g, g_{\mathrm{ref}}, \mathscr{C}, \mathscr{C}_{\mathrm{ref}})$, not of g. Explicitly ($c = 1$, static emitter and reflector at areal radii r_S, r_R, endpoints identified by areal radius and swept angle Φ_{SR}):*

• *Reference metric, sign change. For $g = K_{1,0}$, $r_0 = 10$, $r_S = 20$, $r_R = 30$: $\Delta\tau \approx +6.80$ against Minkowski and $\Delta\tau \approx -2.67$ against $K_{3/2,0}$.*

• *Clock normalization, sign change. For $g = K_{1/10,\,3\times10^{-3}}$, $r_0 = 4$, $r_S = 20$, $r_R = 6$, against Minkowski: $\Delta\tau \approx -4.73$ with the emitter's proper time and $\approx +8.55$ with the Kottler coordinate time.*

• *Endpoint identification, magnitude. For $g = K_{1,0}$, $r_0 = 10$, $r_S = 20$, $r_R = 30$, coordinate radar time against Minkowski: excess ≈ 12.43 with Minkowski endpoints at the areal radii and ≈ 16.36 at the isotropic radii.*

• *Ray branch, magnitude. In the setting of (a), with the Minkowski reference, the branch passing on the other side of the centre (swept angle $2\pi - \Phi_{SR}$, turning point $r_0 \approx 5.78$) gives $\Delta\tau \approx 22.62$ instead of 6.80.*

Proof. Each value is a quadrature of Theorem (a) with the reference ray found by root-finding on Φ_{SR} (C-Big05-66, tolerances stated there).

par *Non-claim.* Sign changes are witnessed for the reference metric and the clock normalization; for endpoint identification and branch only magnitude changes are witnessed, and a sign change there is not claimed (PC-42). No convention is preferred. Check C-Big05-66. par

A prescribed McVittie comparison

The McVittie family is standard [McVittie1933,Kaloper2010,Nolan2014] (source record; not a premise). We use only the displayed metric on the displayed region; no global extension, interior, central source or matter evolution is imported, and the corpus is not cited for it. In this section $c = 1$.

Definition (McVittie comparison host and observer). Let $m > 0$, let $a(t) > 0$ be a declared smooth function on an interval I, $H = \dot{a}/a$, and put $A(r) = 1 - 2m/r$. On $I \times (2m, \infty) \times S^2$ prescribe

$$g_{\mathrm{M}} = -A\,\mathrm{d}t^2 + \left(\frac{\mathrm{d}r}{\sqrt{A}} - H(t)\,r\,\mathrm{d}t\right)^2 + r^2\,\mathrm{d}\Omega^2,$$

with the observer tetrad $e_0 = A^{-1/2}\partial_t + Hr\partial_r$, $e_1 = \sqrt{A}\,\partial_r$, $e_2 = r^{-1}\partial_\theta$, $e_3 = (r\sin\theta)^{-1}\partial_\varphi$. Here r is the areal radius. The host is a prescribed comparison metric, not a new ledger host.

Theorem (McVittie comparison: total, tides and dominance functions). *On Definition put $q = m/r^3$, $d = \dot{H}/\sqrt{A}$ and $F = H^2 + d$, and fix declared Λ and $\chi \neq 0$.*

• *In the tetrad,*

$$G_{00} = 3H^2, \qquad G_{11} = G_{22} = G_{33} = -3H^2 - 2d, \qquad G_{0i} = 0,$$

$R = 12H^2 + 6d$, $C_{abcd}C^{abcd} = 48m^2/r^6$ *and* $\mathscr{K} = 48m^2/r^6 + 12(H^4 + F^2)$.

• *The total is diagonal and isotropic:*

$$\rho_{\mathrm{tot}} = \frac{3H^2 - \Lambda}{\chi}, \qquad p_{\mathrm{tot}} = \frac{-3H^2 - 2d + \Lambda}{\chi}.$$

For $\chi > 0$ it obeys the NEC iff $H \leq 0$, and the WEC iff moreover $3H^2 \geq \Lambda$. At a time with $H \neq 0$, p_{tot} and R are unbounded as r$\mathrm{downarrow}\,2m$.

• *The tidal eigenvalues for the declared observer e_0 (which moves with $\mathrm{d}r/\mathrm{d}\tau = Hr$, at fixed isotropic radius: the*

McVittie flow, not a static observer) are

$$\mathrm{t}_r = 2q + F, \qquad \mathrm{t}_\perp = -q + F.$$

Declare the radial-tide comparison $\mathscr{D}_{\mathrm{M}} = |F|/(2q)$ *and the Kretschmann comparison* $\mathscr{D}_{\mathrm{K}} = C^2/(\mathscr{K} - C^2) = 4q^2/(H^4 + F^2)$.

• *At a time with* $H = 0 \neq \dot{H}$, $\mathscr{D}_{\mathrm{K}} > 1$ *iff* $r < (18m^2/\Lambda_{\mathrm{eff}}^2)^{1/6}$ *with* $\Lambda_{\mathrm{eff}} = 3H^2$, *the Kottler radius* r_K *of Theorem (b). At a time with* $H \neq 0$, $\mathscr{D}_{\mathrm{K}} \to 0$ *both as* r$\downarrow 2m$ *and as* $r \to \infty$, *so* $\{r : \mathscr{D}_{\mathrm{K}} > 1\}$ *has compact closure in* $(2m, \infty)$ *(it may be empty); there is no time-independent crossover radius.*

• *Every quantity in (a)–(d) is a function of the declared labels* (m, a), *the declared* (Λ, χ) *and the tetrad; all are constant on split fibres. Wherever* $T_{\mathrm{tot}} \equiv 0$ *on a compact set the split is not selected (Theorem).*

Proof. For the coframe $\theta^0 = \sqrt{A}\ \mathrm{d}t$, $\theta^1 = \mathrm{d}r/\sqrt{A} - Hr\ \mathrm{d}t$, $\theta^2 = r\,\mathrm{d}\theta$, $\theta^3 = r\sin\theta\ \mathrm{d}\varphi$, with $a_r = m/(r^2\sqrt{A})$ and $b_r = \sqrt{A}/r$, a compatible connection is $\omega^0{}_1 = a_r\theta^0 + H\theta^1$, $\omega^0{}_2 = H\theta^2$, $\omega^0{}_3 = H\theta^3$, $\omega^1{}_2 = -b_r\theta^2$, $\omega^1{}_3 = -b_r\theta^3$, $\omega^2{}_3 = -(\cot\theta/r)\theta^3$. The curvature two-forms give the independent frame components $R_{0101} = -2q - F$, $R_{0202} = R_{0303} = q - F$, $R_{1212} = R_{1313} = H^2 - q$, $R_{2323} = H^2 + 2q$, all mixed components vanishing; contraction gives $R_{00} = -3F$, $R_{ii} = F + 2H^2$, hence (a), and the Weyl pattern $(-2q, q, q, -q, -q, 2q)$ has $C^2 = 48q^2$. The Ricci part of $\mathscr{K}$ is $2R_{ab}R^{ab} - R^2/3 = 12(H^4 + F^2)$. These are confirmed at rational points with two declared expansion histories, and independently in McVittie's isotropic coordinates (C-Big05-41). (b) Substitute into Definition ; for an isotropic diagonal tensor the NEC is $\rho + p \geq 0$, here $-2\dot{H}/(\chi\sqrt{A}) \geq 0$; the WEC adds $\rho \geq 0$; $d \to \pm\infty$ as $A \to 0$. (c) Negate the temporal sectional curvatures. (d) At $\dot{H} = 0$, $\mathscr{D}_{\mathrm{K}} = 2m^2/(H^4r^6)$, and $2m^2/(H^4r^6) > 1 \Leftrightarrow r^6 < 18m^2/(3H^2)^2$. If $\dot{H} \neq 0$, then $H^4 + F^2 > 0$ for all r (if $H = 0$ then $F = d \neq 0$), so $\mathscr{D}_{\mathrm{K}}$ is continuous on $(2m, \infty)$. As r$\downarrow 2m$, $|d| = |\dot{H}|/\sqrt{A} \to \infty$ while $q \to 1/(8m^2)$; as $r \to \infty$, $q \to 0$ while $H^4 + F^2 \to H^4 + (H^2 + \dot{H})^2 > 0$. Both limits of $\mathscr{D}_{\mathrm{K}}$ are 0, so the open set $\{\mathscr{D}_{\mathrm{K}} > 1\}$ lies in a compact subinterval. (e) Lemma .

par *Non-claim.* For time-dependent expansion the Ricci part contains the mass-dependent factor $A^{-1/2}\dot{H}$, so the Kottler statement ``the Ricci part is the Λ piece" does not carry over unchanged (PC-24); the expansion term of a tide may be negative. The surface $r = 2m$ is excluded; no continuation, matched interior, central source, field equation or black-hole statement follows. A prescribed dynamical metric is not derived dynamics ([Hawk07-C-Dyn], [Hawk07-C-Dyn], [I-D], source record; not a premise). Checks C-Big05-41, C-Big05-42. par

Corollary (Constant-rate limit; from the v2 draft). *If* $H = H_0$ *is constant, put* $f = A - H_0^2r^2$. *On* $\{f > 0\}$ *the change of time* $T = t + \psi(r)$, $\psi'(r) = H_0 r/(\sqrt{A}\,f)$, *puts into the Kottler form* $K_{m,\Lambda'}$ *with* $\Lambda' = 3H_0^2$; *the tides and the Kretschmann comparison reduce to those of Theorem .*

Proof. Substituting $\mathrm{d}t = \mathrm{d}T - \psi'\,\mathrm{d}r$ gives $g_{TT} = -f$, a vanishing cross term, and $g_{rr} = 1/A + H_0^2r^2/(Af) = 1/f$.

par *Non-claim.* The limit identifies the constant-rate member with a Kottler host; it does not match a time-dependent McVittie region to anything. Check C-Big05-41. par

Theorem (Mass and expansion do not separate in McVittie tides; plan item #10). *On Definition , with* $\dot{H} = \mathrm{d}H/\mathrm{d}t$ *the derivative in the McVittie time t of , put* $A = 1 - 2m/r$ *and fix a time.*

• *With c restored, t cosmic time in seconds and* $m = GM/c^2$, *the tidal eigenvalues for* e_0 *are*

$$\mathrm{t}_r = \frac{2c^2m}{r^3} + H^2 + \frac{\dot{H}}{\sqrt{A}}, \qquad \mathrm{t}_\perp = -\frac{c^2m}{r^3} + H^2 + \frac{\dot{H}}{\sqrt{A}};$$

equivalently $c^2(2q + F)$, $c^2(-q + F)$ *when time is measured in length* ($s = ct$, $\mathscr{H} = H/c$, $\mathscr{H}' = \mathrm{d}\mathscr{H}/\mathrm{d}s = \dot{H}/c^2$).

• *If* $\dot{H} \neq 0$*, the expansion part* $F(r) = H^2 + \dot{H}/\sqrt{A}$ *of the tide has* $\partial_r F = -\dot{H}m/(r^2 A^{3/2}) \neq 0$*: it is not a function of* H *alone and is not* $\Lambda_{\text{eff}}/3$ *for any radius-independent* Λ_{eff}*.*

• *There is no universal crossover: no function* $r_*(m, h)$ *has the property that, for every expansion history and every time with* $H = h$*,* $\mathscr{D}_{\text{M}}(r) > 1 \Leftrightarrow r > r_*$*. Explicitly, for every* $r_1 > 2m$ *with* $r_1^3 h^2 > 2m$*, the histories with* $\dot{H} = 0$ *and with* $\dot{H} = -h^2\sqrt{A(r_1)}$ *at that time give* $\mathscr{D}_{\text{M}}(r_1) > 1$ *and* $\mathscr{D}_{\text{M}}(r_1) = 0$*.*

• *Shape of* $\mathscr{D}_{\text{M}} = r^3|F|/(2m)$ *at fixed time, using* $(r^3 F)' = 3r^2 H^2 + \dot{H}\, r A^{-3/2}(3r - 7m)$*:*

• *if* $\dot{H} = 0 \neq H$*,* $\mathscr{D}_{\text{M}}$ *is strictly increasing, with the single crossover* $r = (2m/H^2)^{1/3}$*, the Kottler tidal radius for* $\Lambda = 3H^2$*;*

• *if* $\dot{H} > 0$*,* $\mathscr{D}_{\text{M}} \to \infty$ *as r*downarrow $2m$ *and as* $r \to \infty$*, and has a unique critical point, a minimum, at some* $r_c \in (2m, 7m/3]$ *(*$r_c = 7m/3$ *iff* $\dot{H} = 0$*); so* $\{\mathscr{D}_{\text{M}} \leq 1\}$ *is empty or a compact interval not adjoining* $r = 2m$*;*

• *if* $\dot{H} < 0$*,* $\mathscr{D}_{\text{M}} \to \infty$ *as r*downarrow $2m$ *and is strictly decreasing on* $(2m, \min(7m/3, r_F))$*, where* $r_F = 2m/(1 - \dot{H}^2/H^4)$ *is the unique zero of* $\mathscr{D}_{\text{M}}$ *when* $|\dot{H}| < H^2$ *(and* $r_F = \infty$*, no zero, when* $|\dot{H}| \geq H^2$*). {[}Open: the full monotonicity pattern for* $\dot{H} < 0$*; it is not monotone in general, e.g.* $m = 1$*,* $H = 1$*,* $\dot{H} = -0.99$ *has three critical points.{]}} In every case with* $\dot{H} \neq 0$ *the mass-dominated set* $\{\mathscr{D}_{\text{M}} < 1\}$ *does not adjoin* $r = 2m$*, unlike the Kottler case.*

Proof. (a) Theorem (c) in units $c = 1$, t of length dimension; restoring units, $\mathscr{H} = H/c$ and $\mathscr{H}' = \dot{H}/c^2$. (b) Differentiate $A^{-1/2}$; $A' = 2m/r^2$. (c) At $\dot{H} = 0$, $\mathscr{D}_{\text{M}}(r_1) = r_1^3 h^2/(2m) > 1$; at the other value $F(r_1) = 0$. Both are values of declared smooth histories (e.g.?$H(t) = h + \dot{H}(t - t_0)$ near t_0). (d) The derivative identity is direct. For $\dot{H} = 0$ it is $3r^2H^2 > 0$. For $\dot{H} > 0$, $F > 0$; $3rH^2A^{3/2} = \dot{H}(7m - 3r)$ has increasing left and decreasing right side, the left side vanishes at $r = 2m$ and the right side is positive there and nonpositive for $r \geq 7m/3$; limits from $A^{-1/2} \to \infty$ and $r^3H^2 \to \infty$. For $\dot{H} < 0$, $F \to -\infty$ at $2m$; where $F < 0$, $(r^3|F|)' = -3r^2H^2 + |\dot{H}$rvertrA$^{-3/2}(3r - 7m) < 0$ for $r < 7m/3$; $F = 0$ iff $\sqrt{A} = |\dot{H}|/H^2$. The counterexample is numerical (C-Big05-61).

par *Non-claim.* The observer e_0 is declared; for $\dot{H} \neq 0$ a radially boosted observer reads different transverse tides (Theorem (c)), so even the tidal split into ``mass" and ``expansion" parts is contract-relative. No matter model, no matching and no statement across $r = 2m$ (PC-37). Check C-Big05-61. par

Proposition (Constant-rate McVittie is Kottler; plan item #11). *Let* $H = H_0 > 0$ *be constant,* $f = A - H_0^2 r^2$*, and* J *a connected component of* $\{r > 2m : f > 0\}$*. Then* $\Psi(t, r, \theta, \varphi) = (T, r, \theta, \varphi)$*,* $T = t + \psi(r)$*,* $\psi'(r) = H_0 r/(\sqrt{A}\, f)$*, is an isometry from* $(I \times J \times S^2, g_{\text{M}})$ *onto an open subset of the static region of* $K_{m,\Lambda'}$ *with* $\Lambda' = 3H_0^2$ *(with units,* $\Lambda' = 3H_0^2/c^2$ *), and* $9m^2\Lambda' < 1$ *iff* $J \neq \varnothing$*. Under* Ψ*:*

• *all curvature invariants agree pointwise, and the areal radius and* $\partial_T = \partial_t$ *are preserved, so the static-region boundary* $\{f = 0\}$ *agrees;*

• *circular geodesics (constant r, with* φ *constant) correspond, with the conditions of Proposition ;*

• *the observer* e_0 *is the radial boost of the static observer with outward velocity* $v = H_0 r/\sqrt{A}$*; the tides, and hence* $\mathscr{D}_{\text{M}}$ *and* $\mathscr{D}_{\text{K}}$*, agree with the Kottler static ones (radial boosts leave Kottler tides unchanged);*

• *finite-distance angles agree only after the observer contract is transformed: angles read by* e_0 *are the static angles of Theorem aberrated by v (Theorem (d)); radar intervals agree for a static emitter; an emitter moving*

with e_0 has a different worldline, which is a different contract and is not computed here.

Proof. Corollary gives the pull-back. Ψ fixes r, θ, φ, and $\partial_t|_r = \partial_T|_r$. The maximum of f over $r > 2m$ is positive iff $27m^2H_0^2 < 1$, i.e. $9m^2\Lambda' < 1$ (Definition). (b) Isometries map geodesics to geodesics and keep r. (c) With $u_s = f^{-1/2}\partial_t$, $-g(e_0, u_s) = \sqrt{A/f} = \gamma$, so $v^2 = 1 - f/A = H_0^2 r^2/A$; the radial-boost invariance is computed in C-Big05-62. (d) Aberration formula at a common event; the static emitter's worldline is the Kottler one.

par *Non-claim.* Only the constant-rate member is Kottler; nothing transfers to $\dot{H} \neq 0$. Units: H_0 is a rate and Λ' has dimension length^−2 (PC-38). Check C-Big05-62. par

A Ricci-dominated layer near r=2m

Theorem (d) shows that $\{\mathscr{D}_K > 1\}$ stays away from $r = 2m$ when $\dot{H} \neq 0$. The next result gives the rate and an explicit layer. The notation is that of Definition and Theorem : $c = 1$; t is the McVittie time, and $\dot{H} = \mathrm{d}H/\mathrm{d}t$ at the fixed time considered; $q = m/r^3$, $A = 1 - 2m/r$, $F = H^2 + \dot{H}/\sqrt{A}$; and $\mathscr{D}_K = C^2/(\mathscr{K} - C^2) = 4q^2/(H^4 + F^2)$. Both C^2 and $\mathscr{K}$ are scalars, so $\mathscr{D}_K$ does not depend on the observer. Only $\mathscr{D}_M$ uses e_0.

Theorem (An inner Ricci-dominated layer; plan P5). *At a time with $\dot{H} \neq 0$, on $r > 2m$:*

• $\lim_{r \,\mathrm{downarrow}\, 2m} \dfrac{\mathscr{D}_K(r)}{r - 2m} = \dfrac{1}{32\, m^5 \dot{H}^2}$, *for either sign of $\dot{H}$ and every H;*

• $\mathscr{D}_K(r) < 1$, *i.e. the Ricci part $\mathscr{K} - C^2$ of the Kretschmann scalar exceeds the Weyl part C^2, for*

$$2m < r < 2m + w, \qquad w = \frac{2m\,\dot{H}^2}{(H^2 + 1/(4m^2))^2}.$$

Proof. (a) Put $\delta = r - 2m$. Then $A = \delta/r$, $4q^2 \to 1/(16m^4)$, and $F^2 = \dot{H}^2 r/\delta + O(\delta^{-1/2})$, so $(H^4 + F^2)\delta \to 2m\dot{H}^2$. The ratio tends to $(1/(16m^4))/(2m\dot{H}^2)$. Computer algebra gives the same limit for both signs (C-Big05-75). (b) If $\delta < w$, then $A = \delta/r < \delta/(2m) < \dot{H}^2/(H^2 + 1/(4m^2))^2$, so $|H|/\sqrt{A} > H^2 + 1/(4m^2) \geq H^2 + 2q$, using $q < 1/(8m^2)$. Hence $|F| \geq |H|/\sqrt{A} - H^2 > 2q$, so $F^2 > 4q^2$ and $\mathscr{D}_K < 1$.

par *Non-claim.* This is not evidence for a physical shell around real black holes. At $\dot{H} \neq 0$ the prescribed metric has unbounded R and p_{tot} at $r = 2m$ (Theorem (b)), and no regular interior, matching or formation model is supplied. The layer is a statement about the prescribed comparison, and it is constant on split fibres (Theorem (e)). Check C-Big05-75. par

Corollary (The slow-expansion limit is not uniform at r=2m). *Fix $m > 0$ and $\dot{H} \neq 0$, and write $\mathscr{D}_K^{(\varepsilon)}$ for the comparison at $\dot{H} = \varepsilon$. For each $r > 2m$, $\mathscr{D}_K^{(\varepsilon)}(r) \to \mathscr{D}_K^{(0)}(r) = 2m^2/(H^4 r^6)$ as $\varepsilon \to 0$. However,*

$$\lim_{r \,\mathrm{downarrow}\, 2m} \lim_{\varepsilon \to 0} \mathscr{D}_K^{(\varepsilon)}(r) = \frac{1}{32m^4H^4}, \qquad \lim_{\varepsilon \to 0} \lim_{r \,\mathrm{downarrow}\, 2m} \mathscr{D}_K^{(\varepsilon)}(r) = 0,$$

and $\sup_{r > 2m} |\mathscr{D}_K^{(\varepsilon)} - \mathscr{D}_K^{(0)}| \geq 1/(32m^4H^4)$ for every $\varepsilon \neq 0$. If $27m^2H^2 < 1$, the Kottler condition $9m^2\Lambda_{\mathrm{eff}} < 1$ with $\Lambda_{\mathrm{eff}} = 3H^2$, then $1/(32m^4H^4) > 1$. In that case the $\dot{H} = 0$ metric is Weyl-dominated near $2m$, while every $\dot{H} \neq 0$ member is Ricci-dominated on a layer of width at least $2m\varepsilon^2/(H^2 + 1/(4m^2))^2$.

Proof. At $\varepsilon = 0$, $\mathscr{D}_K = 4q^2/(2H^4)$, which is continuous in ε at fixed r, and $q \to 1/(8m^2)$. The inner limit at $\varepsilon \neq 0$ is 0 by Theorem (a). The supremum bound follows from the two one-sided limits at $r\,\mathrm{downarrow}\, 2m$. If $27m^2H^2 < 1$, then $m^4H^4 < 1/729$, so $32m^4H^4 < 1$. The width is Theorem (b).

par *Non-claim.* Taking $\dot{H} \to 0$ first and $r\,\mathrm{downarrow}\, 2m$ first give different answers. No statement is made about

physical black holes in an expanding universe, and none about any time dependence of m. Check C-Big05-75. par

Galactic comparison hosts

The crossover radii of Theorem treat the Sun as isolated. A galactic comparison needs its own prescribed metric and declared profile; it is not a reading of the Solar-System Kottler host, it is not a fit, and it creates no new ledger host (Host A and Host B stay separate; Host C is not created). Related anisotropic halo models with further physical hypotheses are studied in [BoehmerHarko2007] (source record; not a premise); nothing from that article is imported. In this section $c = 1$.

Definition (Halo-plus-Λ host). Declare $m_b \geq 0$, $\Lambda \geq 0$ and a smooth nondecreasing halo mass function $\mathscr{M}_h \geq 0$ on $(0, \infty)$. Put $\mathscr{M} = m_b + \mathscr{M}_h + \Lambda r^3/6$, choose φ_h with $\varphi_h' = \mathscr{M}_h/r^2$, and

$$g_G = -A\,dt^2 + (1 - \frac{2\mathscr{M}}{r})^{-1}\,dr^2 + r^2\,d\Omega^2, \qquad A = 1 - \frac{2m_b}{r} - \frac{\Lambda r^2}{3} + 2\varphi_h,$$

on an annulus J where $A > 0$ and $1 - 2\mathscr{M}/r > 0$. Examples: the singular isothermal profile $\mathscr{M}_h = vr$, $v > 0$, and the NFW profile $\mathscr{M}_h = M_s\,g(r/r_s')$ with $g(x) = \ln(1 + x) - x/(1 + x)$, $M_s, r_s' > 0$.

Theorem (Galactic dominance functions on a prescribed halo host). *On Definition , with declared Λ equal to the metric parameter and $\chi \neq 0$:*

• $G^{\wedge}_{tt} = 2\mathscr{M}'/r^2$, *so* $\rho_{tot} = 2\mathscr{M}_h'/(\chi r^2)$; $G^r_{\ r} = (1 - 2\mathscr{M}/r)A'/(rA) - 2\mathscr{M}/r^3$; *the Misner–Sharp mass is* $\mathscr{M}$.

• *The Kepler reading is* $\Omega^2 = (m_b + \mathscr{M}_h(r))/r^3 - \Lambda/3$. *Declare* $\mathscr{D}_{hb} = \mathscr{M}_h/m_b$ *(halo versus central) and* $\mathscr{D}_\Lambda = \Lambda r^3/(3(m_b + \mathscr{M}_h))$ *(Λ versus mass).*

• *For* $\mathscr{M}_h = vr$: $\mathscr{D}_{hb} > 1$ *iff* $r > m_b/v$; *the Λ term of Ω^2 exceeds the halo term iff* $r > (3v/\Lambda)^{1/2}$, *and the Λ term of $\mathscr{M}$ exceeds the halo term iff* $r > (6v/\Lambda)^{1/2}$; *for* $\Lambda > 0$, $\Omega^2 = 0$ *exactly at the unique positive root of* $\Lambda r^3/3 - vr - m_b = 0$ *(Cardano), with* $\mathscr{D}_\Lambda > 1$ *beyond it.*

• *For the NFW profile and* $m_b > 0$, *the halo/central crossover* $g(r/r_s') = m_b/M_s$ *has exactly one root, and for* $\Lambda > 0$ *the turnaround* $(m_b + \mathscr{M}_h)/r^3 = \Lambda/3$ *has exactly one root; neither is elementary in general.*

• *If* $\mathrm{Ric}[g_G] = \Lambda' g_G$ *on an open subinterval for some* Λ', *then* $\mathscr{M}_h = c_0 + (\Lambda' - \Lambda)r^3/6$ *there. The SIS and NFW profiles are of this form on no subinterval, so these hosts are not Kottler hosts, and dominance there is a change of metric labels, not a relabelling of a Kottler exterior.*

• *All readings are functions of the declared labels and are constant on split fibres; wherever* $T_{tot} \equiv 0$ *the split is not selected.*

Proof. (a),(b) Direct computation for a general static spherical metric with $\varphi_h' = \mathscr{M}_h/r^2$ substituted (C-Big05-43); the Kepler reading is $\Omega^2 = A'/(2r)$; the Misner–Sharp mass is $\frac{r}{2}(1 - g^{rr})$. $\mathscr{M}' = \mathscr{M}_h' + \Lambda r^2/2$ gives ρ_{tot}. (c) Compare $\Lambda/3$ with v/r^2, and $\Lambda r^3/6$ with vr; the cubic $h(r) = \Lambda r^3/3 - vr - m_b$ has $h(0) \leq 0$, $h'' > 0$ on $r > 0$ and $h \to \infty$, so it has one positive root, and Ω^2 has the sign of $-h$. (d) $g'(x) = x/(1 + x)^2 > 0$ and $g \to \infty$. For the turnaround, $((m_b + \mathscr{M}_h)/r^3)' < 0$ iff $r\mathscr{M}_h' < 3(m_b + \mathscr{M}_h)$, which holds because $h(x) = g - xg'/3$ has $h(0) = 0$ and $h'(x) = x(1 + 3x)/(3(1 + x)^3) > 0$; the left side decreases from ∞ to 0. (e) $\mathrm{Ric} = \Lambda' g$ gives $G = -\Lambda' g$, so $2\mathscr{M}'/r^2 = \Lambda'$ and $\mathscr{M} = m_0 + \Lambda' r^3/6$. On no interval is vr of the form $c_0 + kr^3$ (its derivative v is not $3kr^2$), and $M_s g(r/r_s')$ is real-analytic with non-constant third derivative (C-Big05-43). (f) Lemma .

par *Non-claim.* The profile is declared, not derived or fitted; the radial pressure of this prescription is generally nonzero, and no species, distribution function, stability or matching is asserted. The galactic host is separate from the Kottler host, as the two prescribed hosts of [I-D] are separate (PC-22). Check C-Big05-43. par

Definition (Zero-radial-pressure halo; from the v2 draft). Declare $m_b \geq 0$, $m_h > 0$, $a > 0$, $\lambda \geq 0$,

$\mu_{\mathrm{h}} = m_{\mathrm{h}} r^3/(r^2+a^2)^{3/2}$, $\mu = m_{\mathrm{b}} + \mu_{\mathrm{h}}$, $B = 1 - 2\mu/r - \lambda r^2/3$. On an annulus JSubset $\{B > 0\}$ declare $r_* \in J$, $N_* > 0$, $\Phi(r) = \ln N_* + \int_{r_*}^{r} \frac{\mu(x)/x^2 - \lambda x/3}{B(x)}\,\mathrm{d}x$, and

$$g_{\mathrm{h}} = -e^{2\Phi}\,\mathrm{d}t^2 + B^{-1}\,\mathrm{d}r^2 + r^2\,\mathrm{d}\Omega^2.$$

Proposition (Plummer halo stresses; the v2 draft's halo theorem). *With declared $\Lambda = \lambda$, in the static tetrad of*

$$\rho_{\mathrm{tot}} = \frac{2\mu'}{\chi r^2}, \qquad p_r = 0, \qquad p_\perp = \frac{\mu'\Phi'}{\chi r}, \qquad \mu' = \frac{3m_{\mathrm{h}}a^2r^2}{(r^2+a^2)^{5/2}} > 0.$$

A nonzero timelike circular geodesic exists exactly where $0 < r\Phi' < 1$, with

$$\Omega^2 = e^{2\Phi}\frac{\Phi'}{r}, \qquad v_{\mathrm{loc}}^2 = r\Phi' = \frac{\mu/r - \lambda r^2/3}{B},$$

and a static observer has outward acceleration

$$\hat{a}^{r}_{\mathrm{stat}} = \frac{1}{\sqrt{B}}\left(\frac{m_{\mathrm{b}} + \mu_{\mathrm{h}}}{r^2} - \frac{\lambda r}{3}\right).$$

On a circularly admissible region with $\chi > 0$, $0 < p_\perp = (r\Phi'/2)\rho_{\mathrm{tot}} < \rho_{\mathrm{tot}}/2$, so the total obeys the WEC and the dominant energy condition; it is not dust.

Proof. For $-e^{2\Phi}\,\mathrm{d}t^2 + B^{-1}\,\mathrm{d}r^2 + r^2\,\mathrm{d}\Omega^2$: $G^{\wedge\wedge}_{00} = (1 - B - rB')/r^2$, $G^{\wedge\wedge}_{11} = (B-1)/r^2 + 2B\Phi'/r$, $G^{\wedge\wedge}_{22} = B(\Phi'' + \Phi'\wedge 2 + \Phi'/r) + \frac{B'}{2}(\Phi' + 1/r)$; substituting B and Φ' gives $G^{\wedge\wedge}_{00} = 2\mu'/r^2 + \lambda$, $G^{\wedge\wedge}_{11} = -\lambda$ and $G^{\wedge\wedge}_{22} = -\lambda + \mu'\Phi'/r$ (C-Big05-44). The radial geodesic equation at constant r gives Ω^2; the local speed is $r\Omega e^{-\Phi}$; the static observer has $\nabla_U U = B\Phi'\partial_r$, of physical size $\sqrt{B}\,\Phi'$.

par *Non-claim.* The labels m_{b} and ``halo'' identify no baryonic source and no species; the comparison is prescribed, not fitted. Check C-Big05-44. par

Corollary (Exact profile crossovers; from the v2 draft). *If $m_{\mathrm{h}} > m_{\mathrm{b}} > 0$, the unique halo/central crossover is $r_{\mathrm{hb}} = a\,k^{1/3}/\sqrt{1-k^{2/3}}$, $k = m_{\mathrm{b}}/m_{\mathrm{h}}$, and $\mu_{\mathrm{h}} > m_{\mathrm{b}}$ exactly for $r > r_{\mathrm{hb}}$; if $m_{\mathrm{h}} \le m_{\mathrm{b}}$ there is none. For $\lambda > 0$ the equation*

$$\frac{m_{\mathrm{b}}}{r^3} + \frac{m_{\mathrm{h}}}{(r^2+a^2)^{3/2}} = \frac{\lambda}{3}$$

has exactly one positive root r_λ, and the λ term exceeds the mass terms in exactly for $r > r_\lambda$.

Proof. $r/\sqrt{r^2+a^2}$ increases strictly from 0 to 1, and $\mu_{\mathrm{h}} < m_{\mathrm{h}}$; the left side of decreases strictly from ∞ to 0.

par *Non-claim.* The crossovers apply on the prescribed annulus only; a crossover outside it is not an available reading. Since $\mu' > 0$, $G + \lambda g \neq 0$ on the annulus: this is not a Kottler host (the argument of Theorem (e) applies with $\mu + \lambda r^3/6$ in place of $\mathscr{M}$). Check C-Big05-44. par

Theorem (Halo realization by an anisotropic total; plan item #12). *Let μ be any smooth function with $\mu' > 0$ on an interval, $B = 1 - 2\mu/r - \lambda r^2/3$, $\Phi' = (\mu/r^2 - \lambda r/3)/B$, and let J be an annulus with $B > 0$; declare $\Lambda = \lambda$ and $\chi > 0$. In the static tetrad of the total is conserved and*

$$\rho = \frac{2\mu'}{\chi r^2} > 0, \qquad p_r = 0, \qquad p_\perp = \frac{r\Phi'}{2}\rho.$$

On J: the NEC and the WEC hold iff $r\Phi' \ge -2$, i.e. $3\mu/r + \lambda r^2 \le 2$; the DEC holds iff $|r\Phi'| \le 2$, i.e. moreover $5\mu/r + \lambda r^2/3 \le 2$; and nonzero circular geodesics exist iff $0 < r\Phi' < 1$, i.e. $\lambda r^3 < 3\mu < r$. On the circularly admissible region all three conditions hold. For the Plummer μ of Definition , the Misner–Sharp mass is $\mu + \lambda r^3/6$, and $\mu \to m_{\mathrm{b}} + m_{\mathrm{h}}$ as $r \to \infty$; for $\lambda = 0$ the region $\{B > 0\}$ contains (r_1, ∞) for r_1 large, with finite total mass

$m_b + m_h$, *while for* $\lambda > 0$ *every annulus with* $B > 0$ *is bounded.*

Proof. Proposition 's frame formulas hold for every μ (C-Big05-63); conservation by Lemma . With $\rho > 0$, $p_r = 0$: NEC and WEC reduce to $\rho + p_\perp \geq 0$, DEC to $|p_\perp| \leq \rho$. Multiply the inequalities for $r\Phi'$ by $B > 0$: $r\Phi' \geq -2 \Leftrightarrow 2 - 3\mu/r - \lambda r^2 \geq 0$; $r\Phi' \leq 2 \Leftrightarrow 2 - 5\mu/r - \lambda r^2/3 \geq 0$; $r\Phi' > 0 \Leftrightarrow 3\mu > \lambda r^3$; $r\Phi' < 1 \Leftrightarrow 3\mu < r$. The circular-orbit criterion is that of Proposition . $\frac{r}{2}(1 - B) = \mu + \lambda r^3/6$; $B \to 1$ for $\lambda = 0$ and $B \to -\infty$ for $\lambda > 0$.

par *Non-claim.* A flat or slowly varying rotation curve is compatible with a total that is not dust ($p_\perp > 0$); this realizes the profile by a total source, not by a species, and does not split it (Theorem). The plan's region $0 < r\Phi' < 1$ is sufficient, not necessary, for the energy conditions (PC-39). Check C-Big05-63. par

Theorem (Stability of circular geodesics on static spherical hosts; plan item #13). *Let* $g = -e^{2\Phi}\,\mathrm{d}t^2 + B^{-1}\,\mathrm{d}r^2 + r^2\,\mathrm{d}\Omega^2$ *(*$c = 1$*) with* $B > 0$*, and let* r_0 *carry a circular timelike geodesic,* $0 < r_0\Phi'(r_0) < 1$*. With* $V = e^{2\Phi}(1 + L^2/r^2)$*, radial motion obeys* $\dot{r}^2 = Be^{-2\Phi}(E^2 - V)$*, the circular orbit has* $L^2 = r^3\Phi'/(1 - r\Phi')$*, and*

$$V''(r_0) = \frac{2e^{2\Phi}}{1 - r\Phi'}\left(\Phi'' - 2\Phi'^2 + \frac{3\Phi'}{r}\right)\Big|_{r_0}.$$

The orbit is linearly stable ($V'' > 0$*) iff* $S := \Phi'' - 2\Phi'^2 + 3\Phi'/r > 0$ *at* r_0*, equivalently iff* $\mathrm{d}L^2/\mathrm{d}r > 0$ *along the circular family, equivalently*

$$\frac{\mathrm{d}\ln\Omega^2}{\mathrm{d}\ln r} > -4\,(1 - r\Phi'), \qquad \Omega^2 = e^{2\Phi}\Phi'/r,$$

a relativistic Rayleigh criterion; it is not a sign condition on $\mathrm{d}\Omega^2/\mathrm{d}r$*. For* $\Phi' = (\mu/r^2 - \lambda r/3)/B$*,*

$$S = \frac{3\,Q(r)}{r^2(\lambda r^3 - 3r + 6\mu)^2}, \qquad Q = 3r^2\mu' + 3\mu(r - 6\mu) + \lambda r^3(15\mu - 3r\mu' - 4r),$$

so stability is $Q(r_0) > 0$*. For the Plummer* μ *of Definition this is the explicit inequality, with* $s = r_0^2 + a^2$*,*

$$\frac{9m_h a^2 r_0^4}{s^{5/2}} + 3\mu_0(r_0 - 6\mu_0) + \lambda r_0^3\left(15\mu_0 - \frac{9m_h a^2 r_0^3}{s^{5/2}} - 4r_0\right) > 0, \qquad \mu_0 = m_b + \frac{m_h r_0^3}{s^{3/2}}.$$

For $\mu = m$*,* $\lambda = 0$ *it gives* $r_0 > 6m$*; for* $\mu = m$*,* $\lambda > 0$ *the Kottler condition* $m(r_0 - 6m) > \lambda r_0^3(4r_0 - 15m)/3$*.*

Proof. $E = e^{2\Phi}\dot{t}$, $L = r^2\dot{\varphi}$ and the normalization give the radial equation. $V' = 0$ gives L^2; differentiating $V' = e^{2\Phi}X$ with $X(r_0) = 0$ gives $V'' = e^{2\Phi}X'$, and substituting L^2 yields the formula (C-Big05-64). Since $Be^{-2\Phi} > 0$, small radial perturbations oscillate iff $V'' > 0$. The L^2 and Ω^2 forms follow from $\mathrm{d}L^2/\mathrm{d}r = r^3S/(1 - r\Phi')^2$ and $\mathrm{d}\ln\Omega^2/\mathrm{d}r = 2\Phi' + \Phi''/\Phi' - 1/r = S/\Phi' - 4(1 - r\Phi')/r$. The formula for S is exact algebra; $\mu' = 3m_h a^2 r^2/s^{5/2}$ for Plummer.

par *Non-claim.* Linear stability of geodesics on a prescribed metric; no dynamics of the source, no fit to rotation curves, and $V'' = 0$ (marginal) is not decided (PC-40). Check C-Big05-64. par

Contract-relative dominance

Theorem (Dominance is relative to a declared contract; plan item #16). *A geometric dominance statement ``* $X[g] > Y[g]$*'' is a predicate* $P_{\mathscr{C}}(g)$ *only after a contract* $\mathscr{C} = (\mathscr{M}, \mathscr{O}, \mathscr{U}, \mathrm{preceq}, \mathscr{R}_{\mathrm{ef}}, \mathscr{D})$ *is declared: metric family, observer, domain, ordering or norm, reference subtraction, admissibility. For each component there are two contracts that differ only in it and give different truth values on one metric. With* $m, \Lambda > 0$*,* $9m^2\Lambda < 1$*,* $c = 1$*, on* $K_{m,\Lambda}$*, and ``*Λ *dominates* m*'' meaning that the part of the reading carried by* Λ *exceeds the part carried by* m *in absolute value (for* $\mathscr{K}$*: the Ricci part* $8\Lambda^2/3$ *against the Weyl part* $48m^2/r^6$*):*

• *Reading. Kepler, Kretschmann and radial-tide readings give the inequivalent predicates* $r > r_s$*,* $r > r_K$*,* $r > r_t$*,*

with $r_s < r_K < r_t$ (Theorem).

• *Ordering. For the static tidal tensor* $\mathrm{diag}(2q, -q, -q) + \frac{\Lambda}{3}I$*, comparing radial eigenvalues gives* $r > r_t = (6m/\Lambda)^{1/3}$*, comparing Frobenius norms gives* $r > r_{\mathrm{F}} = (3\sqrt{2}\, m/\Lambda)^{1/3} < r_t$.

• *Observer. Radial boosts leave Kottler tides unchanged, but for an observer moving tangentially with speed v the radial tidal eigenvalue is* $\frac{\Lambda}{3} + q\frac{2+v^2}{1-v^2}$*, so the radial-tide predicate is* $r^3 > \frac{6m}{\Lambda} \cdot \frac{1+v^2/2}{1-v^2}$*. On a McVittie host with* $\dot{H} \neq 0$ *already a radial boost by v changes the transverse tide to* $-q + H^2 + d/(1-v^2)$.

• *Domain. ``$\Lambda$ dominates the Kepler reading at $r_2$'' and ``on $[r_1, r_2]$'' differ when $r_1 < r_s < r_2$.*

• *Reference. The radar comparison of Theorem (a): ``the tested metric delays more than the reference'' holds against Minkowski and fails against* $K_{3/2,0}$.

• *Admissibility. Read as a derivative* $\mathscr{B}(r) = m/r^3 - \Lambda/3$*, Λ dominates for $r > r_s$; read as the squared frequency of a circular geodesic, admissible only on* $(3m, r_s)$ *(Proposition), the mass term dominates at every admissible radius. Every* $P_{\mathscr{C}}$ *is split-blind (Theorem).*

Proof. (a) Theorem (b). (b) The Weyl part has Frobenius norm $\sqrt{6}\, q$ and the Λ part $\Lambda/\sqrt{3}$; $\Lambda/\sqrt{3} > \sqrt{6}\, m/r^3 \Leftrightarrow r^3 > 3\sqrt{2}\, m/\Lambda$, and $3\sqrt{2} < 6$. (c) Boost the frame curvature of Theorem (Kottler: $F = H^2 = \Lambda/3$) and compute $-R(\xi, u', \eta, u')$ (C-Big05-67). (d) The Kepler predicate at r is $r > r_s$. (e) Theorem (a). (f) Proposition : on $(3m, r_s)$, $m/r^3 > \Lambda/3$.

par *Non-claim.* This makes the H-geom distinction precise: ``dark matter dominates curvature'' is incomplete until the reading and the comparison protocol are declared, and no contract is preferred here (PC-43). Check C-Big05-67. par

From non-selection to predictive closure

The core of this sheet separates two questions: what follows from a prescribed geometry, and what added supply would select a geometry or a split. This section asks a third question: which forecasts become available, and at what price in added supply. Each forecast below names the theorem that yields it, the supply it depends on and the observation that could falsify it. None of them selects a split (Proposition).

Four levels

toprule Level Supplied Becomes testable Status here

midrule Core (unchanged) Prescribed hosts; declared Λ, χ; observer, clock and reference contracts Geometric readings; attribution limits (Theorem); future non-determination (Theorem) Proved; ledger unchanged

Geometric prediction package FLRW geometry; comoving emitter and observer; null rays; observer proper time (Definition) Distance–drift consistency and curvature constancy (Theorem) Proved; no closure used

Optional evolution package The declared closure of Hypothesis with (n, H_∞) and initial data; for numbers, a documentary benchmark $N(z) \equiv n$; acceleration transition, drift curve and horizon jointly (Theorems ,) Conditional on the hypothesis; the table is a conditional calculation, not a measurement

Dark-sector package Constitutive or split-coupled laws: equations of state per piece, perturbation laws, couplings, initial perturbation data Species-sensitive or clustering predictions Requirements only (Proposition); not constructed

bottomrule

The first level is the sheet as it stood in version 2, together with Theorems and . Nothing in the other three levels is a premise of any core result.

Geometric prediction package

Definition (Drift and distance contract). Prescribe $g = -c^2\, \mathrm{d}t^2 + a(t)^2 \gamma_K$ on an interval of t, where γ_K has constant

sectional curvature K, $a > 0$ is C^2 and $H = \dot{a}/a > 0$. Observer and emitter are comoving, and the clock is the observer's proper time t_0, which equals the cosmic time. Photons travel on past-directed radial null geodesics. For an emitter seen at t_0 with emission time t_e: $1 + z = a(t_0)/a(t_e)$; $H_0 = H(t_0)$; $H(z) = H(t_e)$; $\dot{z} = \mathrm{d}z/\mathrm{d}t_0$ for the same emitter; $D(z) = (1 + z)D_A(z)$, the transverse comoving distance at t_0, where D_A is the angular-diameter distance; and $\Omega_k = -Kc^2/(a(t_0)^2H_0^2)$, which is dimensionless.

Theorem (Distance–drift consistency; plan P2). *Under Definition :*

• $\dot{z} = (1 + z)H_0 - H(z)$;

• $D'(0) = c/H_0$; *if* $K = 0$, *then* $D'(z) = c/H(z)$, *hence* $[(1 + z)H_0 - \dot{z}(z)]D'(z) = c$;

• *for every* K *and* $z > 0$,

$$\widehat{\Omega}_k(z) := \frac{[H(z)D'(z)]^2 - c^2}{H_0^2 D(z)^2} = \Omega_k, \qquad ([(1 + z)H_0 - \dot{z}]D')^2 - c^2 = \Omega_k H_0^2 D^2,$$

with $H_0 = c/D'(0)$, *so distances and drifts alone test the host family;*

• $\frac{\mathrm{d}}{\mathrm{d}z}[\frac{\dot{z}}{1+z}] = \frac{(\ddot{a}/a)(t_e)}{(1+z)^2H(z)}$. *The spectroscopic shift* $\Delta v = c\,\dot{z}\,\Delta t_0/(1 + z) + O(\Delta t_0^2)$ *therefore increases with z over accelerating emission epochs and decreases over decelerating ones. Its stationary points are exactly the acceleration transitions, and* $\Delta v > 0$ *for small* $z > 0$ *iff the deceleration parameter* q_0 *is negative.*

Proof. (a) Successive wavefronts between the same comoving pair satisfy $\int_{t_e}^{t_0} \mathrm{d}t/a = \text{const}$, so $\mathrm{d}t_e/\mathrm{d}t_0 = a(t_e)/a(t_0)$. Differentiating $1 + z = a(t_0)/a(t_e)$ gives $(1 + z)H_0 - H(t_e)$. (b), (c) With $\chi_c(z) = c\int_0^z \mathrm{d}\zeta/H(\zeta)$, the comoving coordinate distance scaled by $a(t_0)$, one has $D = S_K(\chi_c)$, where S_K is the identity for $K = 0$, $\sin(\sqrt{k}\chi_c)/\sqrt{k}$ for $k = K/a(t_0)^2 > 0$ and sinh for $k < 0$. Then $HD' = c\,C_K(\chi_c)$ with $C_K \in \{1, \cos, \cosh\}$, and $C_K^2 - 1 = -kS_K^2$. Substituting (a) gives the drift form; $D'(0) = c/H_0$ because $\chi_c'(0) = c/H_0$. (d) $H(z)/(1 + z) = \dot{a}(t_e)/a(t_0)$, and $\mathrm{d}t_e/\mathrm{d}z = -1/((1 + z)H(z))$. To first order, $\Delta z = z\Delta t_0$, and $\Delta v = c\Delta z/(1 + z)$. At $z = 0$ the derivative is $(\ddot{a}/a)(t_0)/H_0 = -q_0H_0$. All identities are confirmed by computer algebra, for every $a(t)$ and both signs of K (C-Big05-71).

par *Non-claim.* The identities are FLRW kinematics. The drift as a direct expansion probe is [Loeb1998] (its equation (3), whose Ω_R is the curvature parameter), and the curvature form in (c) is equation (2) of [Clarkson2008] in units $c = 1$ (source record; not a premise). Satisfying them does not prove FLRW geometry, and it identifies no dark sector. A robust failure, after measurement and astrophysical effects, would challenge the joint geometric and observational contract, not an assumed dark fraction. Part (d) is added here. Check C-Big05-71. par

Optional evolution package

Hypothesis (Declared closure; optional package, outside the ledger). On a flat host of Definition ($K = 0$), with $a(t_0) = 1$, the supplied law is

$$\dot{H} = -\frac{n}{2}(H^2 - H_\infty^2), \qquad n > 0, \quad H_\infty > 0,$$

together with initial data H_0. The numbers n, H_∞ and H_0 are added supplies, not consequences of operational darkness or of any host datum. This hypothesis is optional and separately declared. It is not a premise of this sheet: no result outside this subsection, Theorem and Documentary record uses it, and it adds no premise to the core or to the standing ledger.

Theorem (Closure: exact expansion and an observable diagnostic; plan P3). *Under Hypothesis put* $B = H_\infty^2$, $A = H_0^2 - B$, $x = 1 + z$, $Y(x) = H^2$ *and, where* $Y' \neq 0$, $N = 1 + xY''/Y'$.

• $H^2 = B + Aa^{-n} = B + Ax^n$. *Conversely, if* $H > 0$ *and* $H^2 = B + Aa^{-n}$ *with* $B > 0$, *then the closure holds with* $H_\infty = \sqrt{B}$.

• *Branches. If* $H_0 > H_\infty$, *then* $H = H_\infty \coth(\frac{n}{2}H_\infty(t - t_b))$ *and* $a = (A/B)^{1/n}\sinh^{2/n}(\frac{n}{2}H_\infty(t - t_b))$ *for* $t > t_b$, *with* $t_0 - t_b = \frac{2}{nH_\infty}\operatorname{arcoth}(H_0/H_\infty)$. *The scale factor tends to* 0 *and* H *to* ∞ *as* $t$downarrow t_b, *and* $H < 0$. *If* $H_0 = H_\infty$, *then* $H \equiv H_\infty$: *de Sitter, for every n. If* $H_0 < H_\infty$, *then* $H = H_\infty \tanh(\frac{n}{2}H_\infty(t - t_m))$ *and* $a = (|A|/B)^{1/n}\cosh^{2/n}(\frac{n}{2}H_\infty(t - t_m))$. *The branch expands only for* $t > t_m$, *from a bounce with* $H = 0$, *and it covers* $0 \le z < (H_\infty^2/(H_\infty^2 - H_0^2))^{1/n} - 1$. *There* $\dot{H} > 0$, *so the NEC of the effective total fails for every declared* Λ.

• *Diagnostic. If* $A \neq 0$, *then* $N \equiv n$ *on the whole domain. If* $A = 0$, *then* $Y' \equiv 0$, N *is undefined and n is not identified by the expansion history. Conversely, if* $Y \in C^2$ *with* $Y' \neq 0$ *on an interval J and* $N \equiv n$ *on J, then* $Y = \beta + \alpha x^n$ *on J with* $\alpha \neq 0$. *This is the closure with* $H_\infty^2 = \beta$ *iff* $\beta > 0$.

• *Relation to Om. Let* $Om(z) = (Y/H_0^2 - 1)/(x^3 - 1)$ *for* $z > 0$. *On an interval* $J \subset (0, \infty)$ *of z,* $Om \equiv \Omega$ *iff* $Y = H_0^2[(1 - \Omega) + \Omega x^3]$ *on J. Hence* $Om \equiv \Omega \neq 0$ *implies* $N \equiv 3$. *Conversely,* $N \equiv 3$ *on J gives* $Y = \beta + \alpha x^3$, *and then Om is constant on J iff* $\beta + \alpha = H_0^2$. *This holds automatically when the cubic form holds on an interval reaching* $z = 0$. *Neither statement uses flatness, since both concern the function* $H(z)$ *alone. Flatness enters through the reconstruction* $D' = c/H$ *(Theorem (b)) and through the reading of* β, α *as* $H_0^2\Omega_\Lambda, H_0^2\Omega_{\mathrm{m}}$. *For* $Y = H_0^2(\Omega_{\mathrm{m}}x^3 + \Omega_k x^2 + \Omega_\Lambda)$, $N = (9\Omega_{\mathrm{m}}x + 4\Omega_k)/(3\Omega_{\mathrm{m}}x + 2\Omega_k)$, *which is constant iff* $\Omega_k\Omega_{\mathrm{m}} = 0$.

• *What the closure says about the total. With declared* $\Lambda = 3H_\infty^2$, *the effective total is a perfect fluid with* $\chi\rho = 3Aa^{-n}$ *and* $p = (n/3 - 1)\rho$. *With any other declared* Λ, *it is that fluid plus the vacuum-type term* $(\Lambda - 3H_\infty^2)g/\chi$. *For* $n = 3$ *and* $\Lambda = 3H_\infty^2$ *it is dust.*

Proof. (a) $\dot{a} = aH$ gives $\mathrm{d}(H^2)/\mathrm{d}\ln a = 2\dot{H} = -n(H^2 - B)$; integrate. The converse is differentiation. (b) The displayed functions solve $\dot{H} = -\frac{n}{2}(H^2 - H_\infty^2)$, and $\dot{a}/a = H$ holds for them. Uniqueness for the ODE gives the branches; $H^2 = B + Aa^{-n}$ fixes the amplitudes. The NEC statement is Theorem (a). (c) $Y' = nAx^{n-1}$ and $Y'' = n(n-1)Ax^{n-2}$. The converse solves $xY'' = (n-1)Y'$. (d) Solve for Y, then use (c) with $n = 3$. The curved N is a direct computation. (e) $\chi\rho = 3H^2 - \Lambda$ and $\chi p = -2\dot{H} - 3H^2 + \Lambda$. Insert (a) and the closure (C-Big05-72).
par *Non-claim.* $N \equiv 3$ is consistent with the flat matter-plus-constant-vacuum background expansion, with radiation neglected. A constant $N \neq 3$ is consistent with the wider family, and a varying N rejects the constant-n closure. Neither N nor *Om* identifies microscopic dark-energy physics or a split. *Om* is the null diagnostic of [Sahni2008], its equations (2.5) and (2.8) (source record; not a premise). Differentiating noisy data is unstable: a practical analysis fits the integrated law (a) and propagates uncertainties. Part (e) shows the closure is a condition on the total, not on its pieces. Check C-Big05-72. par

Theorem (Acceleration, drift and horizon follow jointly; plan P4). *Under Hypothesis , on the branch* $H_0 > H_\infty$ *(*$A > 0$*):*

• $\ddot{a}/a = H^2 + \dot{H} = B + (1 - \frac{n}{2})Aa^{-n}$.

• *If* $n > 2$, *there is exactly one deceleration-to-acceleration transition, at* $a_{\mathrm{acc}} = [(n-2)A/(2B)]^{1/n}$, *i.e.* $z_{\mathrm{acc}} = [2B/((n-2)A)]^{1/n} - 1$. *If* $0 < n \le 2$, *the expanding branch accelerates throughout. On the branch* $H_0 < H_\infty$ *it also accelerates throughout, for every n.*

• $\dot{z} = (1+z)H_0 - \sqrt{B + A(1+z)^n}$ *and* $\Delta v = c\Delta t_0[H_0 - \sqrt{B + A(1+z)^n}/(1+z)] + O(\Delta t_0^2)$. *Suppose* $n > 2$ *and* $z_{\mathrm{acc}} > 0$. *Then* Δv *rises on* $(0, z_{\mathrm{acc}})$, *is maximal at* z_{acc}, *and has exactly one zero* $z_* > z_{\mathrm{acc}}$, *after which it tends to* $-\infty$. *If* $n > 2$

and $z_{\mathrm{acc}} \le 0$*, or if* $n \le 2$*, there is no zero with* $z > 0$*. For* $n = 3$*, with* $\Omega_{\mathrm{m}} = A/H_0^2$ *and* $\Omega_\Lambda = B/H_0^2$*,*

$$1 + z_{\mathrm{acc}} = \left(\frac{2\Omega_\Lambda}{\Omega_{\mathrm{m}}}\right)^{1/3}, \qquad 1 + z_* = \frac{\Omega_\Lambda + \sqrt{\Omega_\Lambda^2 + 4\Omega_{\mathrm{m}}\Omega_\Lambda}}{2\Omega_{\mathrm{m}}}.$$

• *If the closure holds for all* $t \ge t_0$*, then H*downarrow H_∞ *and* $a \sim Ce^{H_\infty t}$*. The event horizon* $R_e(t) = c\,a(t)\int_t^\infty \mathrm{d}s/a(s)$ *is finite, satisfies* $R_e(t) < c/H_\infty$*, and tends to* c/H_∞*. There is no finite-time Big Rip:* $\int^\infty \mathrm{d}a/(a\sqrt{B + Aa^{-n}})$ *diverges, and* H *and* $\dot{H}$ *stay bounded on* $[t_0, \infty)$*.*

Proof. (a) Theorem (a) and the closure. (b) With $A > 0$, $B > 0$, the right side of (a) is increasing in a when $n > 2$, and it vanishes once. For $n \le 2$ both terms are ≥ 0 and $B > 0$. On the branch $A < 0$, $-B \le Aa^{-n} < 0$, so $\ddot{a}/a \ge \frac{n}{2}B > 0$ for $n < 2$, and $\ddot{a}/a \ge B > 0$ for $n \ge 2$. (c) Theorem (a),(d). Since $\Delta v(0) = 0$, the sign pattern of $\ddot{a}$ gives the monotonicity. For $n > 2$, $\sqrt{Ax^n}/x \to \infty$. For $n < 2$, $\Delta v \to c\Delta t_0 H_0 > 0$; for $n = 2$, $\Delta v \to c\Delta t_0(H_0 - \sqrt{A}) > 0$. For $n = 3$, $x^2 = \Omega_\Lambda + \Omega_{\mathrm{m}}x^3$ factors as $(x-1)(\Omega_{\mathrm{m}}x^2 - \Omega_\Lambda x - \Omega_\Lambda) = 0$, since $\Omega_{\mathrm{m}} + \Omega_\Lambda = 1$. (d) $\dot{H} < 0$ and $H > H_\infty$. Then $R_e(t) = c\,a\int_a^\infty \mathrm{d}a'/(a'\text{^}2H(a'))$ $< c\,a\int_a^\infty \mathrm{d}a'/(a'\text{^}2H_\infty) = c/H_\infty$, and l'Hôpital gives the limit c/H_∞. For $a \ge 1$, $H \le H_0$, so $t - t_0 \ge H_0^{-1}\ln a \to \infty$. Checks: C-Big05-73.

par *Non-claim.* The future-horizon conclusion is only as strong as the assumption that the closure continues into the future. By Theorem , no amount of past or present data establishes that continuation. One parameter set must satisfy (a)–(d) and Theorem (c) at once, and fitting each separately would discard that content. The maximum of Δv at z_{acc} (Theorem (d)) is a closure-free cross-check. The drift programme and its difficulties are in [Liske2008] (source record; not a premise); no number is taken from it. Check C-Big05-73. par

Documentary record (Conditional forecasts at the documentary benchmark). *Conditional calculations, not measurements and not predictions of this sheet's core.* Take Hypothesis with $n = 3$, and the documentary inputs of Documentary record : $\Omega_{\mathrm{m}} = 0.3153$, $\Omega_\Lambda = 0.6847$, $H_0 = 67.36\ \mathrm{km\,s^{-1}\,Mpc^{-1}}$. These are the Planck 2018 TT,TE,EE+lowE+lensing values [Planck2018] (documentary record; not a premise), and the parameter inference behind them itself assumes a cosmological model. Then $A = \Omega_{\mathrm{m}}H_0^2$ and $B = \Omega_\Lambda H_0^2$, and $\Omega_{\mathrm{m}} + \Omega_\Lambda = 1$: radiation is neglected. Constants: $c = 299\,792\,458\ \mathrm{m\,s^{-1}}$; 1 Mpc $= 10^6 \cdot 648000/\pi$ AU $= 3.0856775814913673 \times 10^{22}$ m; Julian year $= 31\,557\,600$ s; 1 ly $= c \times$Julian year $= 9.4607304725808 \times 10^{15}$ m; $\Delta t_0 = 10$ Julian years. Hence $H_0 = 2.182989 \times 10^{-18}\ \mathrm{s^{-1}}$. toprule Quantity (conditional on the closure) Value

midrule Acceleration-transition redshift z_{acc} 0.6316

Nonzero redshift with $\dot{z} = 0$, z_* 1.9162

Δv at $z = 1$, $\Delta t_0 = 10$ yr $+2.160\ \mathrm{cm\,s^{-1}}$

Δv at $z = 4$, $\Delta t_0 = 10$ yr $-5.503\ \mathrm{cm\,s^{-1}}$

Maximum of Δv (at $z = z_{\mathrm{acc}}$), $\Delta t_0 = 10$ yr $+2.511\ \mathrm{cm\,s^{-1}}$

Asymptotic event-horizon radius c/H_∞ 17.543 Gly (5.3786 Gpc)

Present event-horizon radius $R_e(t_0)$ 16.691 Gly

Time since $a \to 0$ on the closure branch, $t_0 - t_b$ 13.80 Gyr

bottomrule The plan's ``$z_{\mathrm{acc}} \approx 0.632$" rounds 0.631556. Its $z_* \approx 1.916$, +2.16, −5.50 and 17.54 are confirmed. The alternative value $z_* \approx 2.09$ is the same formula at the rounded parameters $(\Omega_{\mathrm{m}}, \Omega_\Lambda) = (0.3, 0.7)$, which give $z_* = 2.0888$; at $(0.31, 0.69)$ it is 1.9742. No definition evaluated at the benchmark gives 2.09 (PC-51). Radiation

sensitivity, for illustration only: a flat radiation term of density parameter 10^{-4}, taken from Ω_Λ, would move z_* to 1.9130, z_{acc} to 0.6309 and $\Delta v(1)$ to $+2.156\ \mathrm{cm\,s^{-1}}$. The value 10^{-4} is a probe, not a sourced parameter. Every entry is recomputed in C-Big05-74.

Expansion forecasts do not identify the source decomposition

Proposition (Forecasts are split-blind; plan S 6). *Every quantity of Theorems , , , and of Documentary record is a function of g and of declared contracts and constants. These quantities are z, D, $\widehat{\Omega}_k$, N, Om, z_{acc}, z_*, Δv, R_e and R_*. Each is therefore constant on the compatible split fibre over its host. The closure is a condition on g alone, so restricting to closure hosts shrinks no fibre. Wherever $T_{\mathrm{tot}} \equiv 0$ on a compact set, every dominance target of Definition stays non-selected, even if every forecast succeeds. In particular, with $n = 3$ and declared $\Lambda = 3H_\infty^2$, the total is dust (Theorem (e)), and its split into ordinary and dark dust is not selected.*

Proof. Theorem (a),(b) and Theorem . For the dust total, $\sigma_s = (sT_{\mathrm{tot}}, (1-s)T_{\mathrm{tot}}, 0)$ are positive dust pieces with the same data.

par *Non-claim.* Predicting expansion is not identifying its source decomposition. This is a corollary of the central theorem, not a new selection result. Check C-Big05-76. par

Proposition (What a dark-sector package must supply). *A target that varies on a split fibre, such as a dark fraction, a dominance indicator or $\mathscr{R}$, becomes identifiable only after one of two supplies. Either a split-coupled observation separates the fibre (Theorem), or a constitutive law is declared on whose intersection with the fibre the target is constant (Theorem (c)). Background expansion data, including everything in Section and Section , are neither. Admissible examples of such supply are: an equation of state for each piece; a perturbation evolution law; a coupling of the dark piece to baryons or photons; a clustering or sound-speed prescription; and initial perturbation data. With such a law, for example $\mathscr{L}_\beta$ of Theorem (d), the split is fixed by the declaration, not derived.*

Proof. Theorem (c),(d) and Proposition .

par *Non-claim.* No dark-sector package is constructed here, and none of the listed ingredients is supplied. An operational-capacity label alone supplies none of them (Proposition). Structure-growth, lensing or detector forecasts would need such a package. Check C-Big05-76. par

Operational darkness and mouth forms

Proposition (Big02-A dark capacity is not stress-energy). *On* DSS_H *with fixed Λ, χ, let accounts carry declared data with q idle qubits as in [Big01-A] (*source record; not a premise*), and let δ be any dark-capacity measure that strictly increases when idle qubits are adjoined (for instance* $\log_2$ *of the declared unused-factor dimension, category D3 of [Big02-A],* source record; not a premise*).*

- *δ is not a host functional: the reorganization $q \mapsto q + 1$ changes it.*
- *The metric, T_{tot}, every curvature reading and every reading of Section are host functionals.*
- *If a dictionary assigns $T_{\mathrm{dm}} = \Phi(\delta)$ within compatible splits with Φ non-constant, then T_{dm} and $T_{\mathrm{b}} = T_{\mathrm{tot}} - T_{\mathrm{dm}} - T_\Lambda$ change under a reorganization that changes no host functional and no reading; the assignment is extra data outside the ledger.*
- *If all pieces obey the NEC, every such Φ takes values in constant multiples of g (Theorem (c)): no dictionary can realize dark capacity as clustering, dust-like dark matter on* DSS_H.

Proof. (a) The map fixes H and changes the declared dimension by a factor two. (b) They depend on g_H and the fixed constants only. (c) A non-constant Φ composed with δ is not a host functional, by (a), and the reorganization $q \mapsto q + n$ moves it. (d) Theorem (c).

par *Non-claim.* This is the separation recorded in Big02-A itself: its classification ``is not a substance" ([Big02-A]) and supplies ``no particle species, no clustering mechanism" ([Big02-A]) (source record; not a premise). Big02-A

operational darkness is not identified with dark-matter density. par

Proposition (Mouth-form blindness under explicit factorization; from v0). *Let $B : V \to W$ be linear and β bilinear on W. The form $Q(v_1, v_2) = \beta(Bv_1, Bv_2)$ is unchanged when either argument changes by an element of* $\ker B$ *. If B is distributional restriction to $O = Y \setminus I$, I closed, then Q is blind to residuals supported in I; if the allowed I -supported space has dimension $> N$, adjoining N scalar linear readings leaves a non-zero invisible direction.*

Proof. $B(v + r) = Bv$ for $r \in \ker B$; $r|_O = 0 \Leftrightarrow \operatorname{supp} r \subseteq I$; a linear map into $\mathbb{R}^N$ from a space of dimension $> N$ has a non-zero kernel.

par *Non-claim.* The support identity is [Res05-A] (source record; not a premise). The plan's claim that a mouth form ``remains blind to an island-support residual that would be needed to push dark dominance inside the Solar System'' is rejected as stated (PC-11): [Res01-C] and [Res01-C] concern bookkeeping forms on a finite Haar model, whose own non-claim says the form is not a metric on a gravitational spacetime; [Hawk05-B] and [Hawk06-A] concern finite interfaces (source record; not a premise). Nothing here shows such a residual to be necessary or sufficient for post-Newtonian agreement. par

Documentary record: observational numbers

This section is a documentary record; not a premise, in the way Big03-A treats CODATA values ([Big03-A], source record; not a premise). Nothing here is used to derive anything inside the ledger. The arithmetic is checked (C-Big05-03, C-Big05-14); where the plan's arithmetic is wrong, the correction is a PC.

Documentary record (Inputs). Planck 2018 (TT, TE, EE, lowE and lensing): $H_0 = 67.36\ \mathrm{km\,s^{-1}\,Mpc^{-1}}$, $\Omega_\Lambda = 0.6847$, $\Omega_\mathrm{m} = 0.3153$, $\Omega_\mathrm{b}h^2 = 0.02237$, $\Omega_\mathrm{c}h^2 = 0.1200$ [Planck2018] (the first two are the values used in [Big01-A], source record; not a premise). IAU: $1\ \mathrm{AU} = 149\,597\,870\,700\ \mathrm{m}$ exactly [IAU2012]; nominal $\mathscr{GM}^\mathrm{N}_\odot = 1.3271244 \times 10^{20}\,?\mathrm{m^3\,s^{-2}}$ [Prsa2016]. $1\ \mathrm{Mpc} = 10^6 \cdot 648000/\pi\ \mathrm{AU}$, $c = 299\,792\,458\ \mathrm{m\,s^{-1}}$, $G = 6.67430 \times 10^{-11}$ SI. Local dark-matter density $0.3\ \mathrm{GeV\,cm^{-3}}$ (the plan's conventional reference value; not verified here). Mercury: $a = 0.387098\ \mathrm{AU}$, $e = 0.205630$.

Documentary record (Evaluations).

• *Budget.* $h = 0.6736$ gives $\Omega_\mathrm{b} = 0.0493$ and $\Omega_\mathrm{c} = 0.2645$; with $\Omega_\Lambda = 0.6847$ the dark and vacuum share is 0.949. The plan's $0.68/0.27/0.05$ holds to rounding (Ω_c rounds to 0.26).

• *Dark-energy density.* $\rho_\mathrm{crit} = 3H_0^2/(8\pi G) = 8.52 \times 10^{-30}\,?\mathrm{g\,cm^{-3}}$ and $\rho_\Lambda = \Omega_\Lambda \rho_\mathrm{crit} = 5.84 \times 10^{-30}\,?\mathrm{g\,cm^{-3}}$; the plan's ``$\sim 10^{-29}$'' is correct only in order of magnitude (PC-2).

• *Expansion versus solar acceleration at* $1\ AU$. $H_0 = 2.1830 \times 10^{-18}\ \mathrm{s^{-1}}$ and $H_0^2 r = 7.13 \times 10^{-25}\ \mathrm{m\,s^{-2}}$, not the plan's $\sim 10^{-15}\ \mathrm{m\,s^{-2}}$ (PC-1). The Λ term of the Kottler acceleration, $\Lambda c^2 r/3 = \Omega_\Lambda H_0^2 r$, is $4.88 \times 10^{-25}\ \mathrm{m\,s^{-2}}$, while $\mathscr{GM}^\mathrm{N}_\odot/r^2 = 5.930 \times 10^{-3}\ \mathrm{m\,s^{-2}}$; the ratios are 1.20×10^{-22} and 8.23×10^{-23}, and the two terms have opposite signs. v0's fiducial $H_\mathrm{ref} = 70\ \mathrm{km\,s^{-1}\,Mpc^{-1}}$ gives $2.26855 \times 10^{-18}\ \mathrm{s^{-1}}$, $7.69875 \times 10^{-25}\ \mathrm{m\,s^{-2}}$ and ratio 1.29825×10^{-22}, all confirmed.

• *Crossover radii for the Sun.* With $\Lambda = 3\Omega_\Lambda H_0^2/c^2 = 1.089 \times 10^{-52}\ \mathrm{m^{-2}}$ and $m_\odot = 1476.6\ \mathrm{m}$, the radii of Theorem are $r_s = 111.5$, $r_K = 125.1$ and $r_t = 140.4\ \mathrm{pc}$; $(m^2\Lambda)^{1/3} \approx 6 \times 10^{-16}$, so all lie in the static region. (These treat the Sun as isolated; the Galaxy is not modelled.)

• *Perihelion of Mercury.* $6\pi m/p = 5.02 \times 10^{-7}$ rad per orbit and $\pi\Lambda a^3\sqrt{1-e^2}/m = 4.40 \times 10^{-23}$ rad per orbit, ratio 8.8×10^{-17}.

• *Local dark matter.* $0.3\ \mathrm{GeV\,cm^{-3}} = 5.35 \times 10^{-25}\,?\mathrm{g\,cm^{-3}}$; a uniform sphere of radius $1\ \mathrm{AU}$ at this density has mass $7.5 \times 10^{12}\ \mathrm{kg}$, $3.8 \times 10^{-18}\,M_\odot$, and surface acceleration $2.2 \times 10^{-20}\ \mathrm{m\,s^{-2}}$.

• *External tests.* Cassini measured $\gamma - 1 = (2.1 \pm 2.3) \times 10^{-5}$ within its model [Bertotti2003]. The Bullet Cluster

lensing peaks are offset from the X-ray gas [Clowe2006]. Galactic rotation-curve fractions (``10–20%" in the plan) are not verified here.

par *Non-claim.* These numbers do not exclude inhomogeneous dark sources or alternative laws, and they are not fits. They show only that, in the Kottler comparison, the expansion term is negligible at 1 AU and dominant beyond about 10^2 pc for an isolated solar mass. par

Documentary record (Version-2 evaluations). With the inputs of Documentary record and the nominal solar radius $\mathscr{R}_\odot^{\mathrm{N}} = 6.957 \times 10^8$ m [Prsa2016]:

• $\Omega_{\mathrm{c}} + \Omega_\Lambda = 0.9492$ (the 0.949 of Documentary record to four places).

• *Observer angles.* For a ray with turning point $r_0 = \mathscr{R}_\odot^{\mathrm{N}}$ read by a static observer at $r_O = 1$ AU, the mass term of Theorem (b) has size $m_\odot/r_0 = 2.12 \times 10^{-6}$ (and the weak-field magnitude $4m_\odot/r_0 = 8.49 \times 10^{-6}$ rad $= 1.751''$), while the Λ terms are $\Lambda r_0 r_O/6 = 1.89 \times 10^{-33}$ and $\Lambda r_0^3/(6r_O) = 4.09 \times 10^{-38}$.

• *Radar.* For one leg from $r_0 = \mathscr{R}_\odot^{\mathrm{N}}$ to 1 AU, the first-order mass terms of Theorem (c) are $2m_\odot \ln((r + w)/r_0)/c = 5.97 \times 10^{-5}$ s and $m_\odot\sqrt{(r - r_0)/(r + r_0)}/c = 4.90 \times 10^{-6}$ s; the $m = 0$ linear Λ term is $\Lambda(r_0^2 w/6 + w^3/9)/c = 1.35 \times 10^{-28}$ s.

par *Non-claim.* These are magnitudes in one declared contract, not a Solar-System fit or a test; they show only that the Λ terms of the observer readings are negligible at 1 AU. Check C-Big05-47. par

Scale-by-scale placement

Cosmological scales. On DSS_H and on de Sitter regions of comparison hosts all curvature is of expansion type (Theorem), and every split into NEC pieces is of vacuum type. How $\Lambda_{\mathrm{eff}} = \Lambda + \chi\rho_\Lambda$ divides into geometric Λ and vacuum source is a declaration (Theorem ; Corollary ; [VC-OB-1-CERT], [DS-OB-1-CERT], source record; not a premise). On FLRW comparison regions the conserved curvature family has the ranks of Theorem , and on matter-era regions positive dust splits exist with every dominance target undecided (Theorem). The budget of Documentary record is therefore a supplied split: the host is consistent with it and does not select it. The labels Λ, H are external ([Big01-A], [Big01-A], source record; not a premise). Absolute vacuum energy stays open. OpenAI Family 003 (a zero-free half-plane for L-functions) is recorded only as a separation; it is not an explanation of vacuum-energy smallness ([OpenAI], source record; not a premise).

Galactic scales. A dark-matter term growing with radius can be written into a supplied T_{dm} (Proposition (b)); nothing here constructs it, and an enclosed mass growing with radius must not be confused with a density growing with radius. Big02-A's operational dark capacity is not such a term (Proposition). nuADaM01-A's tightly coupled and decoupled dark sector on a prescribed two-epoch host is a source record of declared phases and junction certificates, not a premise ([nuADaM01-A], source record; not a premise).

Solar-System and laboratory scales. On Kottler hosts every reading is mass-dominated inside the crossover radii and expansion-dominated outside them (Theorem); null orbit shapes do not see Λ and bound orbits need $m > 0$ (Theorem). Local dark dominance would be a relabelling or a change of metric labels (Theorem); suppression of the ordinary-matter coupling is not a reorganization (Corollary) and is not implied by the causal-box or tick theorems ([Big01-A], [Big01-A], source record; not a premise). Big04-A-coeff's adaptive negative certificate and unit-covariance forcing are documentary: admitted data fix exponents and orbits, calibration only by supply ([Big04-A-coeff], [Big04-A-coeff], source record; not a premise).

Quantum and series boundaries. XIV-I, XIV-J and XV-B are source records of partial analytic interfaces; nothing here opens XV-B or bears on H2, I3, J2 ([XIV-I,XIV-J,XV-B], source record; not a premise). OpenAI Family 265 (a gapped area law) is not a gravitational Page curve ([OpenAI], source record; not a premise).

Scale-by-scale placement after version 2

Laboratory. Still outside. A Cavendish-type comparison would need, as declared data: source and test-body preparations, apparatus worldtubes, boundary and initial data, a force or phase readout model, clock calibration,

noise and control laws, and an independently specified coupling to the apparatus. None is supplied; such a comparison is future work for a separate sheet (Big05-B), and it would still derive no matter law.

Solar System. Observer readings are now defined: the finite-distance angle and the radar interval under a declared contract are exact quadratures, split-blind, and decide (m, Λ) from two angles of one ray with known turning radius (Theorem). The Λ terms are negligible at 1 AU (Documentary record). The ordinary-matter coupling is not suppressed.

Galactic. A separate prescribed host with a declared halo profile has exact crossover equations (Theorem , Proposition , Corollary). Local dark dominance there is a change of metric labels, not a relabelling of the Kottler exterior; the isolated-Sun radii are not exported to the Galaxy.

Cosmological. Settled on DSS_H as in version 1; on rank-four hosts the vacuum-type rigidity fails and the targets stay non-selected (Theorem); on McVittie comparison hosts the expansion derivative couples to the mass label (Theorem). Two-epoch dark events enter as a separation with a declared access model (Corollary), not as a species.

Scale-by-scale placement after version 3

Laboratory and Solar System. Unchanged from Section .

Black-hole neighbourhoods (prescribed McVittie comparison). For $H \neq 0$ there is an inner Ricci-dominated layer of explicit width, and the slow-expansion limit is not uniform at $r = 2m$ (Theorem , Corollary). This is a statement about the comparison metric only.

Cosmological. Past geometry does not fix the future horizon (Theorem). Distance–drift consistency is a closure-free test of the host family (Theorem). Under the optional closure the transition, drift and horizon forecasts are conditional calculations (Theorem , Documentary record). None selects a split (Proposition).

Release, insertion point and status

Theorem (Big05-A release). *For the hosts, data maps and targets defined here:*

• *the metric and declared* (Λ, χ) *fix* T_{tot}*; a supplied law is compatible iff it sums to* T_{tot}*; only* $\Lambda + \chi\rho_\Lambda$ *is fixed (Lemma , Propositions , , Theorem);*

• *no dominance target of a split is a function of host data, also with positive pieces; the sharp risks are* $\frac{1}{2}$ *and* ∞ *(Theorem , Propositions ,); thm:C-type invariance is vacuous on Big01-A accounts and false on split-extended accounts, true only for spectator actions (Corollary);*

• *on* DSS_H *every NEC split is of vacuum type and the hypothesis is trivially true and locally empty (Theorem , Corollary);*

• *the vacuum fibre, ranks* $1, 2, 3$ *(with* 4 *generic), linear supply, adaptive blindness and the two-epoch fibre hold as stated (Section , Section);*

• *on Kottler hosts the exact crossover radii, the orbit readings and the relabel-or-re-metric dichotomy hold (Theorems , ,);*

• *Big02-A dark capacity is not stress-energy, and mouth-form blindness holds only under explicit factorization (Propositions ,).*

Proof. Each item is the cited result, proved above.

par *Non-claim.* These are conditional certificates and separations. They neither prove nor refute a larger physical theory that reproduces local tests from a supplied dark sector. par

Verdict on the hypothesis. As H-split, the hypothesis is a declaration: always consistent (Proposition (b)), never decided by host data (Theorem), invisible to every reading (Theorem (a)). As H-geom, it is decided: true on DSS_H and beyond the crossover radii of Kottler hosts, false inside them. With the documentary values, ``inside" means within about 10^2 pc of an isolated solar mass, which contains the Solar System.

The insertion point. A physical proposal would have to supply, not rename: a dictionary separating operational

darkness from stress-energy; a constitutive law and an admissible configuration; the normalizations of Λ and χ; compatibility with the claimed metric, or a new metric-selection problem; split-sensitive data that break the fibres; and a local exterior and laboratory comparison with the equivalence-principle and post-Newtonian tests. Supplying them enlarges the admitted problem; this paper installs none.

Status tail (refined only).

• The dynamics part of O8 remains a negative certificate ([Big01-A], source record; not a premise); the supplied-law form is refused as an additional premise.

• Absolute vacuum energy stays open ([VC-OB-1-CERT], [DS-OB-1-CERT], source record; not a premise).

• The coefficient slot remains unfilled ([Big01-A], [Big04-A-coeff], source record; not a premise).

• No local dynamical selection is derived.

• All global ledger lines are unchanged. **Status tail.** the total supplied source on a prescribed metric is fixed by the metric and the declared Λ and coupling, while its split into ordinary, dark and vacuum pieces is not a function of host data (fibre non-selection, worst-case indicator error $\frac{1}{2}$, ratio error infinite); only $\Lambda + \chi\rho_\Lambda$ is fixed; on DSS_H every split into weak-energy pieces is of vacuum type, so the hypothesis holds trivially and says nothing local; on Kottler hosts the Ricci part is the Λ piece and the Weyl part the mass label, with exact crossover radii $(3m/\Lambda)^{1/3} < (18m^2/\Lambda^2)^{1/6} < (6m/\Lambda)^{1/3}$; null orbit shapes are Λ-free, bound orbits need $m > 0$, and Λ enters the perihelion advance first through $\pi\Lambda a^3\sqrt{1-e^2}/m$; local dark dominance is either a relabelling invisible to every reading or a change of metric labels; Big02-A dark capacity is not a host functional and is not identified with stress-energy; supplied-law form refused as an additional premise; absolute vacuum energy open; coefficient slot unfilled; no local dynamical selection derived.

Non-claims. This paper does not derive a matter law, does not suppress ordinary-matter coupling, does not reproduce Solar-System tests from dark components, does not identify Big02-A operational darkness with dark-matter density, does not close O.1, does not admit a quantum coefficient, does not create Host C, and does not claim spacetime emergence or a gravitational Page curve. Once the additional premise is inserted by hand it must still be checked against local experiments; that check is outside the present ledger.

Authorship. Ngo Cheung (authorship requires confirmation). The user's draft v0 is credited in Appendix .

Version-2 release and status

Theorem (Big05-A version-2 release). *In addition to Theorem , for the hosts, contracts and targets defined in version 2:*

• *the indicator risk is* $\frac{1}{2}$ *under absolute loss or randomized decisions and* 1 *for deterministic Boolean rules, and strictly positive three-piece witnesses exist (Propositions ,);*

• *rank four is* C^4*-open, dense and explicitly attained; on rank-four hosts the total is somewhere not of vacuum form and the dominance targets are not selected, also with WEC pieces on open families (Proposition , Theorem , Proposition);*

• *on Kottler hosts with a declared optical contract, angles, bending and radar intervals are exact, split-blind and observer-dependent, and two angles decide* (m,Λ) *(Theorem , Corollary , Propositions , ,);*

• *on the prescribed McVittie comparison the total, tides and dominance functions are explicit and split-blind, and the constant-rate member is Kottler (Theorem , Corollary);*

• *on the prescribed galactic hosts the crossover equations are exact and the hosts are not Kottler hosts (Theorem , Proposition , Corollary);*

• *coefficient labels, declared clocks and future-dependent access select no split, and calibration is added supply (Propositions , , Corollary);*

• *(t323u) every geometric observable is constant on the split fibre, so attribution needs a split-coupled observation or a constitutive law (Theorem and its corollaries); the identifiability theorems, the rank/split separation, the finite-jet genericity, the Einstein collapse, the McVittie tidal and constant-rate results, halo realization and orbit*

stability, optical calibration, radar reference dependence and contract-relative dominance hold as stated in Theorems – (partial items with their open brackets, Appendix).

Proof. Each item is the cited result, proved above.

par *Non-claim.* Conditional certificates and separations only; no physical theory is proved or refuted, and the insertion point of Section is unchanged. par

t315u items (c) and (d). *(c) closed in the scoped sense:* a McVittie-type comparison host is prescribed and computed (Theorem); no matched interior, central source, continuation across $r = 2m$ or field equation is supplied, so ``matched interior'' stays open. *(d) closed in the scoped sense:* the measured deflection angle and the radar (Shapiro) interval are defined and evaluated under a declared observer, image-branch, clock and reference contract (Theorem , Definition , Proposition); no convention is preferred and nothing is fitted.

Status tail (v2).

• All version-1 status lines stand; the supplied-law form remains refused as an additional premise, absolute vacuum energy stays open, the coefficient slot remains unfilled, and no local dynamical selection is derived.

• Rank four is not selection; observer and clock contracts are not matter laws; McVittie and halo hosts are prescribed comparisons, not derived metrics.

• Laboratory (Cavendish) comparisons are future work for Big05-B only.

• (t323u) Open: sharper codimension bounds for rank deficiency; the monotonicity pattern of $\mathscr{D}_{\mathrm{M}}$ for $H < 0$; radar for an emitter moving with the McVittie flow; sign changes of radar excess under endpoint identification or branch change alone.

• No quantum coefficient is admitted. 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, U6-sel is not moved, and H2, I3, J2 and T3 stay unresolved. **Status tail (v2).** version 1 stands as stated; on rank-four hosts (open and dense, explicitly attained) the total is somewhere not of vacuum form and no dominance target is selected; on Kottler hosts the finite-distance angle and the radar interval are exact readings of a declared observer, branch, clock and reference contract, split-blind, with the static angle depending on Λ although the orbit shape does not, and two angles of one ray at known radii with known turning radius decide (m, Λ); on a prescribed McVittie comparison the total, tides and dominance functions are explicit, the Ricci part couples to the mass through $H/\sqrt{1 - 2m/r}$, and there is no time-independent crossover; on prescribed halo-plus-Λ hosts the crossover equations are exact and the hosts are not Kottler hosts; coefficient orbits, declared clocks and future-dependent access select no split; t315u (c) and (d) are closed in the scoped sense only; laboratory comparisons are future work (Big05-B); every geometric observable is constant on split fibres, so attribution needs a split-coupled observation or a constitutive law (t323u); absolute vacuum energy open; coefficient slot unfilled; no local dynamical selection derived.

Authorship (v2). Ngo Cheung (authorship requires confirmation). The user's version-2 draft (t320u) is credited item by item in Appendices and .

Version-3 release and status

Theorem (Big05-A version-3 release). *In addition to Theorems and :*

• *over smooth expanding flat NEC hosts with a de Sitter past, the set of future event-horizon radii is exactly* $[c/H_{\mathrm{E}}, \infty]$, *every value is attained to all orders at the present, every rule of the past has infinite error on it, and analytic futures are forced (Theorem);*

• *on every FLRW host with the contract of Definition , redshift drift and transverse distance satisfy the consistency identities of Theorem , and the drift curve is stationary exactly at acceleration transitions;*

• *under the optional Hypothesis , the expansion, the diagnostic N, the acceleration transition, the drift curve and the future horizon are as in Theorems and , and the documentary forecasts are the conditional calculations of Documentary record ;*

• *on the prescribed McVittie comparison with* $H \neq 0$, *the Kretschmann comparison vanishes linearly at* $r = 2m$

with coefficient $1/(32m^5\dot{H}^2)$*, and the slow-expansion limit is not uniform (Theorem , Corollary);*

• *all of these quantities are constant on split fibres, and a dark-sector package needs constitutive or split-coupled supply (Propositions ,).*

Proof. Each item is the cited result, proved above.

par *Non-claim.* The closure is not adopted: it is a declared, optional hypothesis outside the ledger, and nothing in the core depends on it. No forecast is a measurement, and no fit is performed. No physical theory is proved or refuted, and the insertion point of Section is unchanged. par

Status tail (v3).

• All version-1 and version-2 status lines stand, including the scoped closure of t315u (c) and (d) (Section).

• The closure of Hypothesis is outside the ledger and is not a premise of the sheet; the forecast table is a conditional calculation, not a measurement, with radiation neglected.

• No numerical κ is given and the coefficient slot stays unfilled; absolute vacuum energy stays open; H-split stays a declaration.

• Open: whether $\{\mathscr{D}_K > 1\}$ is an interval for $\dot{H} \neq 0$; radiation and curvature in the closure family; any dark-sector package; and every item left open in version 2.

• No quantum coefficient is admitted. 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, U6-sel is not moved, and H2, I3, J2 and T3 stay unresolved. **Status tail (v3).** versions 1 and 2 stand as stated; past geometry, all jets at the present and every split there do not determine the future event horizon of smooth expanding NEC hosts (range $[c/H_E, \infty]$), while real-analytic futures are forced; distance–drift consistency is a closure-free test of the FLRW contract; the evolution closure $\dot{H} = -\frac{n}{2}(H^2 - H_\infty^2)$ is an optional supplied hypothesis outside the ledger, and its forecasts ($N \equiv n$, acceleration transition, drift curve, horizon c/H_∞, documentary table) are conditional calculations, not measurements; the McVittie comparison has an inner Ricci-dominated layer and a non-uniform slow-expansion limit at $r = 2m$; every forecast is constant on split fibres, so predicting expansion selects no split; a dark-sector package is stated as requirements only; absolute vacuum energy open; coefficient slot unfilled; no numerical κ; H-split stays a declaration; no local dynamical selection derived.

Authorship (v3). Ngo Cheung (authorship requires confirmation). The user's request t331u is credited item by item in Appendix .

Standing ledger

Citations identify source records only; no proof transfer. No quantum coefficient is admitted.

Standing ledger. No quantum coefficient is admitted. Host C is not created. O.1 stays NOT_CLOSED. XVI-N is not discharged. XV-B is not opened. H2, I3, and J2 stay unresolved. T3 stays unresolved. U6-sel is not moved. Gate 0 stays NOT_SUPPLIED. No compilation is asserted. No machine-checked proof is claimed. Numerical execution is not asserted. This is not metric reconstruction, not Einstein dynamics, not a Page curve, not a de Sitter state, not spacetime emergence, and not quantized relational time without an external clock.

Standing ledger of the plan (t316u), verbatim. No quantum coefficient is admitted. Host A and Host B stay separate. Host C is not created. O.1 stays NOT_CLOSED. XV-B is not opened. XVI-N is not discharged. H2, I3, J2 stay unresolved. T3 stays unresolved. U6-sel is not moved. Gate 0 stays NOT_SUPPLIED. ST4b stays NOT_SUPPLIED. Absolute vacuum energy stays open. No Einstein dynamics, derived metric, spacetime emergence, external-clock removal, or Page curve is claimed. Cited sheets (including OpenAI catalogue entries) are source records and are not premises. A source record is not a premise.

Standing ledger of Big01-A and Big02-A, verbatim. No quantum coefficient is admitted. Host A and Host B stay separate; Host C is not created. O.1 stays NOT_CLOSED. XVI-N is not discharged; N-Ins.4 stays unresolved. XV-B is not opened. H2, I3, J2 and T3 stay unresolved. U6-sel is not moved. No Einstein dynamics, derived metric, spacetime emergence, Page curve, or quantized relational time without an external clock is claimed. The

last reading bars stay open, and continuum acquisition stays a negative certificate. No Route-B successor is created. Res02-A Q1–Q4 and A1–A2 stay open. Gate 0 and ST4b stay NOT_SUPPLIED. Citations identify source records only; no proof transfer. No compilation is asserted.

The three texts are mutually consistent; their differences are recorded as PC-12.

appendix

Plan corrections

toprule PC Plan statement Correction (proved or verified version)

midrule endhead PC-1 $H_0^2 r$ at 1 AU is $\sim 10^{-15}\ \mathrm{m\,s^{-2}}$ (t315u) $7.13 \times 10^{-25}\ \mathrm{m\,s^{-2}}$ at $H_0 = 67.36$; the Λ term is 4.88×10^{-25}; ratio to $GM_\odot/r^2$ is 1.2×10^{-22} (Documentary record).

PC-2 dark-energy density $\sim 10^{-29}\ \mathrm{g\,cm^{-3}}$ $5.84 \times 10^{-30}\ \mathrm{g\,cm^{-3}}$; order of magnitude only.

PC-3 ``$\Theta[g] = \kappa T$ holds for an arbitrary conserved symmetric $T$'' (t316u) Only ``for some'': the unique solution is T_{tot} (Lemma); [Big01-A] itself says ``for some'' (source record; not a premise).

PC-4 prop:Big05-supply: a declared law with negligible T_{b} satisfies $\Theta = \kappa T$ ``by prop:Dyncert'' Compatible iff it sums to T_{tot}; what Dyncert-type conservation gives is that the declaration $T_{\mathrm{b}} = 0$ always has a conserved completion (Proposition).

PC-5 ``VC-OB-1 prop:s2-vac'' The label is in VC-OB-1-CERT ([VC-OB-1-CERT], source record; not a premise); VC-OB-1 has no such label.

PC-6 Θ ``weakly divergence-free for every $C^2$ metric'' attributed to prop:Dyncert Big01-A says ``divergence-free'' for C^2; the weak (C^2) versus pointwise (C^3) distinction is [VC-OB-1-CERT](a) (source record; not a premise); both are used correctly in Lemma .

PC-7 DS-OB-1-fibre ``effective ranks 1/2/3'' The table runs $0, 1, 1, 2, 3, \le 3, \le 4$, with 4 attained and generic ([DS-OB-1-fibre], source record; not a premise); see Theorem .

PC-8 ``Big01-A thm:fibre = EM-OB-1 / TS-OB-1 / VC-OB-1 fibre lemmas'' Separate parallel records of one principle, not one theorem (Lemma).

PC-9 thm:C and thm:D4 ``leave the relative sizes of ordinary versus dark contributions invariant'' Vacuous on Big01-A accounts (no split), false on split-extended accounts, true for spectator actions (Corollary).

PC-10 two-epoch hosts (prop:E) ``can move the junction radius'' In [Big01-A] $R_0 = c/H_2$ is fixed; it moves across futures ([Big01-A](b), [Big02-A](b), source record; not a premise; Theorem).

PC-11 prop:Big05-mouth: mouth forms blind to an island residual needed for Solar-System dark dominance Rejected as stated (category error: [Res01-C] concerns finite Haar bookkeeping forms, not metrics, source record; not a premise); restricted factorization statement kept (Proposition).

PC-12 Standing ledger ``verbatim, carried from Big01-A / Big02-A'' Not verbatim: relative to [Big02-A] (source record; not a premise) it omits N-Ins.4, the reading bars, continuum acquisition, Route-B, Res02-A Q1–Q4 and A1–A2, the citation sentence and ``No compilation is asserted''; it adds ``Absolute vacuum energy stays open'' (an open item of Big02-A, not a ledger line) and the OpenAI sentence, and writes ``external-clock removal''. All three ledgers are carried (Section).

PC-13 deflection, Shapiro, perihelion depend on Λ ``only at the stated subleading order'' (t315u (d)) Null orbit shapes are exactly Λ-free; the Kepler law is exact; the perihelion Λ term is $\pi\Lambda a^3\sqrt{1-e^2}/m$ at first order; Shapiro delay not treated (Theorem).

PC-14 local dominance ``equivalent to an extra premise rescaling or suppressing T_{b}'' Corrected to the dichotomy: at fixed metric, suppressing T_{b} is a relabelling invisible to every reading; changing the coupling or the mass changes the metric labels, which the readings decide (Theorem).

PC-15 κ for the gravitational coupling κ is the coefficient slot of $\hbar$ in [Big01-A] (source record; not a premise); the

coupling is written χ.

PC-16 Big02-A ``dark capacity lying outside the controllable readable subspace''; nuADaM01-A ``dark sector'' That wording is Big02-A's motivating analogy ([Big02-A]); the certified notion is access-relative ([Big02-A]). nuADaM01-A's certificates concern declared phases and dark *events* ([nuADaM01-A]), not a stress-energy (source record; not a premise).

PC-17 $\Omega_{\mathrm{dm}} \approx 0.27\,\Omega_{\mathrm{c}} = 0.2645$ from $\Omega_{\mathrm{c}} h^2 = 0.1200$; agreement to rounding.

bottomrule

Draft corrections for v0

toprule DC v0 statement Correction

midrule endhead DC-1 Big04-A-coeff, DS-OB-1-fibre and Res01-C are plan-only locators whose texts are unavailable (v0 Sections 1, 7, 9; D11) Their version-5 sources exist on the build box as local, unregistered deliverables (not on the API); they are cited as such, with sha256, as source records.

DC-2 empty author field Required line: Ngo Cheung (authorship requires confirmation).

DC-3 ledger: the t316u text only, called ``retained verbatim'' See PC-12; all three ledgers carried.

DC-4 checks are ``not reports of a SymPy run'' All checks are executed (Appendix).

DC-5 Frontiers citation with volume 14 Volume not verifiable from the source records; Big01-A records the DOI as accepted, final version forthcoming; v1 cites the Enter background through [Big01-A] and [EntPhil].

DC-6 versions ``1'' for Hawk05-B, Hawk06-A, XIV-I, XIV-J and ``2'' for XV-B Not stated in the API titles; v1 identifies these records by sha256 only.

DC-7 VC-OB-1 cited for a ``definition of absolute vacuum energy''; a catalogue record ``dated October 7, 2026'' Not verified; not carried. OpenAI families are cited by [OpenAI], [OpenAI] (source record; not a premise).

DC-8 thm:Big05-fibre (norm and ratio targets, $0 < s < 1$) Held and strengthened: energy conditions preserved, pointwise target, witnesses on DSS_H itself (Theorem).

DC-9 prop:dust (fluids with $\rho + p \geq 0$) Held; strengthened to arbitrary NEC pieces by Lemma (Theorem (c)).

DC-10 cor:Big05-reorg and D4: a split-changing family ``is not a reorganization'' True for spectator actions; in the sense of [Big01-A] (any host-fixing map, source record; not a premise), once the split is declared data a relabelling *is* a reorganization and changes dominance (Corollary (b)).

DC-11 thm:release Superseded by Theorem , which adds bare-host triviality, Kottler radii, orbit readings, the dichotomy and the dark-capacity separation.

bottomrule *v0's debugging record against the PCs.* D1 ↔ PC-3, D2 ↔ PC-4, D3 ↔ Theorem , D4 ↔ PC-9 (with DC-10), D5, D6 ↔ nonclaims of Theorem and Proposition , D7 ↔ Theorem (b), D8 ↔ Theorem , D9 ↔ PC-7, D10 ↔ PC-11, D12 ↔ PC-15: all held. D11 is corrected by DC-1. v0 does not record PC-1, PC-2, PC-5, PC-6, PC-8, PC-10, PC-12–PC-14, PC-16 or PC-17.

Verdicts

toprule Request Item Verdict

midrule endhead t315u formal statement as a property of a supplied split held: Hypotheses ,

t315u (a) vacuity; opposite-dominance witness proved: Theorem (witnesses on DSS_H and on a dust FLRW host)

t315u (b) bare host: all curvature is the Λ piece proved, stronger: Theorem (every NEC split vacuum type)

t315u (c) crossover theorems on SdS/McVittie proved on Kottler (Theorem); McVittie not treated: partial

t315u (d) which experiments see what; suppression not a reorganization; not supplied by thm:Hcert/thm:D partial with exact brackets: Theorems , ; corrected PC-13, PC-14; Shapiro and deflection angle not treated

t315u (e) Big02-A dark is not stress-energy proved: Proposition

t315u documentary second half; arithmetic; motivation labels held, with PC-1, PC-2, PC-17 (Section)

t315u verify cited labels done: Appendix

t316u standing ledger verbatim held with PC-12

t316u restatement inside declared-data discipline held with PC-3

t316u scale-by-scale placement (three scales) held: Section

t316u prop:Big05-supply corrected and proved (PC-4)

t316u thm:Big05-fibre proved (with Corollary , Proposition on the vacuum fibre)

t316u cor:Big05-reorg corrected and proved (PC-9, PC-10)

t316u prop:Big05-mouth (optional) rejected as stated; restricted form held (PC-11)

t316u status tail; edges; non-claims held: Section , Appendix

t316u checks C-Big05-01..04 held and executed; C-Big05-04 corrected to test both directions

t317u Background: the Enter framework; The hypothesis held: Sections ,

t318u conservation with quantifiers held (Lemma)

t318u corrected supplied-law certificate held; v1 stronger (completion and energy conditions)

t318u affine decomposition held

t318u exact-host dust obstruction held; v1 stronger (DC-9)

t318u fibre two-point certificate held

t318u fibre non-identification of dominance held; v1 stronger (DC-8)

t318u scalar-fibre minimax held

t318u Einstein-region reduction held; formulas verified (C-Big05-12)

t318u vacuum-coordinate non-identification held

t318u compatibility trichotomy held; equal to v1's trade-off, v0 form kept

t318u vacuum-ratio fibre held

t318u FLRW invisible direction; ranks $1, 2, 3$ held; adds to [DS-OB-1-fibre] (source record; not a premise)

t318u necessary and sufficient linear supply held

t318u adaptive blindness held

t318u independent external coordinates held

t318u reorganization separation corrected (DC-10)

t318u two-epoch horizon fibre held

t318u exact de Sitter has no mass-tidal sector held (merged into Theorems ,)

t318u mouth-form blindness under factorization held

t318u release theorem corrected (DC-11)

t318u debugging record cross-checked; D11 corrected (DC-1)

bottomrule

Crosswalk from the user's draft v0

The draft Big05-A-v0 (v0_t318u.tex, sha256 56dd8aa5019adb41f640107b4ed08218865f9576517cc348e321318c5e912fbd) is the user's draft; every item was re-proved here. Its 73 labels map as follows. toprule v0 label v1 location

midrule endhead sec:introduction Section

sec:setting Section

eq:dss Definition

eq:static Definition

eq:inverse Definition

def:data Definition
eq:Dg Definition
eq:DL Definition
eq:Dt Definition
def:compatible Definition
eq:compatibility Definition
eq:norm Definition (b)
def:dominance Definition
eq:suppression Definition (b)
eq:ratio Definition (c)
sec:supply Section
lem:bianchi Lemma
prop:Big05-supply Proposition
eq:residual Proposition (a)
prop:affine Proposition
eq:affine Proposition
sec:exactdss Section
eq:flrw proof of Theorem
eq:ricci proof of Theorem
eq:Gflrw proof of Theorem
eq:dssstress Theorem (a)
prop:dust Corollary ; Theorem (c)
sec:fibres Section
lem:fibre Lemma
thm:Big05-fibre Theorem
eq:splitfibre Theorem
ex:dustsplit Example
prop:minimax Proposition
sec:vacuum Section
eq:E1 Section
eq:E2 Section
lem:einstein Lemma
eq:vacfibre Lemma
eq:lambda Lemma
cor:vacnonid Corollary
thm:trichotomy Theorem
eq:compensation Theorem (b)
prop:vacratio Proposition
eq:vacratio Proposition
sec:ranks Section
eq:Lg Theorem
thm:ranks Theorem

eq:E1power Theorem (d)

prop:linear Proposition

eq:kernelcriterion Proposition

sec:adaptive Section

prop:adaptive Proposition

eq:robustminimax Proposition

prop:product Proposition

sec:reorganizations Corollary ; Section

def:spectator Corollary (c)

cor:Big05-reorg Corollary (DC-10)

thm:epochs Theorem

eq:earlyradius Theorem (c)

sec:local Section

prop:weyl Theorems (a),(b), (a)

eq:constantcurvature Theorem (a)

eq:kottler Definition

eq:acceleration Theorem (d); Documentary record (c)

eq:magnitude Documentary record (c)

sec:mouth Section

prop:Big05-mouth Proposition

sec:scales Section

sec:release Section

thm:release Theorem (DC-11)

app:debug Appendices ,

app:checks Appendix

app:edges Appendix

bottomrule

Verification of cited labels

Every label below was found in the stated record (read-only GET of https://enter.grok.me/api/manuscript/<ID> on 24 October 2026, or the local version-5 deliverable where marked); check C-Big05-23 confirms the presence of every label cited through verb | src |. All are source record; not a premise. toprule Record Label Content and comparison with the plans

midrule endhead Big01-A prop:Dyncert $G + \Lambda g$ symmetric, divergence-free for C^2; ``for some" T; selects nothing without a matter law. Matches (PC-3, PC-6).

Big01-A thm:Hcert label coefficients injective; infinite worst-case error; supplying $\hbar$ refused. Matches.

Big01-A thm:fibre fibre criterion with $\Delta/2$ bound. Matches (PC-8).

Big01-A thm:C host functionals = reorganization-invariant maps. Exists; never acts on a split (PC-9).

Big01-A thm:D, thm:D4 fibre-supremum ceiling; dimension unbounded; growing monoid. Match.

Big01-A prop:E, thm:Efuture two-epoch host with fixed $R_0 = c/H_2$; every R_0 realized across futures (PC-10).

Big01-A thm:A, thm:tick causal past and static patch; granularity ceiling (the ``causal-box" and ``tick-ceiling" theorems). Match.

Big01-A spec:host, def:reorg, prop:curvlabels, sec:background, sec:ledger host as input; accounts and

reorganizations; $R = 12H^2/c^2$ (verified, C-Big05-01); background; ledger.

Big02-A def:dark, heu:lead, heu:closing access-relative dark capacity D1–D4; ``not a substance''; analogy supplies no species or clustering (PC-16).

Big02-A thm:IV, sec:ledger ``Theorem IV'': future-dependent dark events; ledger. Match.

VC-OB-1-CERT prop:s2-vac, thm:v5-vac, prop:v5-einstein-n vacuity (weak for C^2, pointwise for C^3); vacuum term not fixed by local geometry. Match (PC-5).

DS-OB-1-CERT thm:v5-vac same statement for the de Sitter background. Match.

DS-OB-1-fibre (local v5) tab:F-rank, prop:F-rank4, thm:F-einstein ranks 0 to 4 (PC-7).

VC-OB-1, EM-OB-1, TS-OB-1 thm:VC-fibre, thm:EM-fibre, thm:TS-fibre parallel fibre principles (PC-8).

Big04-A-coeff (local v5) thm:C-adaptive, thm:C-dim adaptive coefficient-blind experiments; exponents from unit covariance. Match.

nuADaM01-A def:host, thm:dark prescribed two-epoch host; dark events across the junction (PC-16).

Res01-C (local v5) thm:island, thm:blind finite bookkeeping forms; not a spacetime metric (PC-11).

Res05-A thm:support support separation as an access statement.

Hawk05-B thm:classicalpage exact record law and mean record entropy (the plan's ``classical mean'').

Hawk06-A eq:normalform recovery normal form (the plan's ``normal form'').

OpenAI rem:oai-003, rem:oai-265 Family 003 (zero-free half-plane), Family 265 (gapped area law); both ``not a theorem of the Enter series''. Found; separations only.

Red06-G-DSS, En08-ST-DSS spec:R-DSS, spec:E-DSS the prescribed host. Match.

bottomrule

Computer-assisted checks

The script src/checks_Big05-A.py runs the following checks with SymPy, NumPy and SciPy; results are in checks_Big05-A.json. Each check reports pass or fail; negative controls are built in, and C-Big05-32 applies ten mutations (ledger removed from the end, quote altered, a non-claim dropped, a cited label altered, a crosswalk row altered, the Background heading changed, Kretschmann coefficient 47, tidal radius constant 5, the plan's 10^{-15}, perihelion coefficient 2π), each of which must make its predicate fail on the mutated text while it holds on the unmutated text. Every check runs under a per-check timeout of 600s; a check that does not finish is reported as *not run to completion*, never as passed. In the recorded run all 34 checks ran to completion and passed. toprule Check Content

midrule endhead C-Big05-01 DSS_H static patch: $\nabla^a \Theta_{ab} = 0$, Ric $= \Lambda_H g$, $R = 12H^2/c^2$; control: Λ non-constant fails

C-Big05-02 split fibre: dominance, norm and ratio flip at equal total; energy conditions preserved; control: equal-s pair does not flip

C-Big05-03 documentary magnitudes at 1 AU; control: the plan's 10^{-15} is off by more than 10^9

C-Big05-04 reorganizations: spectator words fix every target; the extended relabelling changes dominance; the D4 action commutes with splits

C-Big05-05 Kottler: Ric $= \Lambda g$, $\mathscr{K}$, $\mathscr{C}^2 = 48m^2/r^6$; control: coefficient 47 fails

C-Big05-06 Kottler static tidal components

C-Big05-07 orbit equations: null shape Λ-free, timelike form

C-Big05-08 perihelion integrals (symbolic and quadrature) and ODE shifts against the first-order formula

C-Big05-09 FLRW curvature formulas

C-Big05-10 DSS_H constant curvature $R_{abcd} = \frac{H^2}{c^2}(g_{ac}g_{bd} - g_{ad}g_{bc})$ and $C = 0$, $\mathscr{K} = 24H^4/c^4$; a trigonometric residue is cleared by a deterministic numeric probe followed by trigonometric simplification

C-Big05-11 matter-era FLRW: T_{tot} is positive dust

C-Big05-12 $E^{(1)}, E^{(2)}$ conserved on generic FLRW and generic static metrics; $E^{(2)} = \frac{1}{3}E^{(1)}$ on FLRW; on the static metric the divergences are decided exactly by replacing the jets of f, h by independent symbols and $\sin\theta, \cos\theta$ by tangent-half-angle rational forms, so that zero means a zero numerator polynomial; control: wrong sign breaks conservation

C-Big05-13 $E^{(1)}_{tt} = -54p^2(2p-1)t^{-4}$; ranks two and three

C-Big05-14 remaining documentary numbers (budget $\Omega_c + \Omega_\Lambda \approx 0.949$, densities, radii, Mercury, local dark matter)

C-Big05-15 crossover ordering, c_α constants and $\max f = 1 - (9m^2\Lambda)^{1/3}$

C-Big05-16 null-cone rigidity on random tensors; control: dust plus vacuum is not proportional to g

C-Big05-17 $m = 0$: $V' < 0$

C-Big05-18 Kepler law from the geodesic equations and two-radius injectivity

C-Big05-19 trichotomy compensation

C-Big05-20 minimax midpoint and randomized bound on samples

C-Big05-21 two-epoch fibre: early-radius formula and monotone R_*

C-Big05-22 Bianchi insufficiency witness

C-Big05-23 every cited label exists in its record

C-Big05-24 required lines and ledgers present

C-Big05-25 a non-claim after every result

C-Big05-26 every bibitem cited

C-Big05-27 hypothesis quoted verbatim

C-Big05-28 crosswalk covers all 73 v0 labels

C-Big05-29 input hashes (plans, v0, sources)

C-Big05-30 two builds byte-identical, 0 errors, undefined references, duplicate labels

C-Big05-31 Background and Hypothesis precede the first result

C-Big05-32 mutation tests

C-Big05-33 every bibitem of a sheet carries its tag

C-Big05-34 ledger texts verbatim against the plan and Big02-A

bottomrule

Documentary edges

All edges are documentary, with role separation and declaredPath = null; they are listed in wiring-payload-Big05-A-v1.json (wired: false) and are not registrations or proof dependencies: Big01-A (prop:Dyncert, thm:Hcert, thm:fibre, thm:C, thm:D, thm:D4, prop:E, thm:Efuture); Big02-A (def:dark, thm:IV); VC-OB-1-CERT, DS-OB-1-CERT, DS-OB-1-fibre (vacuum fibre, ranks); Big04-A-coeff (adaptive and unit-covariance certificates); nuADaM01-A (declared two-epoch dark sector); Res01-C, Res05-A, Hawk05-B, Hawk06-A (mouth forms, support, record means); OpenAI Families 003 and 265.

Lower regularity: a variational rank statement

Proposition (Variational curvature directions; from the v2 draft). *Let g be a continuous, locally nondegenerate Lorentzian metric in $W^{2,2}_{\mathrm{loc}}$ on a four-dimensional coordinate region. For smooth compactly supported symmetric h_{ab} define $\mathfrak{E}_i(h) = -\frac{\mathrm{d}}{\mathrm{d}s}\big|_{s=0}\int_K \sqrt{|g+sh|}\,\mathscr{I}_i(g+sh)$, $\mathscr{I}_1 = R^2$, $\mathscr{I}_2 = R_{ab}R^{ab}$, with K a compact neighbourhood of* $\operatorname{supp} h$. *These derivatives exist, do not depend on K, and are distributions of order at most two;*

for smooth metrics they are the pairings of $\sqrt{|g|}\,E^{(i)ab}$ *with* h_{ab}*. Together with* $\sqrt{|g|}\,g^{ab}$ *and* $\sqrt{|g|}\,G^{ab}$ *they span at most four directions, and four is attained by* $g_\alpha = -\mathrm{d}t^2 + (1+tx)\,\mathrm{d}x^2 + (1+z_+^\alpha)\,\mathrm{d}y^2 + \mathrm{d}z^2$, $z_+ = \max(z,0)$, $\alpha = \frac{7}{4}$, *on* $\Omega_\star$, *which is* $C^1 \cap W^{2,2}_{\mathrm{loc}}$ *and not* C^2.

Proof. On compact sets g^{-1} is bounded, $\partial g \in W^{1,2} \subset L^4$ and $\partial^2 g \in L^2$; curvature is linear in $\partial^2 g$ and quadratic in ∂g, hence in L^2, and it depends differentiably on s in $L^2(K)$ with derivative bounded by a constant times $\|h\|_{C^2(K)}$. This gives existence, order at most two and independence of K; for smooth metrics $\delta g^{ab} = -g^{ac}g^{bd}h_{cd}$ gives the stated normalization. For attainment, $(z_+^{7/4})' $ is continuous and $(z_+^{7/4})'' = \frac{21}{16} z_+^{-1/4}$ is unbounded but locally square integrable. On $\{z < 0\}$ the metric equals $g_\star$, which does not depend on z; the evaluation pattern of Proposition at $p_0 = (0,1,0,-1)$, $p_1 = (1,1,0,-1)$ gives the same matrix $M_\star$, so a dependence on the whole region would restrict to one there, which is impossible.

par *Non-claim.* The low-regularity objects are variational density distributions; no product of distributional curvatures, pointwise WEC or classical divergence is inferred (DC-18 moves the evaluation points into $\{z < 0\}$). Parallel [DS-OB-1-fibre] (source record; not a premise). Check C-Big05-48. par

Plan corrections for t319u

Numbering continues from PC-17. Each label of the t319u plan was checked against the current API record (Appendix).

toprule PC Plan statement Correction

midrule endhead PC-18 Res05-A thm:reduction ``(support separation)" thm:reduction is a quantitative residual reduction; support separation is [Res05-A] (source record; not a premise), which is what Proposition uses.

PC-19 Em02-E lapse as an ``external expansion clock"; ``the external parameter is not removed" The Em02-E lapse is a relational scalar-clock lapse on the declared Einstein–scalar background of [Em02-E]; the sheet does not itself state the non-removal sentence. Non-removal is proved locally for the displayed constructions (Proposition).

PC-20 On DSS_H ``the hypothesis is true and locally empty" True for H-geom. For H-split: at $\Lambda = \Lambda_H$ the total vanishes and the only WEC split is zero (strict energy dominance false, ratio undefined); at $\Lambda < \Lambda_H$ the split is undecided (Theorem).

PC-21 ``Sharp risks: indicator error $\frac{1}{2}$" Sharp under absolute loss or randomized decisions; a deterministic Boolean rule has worst case 1 (Proposition).

PC-22 I-D as a template for ``host A and host B" The two hosts of [I-D] are its own prescribed dynamical-spacetime hosts. The galactic host is neither ledger Host B nor an I-D host; it is a separately prescribed comparison metric and creates no ledger host.

PC-23 Observer readings ``decide H-geom" A single angle or delay need not; a record decides a predicate iff the predicate is constant on its fibres (Corollary). Two angles with r_0 known, or a calibrated β, suffice (Theorem (f), Proposition).

PC-24 McVittie: the radial dominance function ``depends only on the declared labels" True, but the labels include H and $\dot{H}$, and the Ricci part couples to the mass through $\dot{H}/\sqrt{1-2m/r}$; the Kottler attribution of the Ricci part does not carry over, and no time-independent crossover exists (Theorem (d)).

PC-25 Rank four: targets take both values ``inside the rank-four open set"; prop:F-sign for the compensation direction Norm suppression: on every rank-four metric. Energy and ratio targets need $\rho_{\mathrm{tot}} > 0$, resp. $\mathscr{E}(T_{\mathrm{tot}}) > 0$, which holds on nonempty C^4-open subfamilies, not on the whole set (Theorem (c)). prop:F-sign concerns a change of the declared Λ; it is not a fibre direction at fixed Λ.

PC-26 Two-epoch host ``prescribed as in Big01-A prop:E" [Big01-A] (source record; not a premise) is a Lipschitz host with a jump of H, stated to be neither Host A nor Host B; Theorem uses a smooth interpolation. Both are prescribed.

PC-27 prop:Big05-clock: an expansion clock ``does not remove the external parameter" Proved for declared clocks and the displayed finite phase reconstruction only; not a universal theorem on relational time.

PC-28 McVittie ``closes t315u (c) as a comparison" Scoped: on $r > 2m$ only; $r = 2m$ is excluded and the pressure is unbounded there when $\dot{H} \neq 0$; matched interiors stay open (Section).

bottomrule

Draft corrections for the v2 draft (t320u)

Numbering continues from DC-11. The draft (sha256 7f549067740ca6437c235aa642ad518643ca2500b01c897a0f0f173cd76732c7, 2702 lines, 78 labels) was read in full; no compilation of it is asserted by its author, and that scope line is a statement about the draft, not a build failure.

toprule DC Draft statement Correction

midrule endhead DC-12 Bibliography versions: XV-B ``version 2"; Hawk05-B, Hawk06-A, Hawk07-C-Dyn, Em02-E, XIV-I, XIV-J ``version 1" The current API record of XV-B states version 1 in its own text; the others state no version. Version-2 prints a version only where the record states it (Big01-A 5, Big02-A 6, Big03-A 2, Big04-A 5, Big04-A-coeff 5, DS-OB-1-fibre 5, the two CERT sheets 5, Red06-G-DSS 8, Res06-A 4, nuADaM01-A 5, I-D 5, SG-OB-1 5, V-DST-G-B 5, En09-C 5, Res01-C 5, Res05-A 8 were confirmed).

DC-13 Browse links as the bibliographic identity of companion sheets A browse URL answers with HTTP 200 even for an identifier without an API record (Big05-A itself has none), so it is not registration evidence. Version 2 adds the sha256 of the current API record to every companion entry (Appendix).

DC-14 IAU 2012 resolution at https://www.iau.org/static/resolutions/IAU2012_English.pdf That URL returned HTTP 404 when checked on 25 October 2026; it is not copied. The version-1 entry, a documentary unit definition, is kept.

DC-15 ``Reference verification" comment lines with tracking-parameter URLs Not copied. All external references were checked against arXiv and Crossref records (Appendix).

DC-16 ``The proposed v1 value $H_0^2 r \sim 10^{-15}$ is not retained" The value 10^{-15} was the t315u plan's, corrected in version 1 (PC-1); version 1 never proposed it.

DC-17 ``No successful pdfLaTeX run … is asserted"; v1 execution reports not adopted Version 2 is built twice and checked by the scripts delivered with it; the ledger line ``No compilation is asserted." is carried verbatim as a ledger scope line (Section). No proof depends on a checker result.

DC-18 prop:weakrank: on $z < 0$ the metric equals $g_\star$, with the witness of prop:rankwitness The witness events p_0, p_1 have $z = 0$, outside $\{z < 0\}$. Since $g_\star$ is z-independent, the same matrix is obtained at $(0, 1, 0, -1)$, $(1, 1, 0, -1)$ (Proposition).

DC-19 Label thm:Big05-galaxy for the Plummer zero-radial-pressure halo In version 2 that label holds the plan's general halo-plus-Λ host (Theorem); the draft's theorem is Proposition , content unchanged.

DC-20 def:halo: ``Declare $m_{>0}$" (malformed macro) Read as $m_{\mathrm{b}} \geq 0$, $m_{\mathrm{h}} > 0$, $a > 0$ (Definition).

DC-21 Overlaps with the six new results Where the draft and the t319u work overlap, the stronger form is kept: the observer theorem adds the exact Λ-form of the angle, the Λ-free radar shape, the $m = 0$ closed form, aberration and two-angle determination; the rank theorem adds non-vacuum form; the McVittie theorem adds the Kretschmann comparison and the pressure singularity; the galactic theorem adds a general mass-function host.

bottomrule

Version-1 errata found in the draft. (E-1) Strict ordering $r_s < r_K < r_t$ only for $m > 0$; (E-2) exact circular-orbit domain $3m < r < r_s$ (Remark , Proposition); (E-3) in Proposition (c) the dictionary Φ must be non-constant on the values of δ realized by the declared accounts; non-constancy on an unrelated domain does not suffice. The version-1 text is unchanged; these are errata.

Version-2 draft verdicts

Every item of the user's version-2 draft (t320u) was re-proved locally, by the proofs printed above and by the checks of Appendix . Verdicts: *held* (adopted, possibly merged into a stronger form), *corrected* (adopted after the stated correction), *rejected* (not adopted).

toprule Draft item Verdict Version-2 location; reason

midrule endhead def:split, def:targets held Definitions , (same content; slot names are not species).

lem:Big05-bianchi held Lemma (v1 label kept).

prop:Big05-supply with eq:vacuumtrade held Propositions , , Theorem ; the compensation needs a fixed non-vacuum tensor.

lem:fibre, thm:Big05-fibre held Lemma , Proposition , Theorem .

prop:boolean held Proposition ; PC-21 (C-Big05-35).

prop:positive held Proposition (C-Big05-35).

prop:adaptive held Proposition (v1).

Remark on reorganizations held Corollary (v1).

lem:Big05-null, cor:Big05-dust held v1 labels kept.

thm:Big05-bare (ρ_0 cases) held Theorem ; the $\rho_0 = 0$ case is PC-20.

lem:rank held Lemma , Theorem .

prop:rankwitness held Proposition ; $\det M_\star = -77/512$ reproduced exactly (C-Big05-36).

thm:Big05-rank4 held, strengthened Theorem ; non-vacuum form and rank-not-selection added; PC-25 (C-Big05-36, 37).

Remark on supplied tensors held Proposition , Corollary (v1).

prop:flrwranks held Power-law part is Theorem (c),(d); tail claim is Proposition (C-Big05-37).

Kottler definition, thm:Big05-kottler held Definition , Theorem ; erratum E-1.

prop:circular held Proposition ; erratum E-2 (C-Big05-38).

thm:Big05-orbits held Theorem (v1 label; the draft's proposition environment is not adopted).

def:opticalcontract held Definition .

thm:Big05-observer held, strengthened Theorem ; DC-21 (C-Big05-39).

def:delay, cor:delay held Definition , Corollary .

prop:opticalcalibration held Proposition ; determinant reproduced (C-Big05-39).

prop:shapirocheck held Proposition ; $O(m^2)$ remainder confirmed numerically (C-Big05-40).

McVittie definition, thm:Big05-mcvittie held, strengthened Definition , Theorem : G, R, C^2, tides and $\mathscr{D}_{\mathrm{M}}$ confirmed; $\mathscr{K}$, $\mathscr{D}_{\mathrm{K}}$ and the pressure singularity added (C-Big05-41, 42).

cor:mcvittielimit held Theorem (b) and Corollary (C-Big05-41).

def:halo corrected Definition ; DC-20.

thm:Big05-galaxy (Plummer) held, relabelled Proposition ; DC-19 (C-Big05-44).

cor:halocrossovers held Corollary (C-Big05-44).

Remark on energy conditions and host separation held Proposition (last sentence), Theorem (e).

prop:Big05-orbit-split held Proposition (a),(c) (C-Big05-45).

Remark on arbitrary metadata held Proposition (d).

prop:Big05-clock held Proposition (c); PC-19, PC-27 (C-Big05-45).

thm:Big05-epochs with access model held Theorem (v1) and Corollary (C-Big05-46).

prop:Big05-dark corrected Proposition (v1) with erratum E-3; the draft's restatement is not adopted in place of v1.

prop:Big05-mouth held Proposition (v1); citation thm:support, PC-18.

doc:inputs and substitutions held Documentary records , , : every number reproduced (C-Big05-03, 14, 47); attribution corrected, DC-16.

thm:Big05-release (draft) held Theorem .

Scale-by-scale status held Section .

Execution and verification paragraph corrected DC-17.

Analytic programme boundaries; OpenAI separations held Section (v1) and Theorem non-claim (Family 212).

prop:weakrank corrected Proposition ; DC-18 (C-Big05-48).

app:debug table held Appendices , and this appendix.

app:sources held Appendix ; all 29 draft (sheet, label) pairs exist in the current API records.

Ledgers (sec:ledger) held Carried verbatim (Section).

Bibliography corrected DC-12–DC-15; every external reference verified (Appendix).

bottomrule

Verdicts on the six t319u results. toprule Plan result Verdict Version 2

midrule thm:Big05-observer held, corrected Theorem ; PC-23.

thm:Big05-rank4 held, corrected Theorem ; PC-25.

thm:Big05-mcvittie held, corrected Theorem ; PC-24, PC-28.

thm:Big05-galaxy held Theorem ; PC-22.

prop:Big05-clock held, scoped Proposition ; PC-19, PC-27.

prop:Big05-orbit-split held Proposition .

bottomrule

Crosswalk from version 1 to version 2

Inserted. Version 2 inserts, without deleting version-1 text: toprule After (version 1) Inserted (version 2) Request

midrule abstract, before the ledgers paragraph ``Version 2'' t319u, t323u

end of sec:intro sec:Big05-guide t323u

prop:Big05-minimax prop:boolean, prop:positive t320u

end of sec:fibre sec:Big05-ident (def:Big05-abstract, thm:Big05-quotient, thm:Big05-convex, thm:Big05-kernel, cor:Big05-measdim, thm:Big05-lecam); sec:Big05-central (def:Big05-geocontract, thm:Big05-flagship, four corollaries) t323u

prop:Big05-linear prop:rankwitness, thm:Big05-rank4, prop:flrwranks t319u, t320u

prop:flrwranks sec:Big05-packageB (thm:Big05-rankident, thm:Big05-jet, prop:Big05-einsteincollapse) t323u

thm:Big05-epochs cor:Big05-access; sec:Big05-labels with prop:Big05-orbit-split, prop:Big05-clock t319u, t320u

thm:Big05-kottler rem:Big05-erratum t320u

thm:Big05-orbits prop:circular t320u

thm:Big05-blind Sections sec:observer (with thm:Big05-calib, thm:Big05-radarref), sec:mcvittie (with thm:Big05-mcvtides, prop:Big05-constrate), sec:galaxy (with thm:Big05-halorealize, thm:Big05-halostab), sec:Big05-contract (thm:Big05-contract) t319u, t320u, t323u

doc:Big05-eval doc:Big05-v2eval t319u

end of sec:scales sec:Big05-scales2 t319u

end of sec:release sec:Big05-release2 with thm:Big05-release2 t319u

app:edges Appendices app:weak, app:pc2, app:dc2, app:draftverdict, app:crosswalk12, app:draftcrosswalk,

app:labels2, app:checks2; app:t323, app:pc3 t319u, t320u, t323u

bottomrule

Changed lines. Only these version-1 lines change: the source header comment, the title, date and PDF title; the three bibliography lines that called DS-OB-1-fibre, Big04-A-coeff and Res01-C ``local unregistered deliverable'' (now registered; the version-1 file hashes are kept on those lines); and every companion bibliography line, which gains its current API record hash and browse link. New macros are added to the preamble. The check C-Big05-50 confirms that every other version-1 line occurs in version 2, in order.

Crosswalk of the v2 draft labels

All 78 labels of the user's version-2 draft, in draft order, with their place in version 2. Equation labels adopted from the draft keep their names.

toprule Draft label Version-2 label (number) Note

midrule endhead sec:introduction sec:intro () mapped

sec:setting sec:setting () same label

def:split def:Big05-split () mapped

eq:total def:Big05-split () mapped

def:targets def:Big05-dominance () mapped

lem:Big05-bianchi lem:Big05-bianchi () same label

prop:Big05-supply prop:Big05-supply () same label

eq:vacuumtrade prop:Big05-affine () with Theorem

sec:fibres sec:fibre () mapped

lem:fibre lem:Big05-fibrecrit () mapped

thm:Big05-fibre thm:Big05-fibre () same label

eq:splitfamily thm:Big05-fibre () mapped

prop:boolean prop:boolean () same label

prop:positive prop:positive () same label

prop:adaptive prop:Big05-adaptive () mapped

sec:desitter sec:bare () mapped

lem:Big05-null lem:Big05-null () same label

thm:Big05-bare thm:Big05-bare () same label

cor:Big05-dust cor:Big05-dust () same label

sec:rank sec:vacuum () mapped

eq:E1 sec:vacuum () display of $E^{(1)}$

eq:E2 sec:vacuum () display of $E^{(2)}$

lem:rank lem:Big05-einstein () with Theorem

prop:rankwitness prop:rankwitness () same label

thm:Big05-rank4 thm:Big05-rank4 () same label

prop:flrwranks prop:flrwranks () same label

sec:kottler sec:local () mapped

eq:kottler def:Big05-hosts () mapped

thm:Big05-kottler thm:Big05-kottler () erratum E-1

eq:kottlertides thm:Big05-kottler () mapped

prop:circular prop:circular () erratum E-2

thm:Big05-orbits thm:Big05-orbits () same label
eq:periapsis thm:Big05-orbits () mapped
sec:observer sec:observer () same label
def:opticalcontract def:opticalcontract () same label
thm:Big05-observer thm:Big05-observer () same label
eq:angleintegral eq:angleintegral () same label
eq:timeintegral eq:timeintegral () same label
eq:finitebending eq:finitebending () same label
eq:radartime eq:radartime () same label
def:delay def:delay () same label
cor:delay cor:delay () same label
prop:opticalcalibration prop:opticalcalibration () same label
prop:shapirocheck prop:shapirocheck () same label
eq:shapiro1pn eq:shapiro1pn () same label
sec:mcvittie sec:mcvittie () same label
eq:mcvittie eq:mcvittie () same label
thm:Big05-mcvittie thm:Big05-mcvittie () same label
eq:mcvittieG eq:mcvittieG () same label
eq:mcvittiesource eq:mcvittiesource () same label
eq:mcvittietides eq:mcvittietides () same label
cor:mcvittielimit cor:mcvittielimit () same label
sec:galaxy sec:galaxy () same label
def:halo def:halo () DC-20
eq:halometric eq:halometric () same label
thm:Big05-galaxy prop:Big05-halo () relabelled (DC-19); v2 thm:Big05-galaxy is the general host
eq:halostress eq:halostress () same label
eq:halovelocity eq:halovelocity () same label
eq:haloacceleration eq:haloacceleration () same label
cor:halocrossovers cor:halocrossovers () same label
eq:haloturnaround eq:haloturnaround () same label
sec:labels sec:Big05-labels () mapped
prop:Big05-orbit-split prop:Big05-orbit-split () same label
eq:radiationorbit eq:radiationorbit () same label
prop:Big05-clock prop:Big05-clock () same label
thm:Big05-epochs thm:Big05-epochs () with Corollary
sec:dark sec:dark () same label
prop:Big05-dark prop:Big05-dark () erratum E-3
prop:Big05-mouth prop:Big05-mouth () same label
sec:numbers sec:doc () mapped
doc:inputs doc:Big05-inputs () with Record
sec:release sec:release () same label
thm:Big05-release thm:Big05-release2 () v1 thm:Big05-release kept

app:weak app:weak () same label

prop:weakrank prop:weakrank () DC-18

app:debug app:draftverdict () with Appendices ,

app:sources app:labels2 () mapped

sec:ledger sec:ledger () same label

bottomrule

Verification of sources, labels and references (version 2)

toprule ID sha256 of the current API record Relation to the v1-cited record

midrule endhead Big01-A 8849b3556e2925beed6a009218d8d84a4a2e9abd2c023dd464437122de0f8c82 browse/blank lines added and a DOI line

Big02-A 8936ba43152e4e524a8a8d94772185c706bb628a32c5dba5147df8f4ff2a208f browse/blank lines added

Big03-A c71007c5e5455227925f625ff9fc488e369cbd66a64b95799f8f34e68519bd6a same as v1

Big04-A a0126c6a30370f6211b5fd0668b405e8ba6ede7f87cc43eb2476351eb439742c browse/blank lines added

Big04-A-coeff 69d97b6fb3d598e731d4a57254c41a4c189a0e686f2cb00b62144c2bbaa03e54 newly registered; equals the v1 local file up to browse/blank lines

DS-OB-1-fibre b81d93b4bf81bd01bcc31aef3cd784a8e187c20e16c8269cb001f79086f8f280 newly registered; equals the v1 local file up to browse/blank lines

DS-OB-1-CERT a0805f8eb081a250f78e8074b9de5986ccd23106749df9e0fe5fac2f71e157f9 same as v1

VC-OB-1-CERT d3a93a3afb0e8803d18f230ce824f78c19253f6a4bc841f8ceef763ce14f7cac same as v1

VC-OB-1 c9d821b4db97cb384fa7c4e5d9a1d44791f989c61625d202586ab689e9091bc1 same as v1

EM-OB-1 ad34a7557952bc83f4d24587e0deb415fd6e8aa281975675ac331971f07ec7b0 same as v1

TS-OB-1 1920bc3915db08e691b1e1d64486ef927f6af3a051540fb7ed93fbf7329972f7 same as v1

nuADaM01-A 813b4ec4c79672d242e9a8f0c09e5048f11e6962beca9b5974c03d91709cdc23 same as v1

Res01-C 5311218b51faedfe6aea65484ba6b7057884314bf9fb88da81bba3f437579916 newly registered; equals the v1 local file up to browse/blank lines

Res05-A 517dbbcea7b4bc4f23e8db979f4334f8e7a20fbbe6dd12ea8c32bcd09bb74d45 browse/blank lines added

Res06-A 9d18d6e575ca4024a8bbc601c9ac4c1d3ef9be11c530a2ea575f507fb3760511 new in v2

Hawk05-B 0404bd27adc8c80d1f2e12f860ac60b9a421349da7826246f8ca0eb715d3ca4a browse/blank lines added

Hawk06-A 3c48969e9950838f1ec9b6db02410069c8d93cb71fee9928a79e1fed4ea46032 browse/blank lines added

Hawk07-C-Dyn aa615946d5ee868c41ad3768ee936561a5548d30949074584d08c5ce596e27cc new in v2

I-D 4431dd996c43678dc8bbb4d8afe0fbe3f03695e7669c35f18cb16832135b0fdb new in v2

SG-OB-1 5103c25042a21d302281bbc558a964a5c8a57a8e2ab6700c3d0d01633e110a86 new in v2

V-DST-G-B a41f03ab10e1f4c3e30da1e66772dbb29f221d95826a6826dcd5431824e61322 new in v2

Em02-E 811d91f3814a8bc164c0f21da06590548c4ff4e24c0901449168f1ef4d82f30b new in v2

En09-C 789b2ef40be69d73fe8f978da57e98289c523f00efb8b28083423dfc79ef60f4 new in v2

Red06-G-DSS 3cdb13ba6281577778a5a4e3337e67cb3635ccfb8c8a3df559823798fefeb09c browse/blank lines added

En08-ST-DSS 7c8d368bedc9e157ef1168560f1fc3ef0edc099109865978498aab72d7ef73cd same as v1

XIV-I a7aaf8d9a3095e9a0fdb50fa58f0d489b6a4ff4e6ecf387b0c0e4d5a2bae0c3a browse/blank lines added

XIV-J b7a1c430139d8635092e3b361e7b074fcddb102fe5083d6de4966d39c69138f3 browse/blank lines added

XV-B b8c24754cad5e7c0cc8ffef0aedb10856367c93eead5a418a693839554b40e07 browse/blank lines added

OpenAI 76314b644e51864fa1818f28f49f32a2ce2e06bdd32364ad939595c792cbf99d same as v1

bottomrule

External references. The arXiv records 0709.2948, 1604.08308, 1602.02751, 1003.4777, 1408.0044, 0705.1756, 1807.06209 and 1605.09788 and the Crossref records of every DOI printed in the bibliography were checked for authors, title, journal, volume and pages on 25 October 2026; the nominal values 6.957×10^{8} m and 1.3271244×10^{20} $\mathrm{m}^{3}\,\mathrm{s}^{-2}$ were read in the text of [Prsa2016]. Each is a source record, not a premise (source record; not a premise).

Computer-assisted checks added in version 2

The version-1 checks C-Big05-01–34 are rerun on the version-2 source (labels are looked up in the current API records). The checks below are added (C-Big05-53–68 for request t323u); each has a negative control or a mutation that must fail. Symbolic identities are exact; numerical ones use stated tolerances.

toprule Check Content; control

midrule endhead C-Big05-35 Boolean risks $\frac{1}{2}, \frac{1}{2}, 1$ on a grid; strictly positive witnesses and the three thresholds; control: a deterministic rule claimed to have risk $\frac{1}{2}$ fails.

C-Big05-36 $g_\star$: R, $\mathrm{Box}\,R$, G, $M_\star$, $\det M_\star = -77/512$, and the DS-OB-1-fibre pattern 27621/6588344; controls: on dust FLRW every evaluation pattern has determinant 0; a mutated entry changes the determinant.

C-Big05-37 Dust total $\frac{4}{3\chi t^2}\mathrm{d}t^2$; $T_{\mathrm{tot}}[g_\star]$ not proportional to g; $\mathrm{tr}\,E^{(1)} = 6\mathrm{Box}\,R$ and $E^{(2)} = E^{(1)}/3$ on FLRW; $E^{(1)}_{tt}$ of t^p; a WEC-and-rank-four perturbation of dust at sample points; control: $p = \frac{1}{2}$ gives $E^{(1)} = 0$.

C-Big05-38 Circular orbits: ℓ^2, E^2 solve $V' = 0$, $E^2 = V$; $\Omega^2 = \mathscr{B}$; domain $(3m, r_s)$; control: ℓ^2 with $2m$ in place of m fails.

C-Big05-39 Optical contract: Minkowski $\alpha_{\mathrm{fin}} = 0$; $\sin^2\Psi$ form and its expansion; N is Λ-free; $m = 0$ closed form and expansions; aberration bijection; two-angle determinant and recovery of (m, Λ); calibrated determinant; weak-field $\alpha_{\mathrm{fin}} \to 4m/r_0$; α_{fin} depends on Λ; controls: a Λ-dependent N and a mutated closed form fail.

C-Big05-40 Isotropic first-order Shapiro formula against the exact quadrature: $(T - D - \text{formula})/m^2$ stable as m halves; control: the coefficient m instead of $2m$ fails.

C-Big05-41 McVittie: frame G, R, sectional curvatures, tides and $\mathscr{K}$ at rational points for two expansion histories; isotropic-coordinate invariants; NEC sum; constant-rate change of time to Kottler; control: $G_{11} = -3H^2 - d$ fails.

C-Big05-42 $\mathscr{D}_{\mathrm{K}}$: reduction to r_K at $H = 0$; limits 0 at $r\mathrm{downarrow}\,2m$ and $r \to \infty$ for $H \neq 0$; control: at $H = 0$ the limit at $r\mathrm{downarrow}\,2m$ is positive, so the compact-closure statement needs $H \neq 0$.

C-Big05-43 Halo-plus-Λ host: $G^{\wedge\wedge}_{tt}$, G^{r}_{r}, Kepler reading, Misner–Sharp mass; SIS radii and cubic; NFW monotonicity of g and h; non-Kottler criterion (non-constant $G^{\wedge\wedge}_{tt}$ for SIS and NFW); control: a constant profile c_0 gives $\mathrm{Ric} = \Lambda g$ exactly, so the criterion is not vacuous.

C-Big05-44 Plummer halo: general static G formulas, $\rho, p_r, p_\perp, \mu', \Omega^2$, acceleration, r_{hb} (exactly at four values of k), turnaround monotonicity; control: $p_\perp$ with a factor 2 fails.

C-Big05-45 Orbit invariance and inverse κ formula; T_{late} injective; stabilizer coset for a random finite generator and probe; $(A, t) \mapsto (A/b, bt)$; control: $(U, q\kappa, q^2\alpha)$ changes T_{r}.

C-Big05-46 Access model: replacement-channel error $1 - d^{-2}$ (lower bound by the entangled input, upper bound by Weyl averaging) for $d = 2, 3$; midpoint bound; control: $1 - d^{-1}$ fails.

C-Big05-47 Version-2 documentary numbers; control: a magnitude off by a factor 10 fails.

C-Big05-48 $z_+^{7/4}$: C^1, second derivative unbounded and in L^2_{loc}; z-independence of the witness matrix; control: $\alpha = \frac{5}{4}$

is not in $W^{2,2}$.

C-Big05-49 Verbatim requirements of version 2: author line, citation line, ledgers in abstract and end, status tail (v2), χ notation, Big05-B only as future work; control: deleting a ledger fails.

C-Big05-50 Insertion only: every version-1 line outside the declared changed lines occurs in version 2 in order; every v1 label retained; all 78 draft labels in the draft crosswalk; controls: a deleted v1 line and a deleted crosswalk row are detected.

C-Big05-51 Bibliography: every companion item carries the current API hash and browse link; no ``local unregistered deliverable''; no tracking URL; all draft (sheet, label) pairs exist; control: a wrong hash is detected.

C-Big05-52 Version-2 mutation tests (drop a non-claim after a new result, alter a new label citation, remove the status tail (v2), alter the determinant).

C-Big05-53 Quotient theorem: on finite and interval fibres the minimax risk equals the half-width (grid search over estimators and two-point laws); attainment caveat with an open-interval fibre; unbounded fibre; control: an estimator claimed to beat the half-width fails.

C-Big05-54 Convex fibre: Gaussian-normal dust $\rho_0|h|^{-1/2}u\otimes u$ conserved for two metrics and two ρ_0; interior example keeps WEC; the counterexample $\mathscr{E}(\sum T_i)$ constant on the fibre; control: $\rho_0|h|^{-1}$ is not conserved.

C-Big05-55 Kernel criterion: random affine systems, identifiability iff kernel inclusion (rank test); rank-one target identified by one observation; rank bound; three-slot corollary rank two; control: a system with $N = q - 1$ fails.

C-Big05-56 Two-point bounds: exact Bernoulli sharpness, randomized grid search; control: the bound with $1 - \delta/2$ is violated.

C-Big05-57 Flagship: geometric observables (curvature scalars, angles, radar, tides) evaluated on two splits of one account agree; split-coupled detector separates; constitutive law gives one split; control: a detector reading T_{b} differs.

C-Big05-58 Rank/split separation: product bijection and T_c inversion for $g_\star$ (rank four) and dust FLRW (rank three); control: the FLRW kernel vector is invisible in T_c.

C-Big05-59 Jet statement: the pointwise evaluator agrees with the symbolic tensors of $g_\star$; pointwise rank four of g_1 at q_1; pointwise ranks three of $g_\star$ (control: all its single-event minors vanish); the two-event minor −77/512; counts 210, 4845.

C-Big05-60 Einstein collapse: $E^{(1)} = E^{(2)} = 0$, $G = -\frac{R}{4}g$ on de Sitter and Kottler; rank one; Weyl tides depend on m; control: $E^{(1)}$ on dust FLRW is nonzero.

C-Big05-61 McVittie tides: derivative identity, units restoration, no-universal-crossover witness, $H > 0$ unique minimum in $(2m, 7m/3]$, $H < 0$ decreasing on $(2m, 7m/3)$ and r_F, the three-critical-point example; frame components R_{1212}, R_{2323}; control: a monotone claim for $H > 0$ fails.

C-Big05-62 Constant-rate McVittie: pull-back to Kottler, $\gamma = \sqrt{A}/f$, $v = H_0 r/\sqrt{A}$, radial-boost invariance of Kottler tides, $27m^2H_0^2 < 1$ criterion; control: $\Lambda' = H_0^2$ fails.

C-Big05-63 Halo realization: general-μ stresses, energy-condition inequalities against direct evaluation on a grid, Misner–Sharp mass; control: $p_\perp = r\Phi'\rho$ fails.

C-Big05-64 Stability: V'' identity, S formula and Q, Schwarzschild $r > 6m$, Kottler condition, Plummer inequality against numerical V'', Rayleigh form; control: a sign condition on $\mathrm{d}\Omega^2/\mathrm{d}r$ disagrees at a witness radius.

C-Big05-65 Calibration: determinant formula, recovery, degeneracy curve with identical angle pairs and admissible rays; control: a third datum (r_0) removes the degeneracy.

C-Big05-66 Radar reference dependence: the four witnesses by quadrature with root residuals below 10^{-9}; control:

same contract twice gives $\Delta\tau$ equal.

C-Big05-67 Contract witnesses: radii order, Frobenius radius, tangential-boost tide, McVittie radial-boost transverse tide, domain, admissibility; control: a radial boost of a Kottler tide is unchanged.

C-Big05-68 Request t323u structure: every item mapped in Appendix , every new result followed by a non-claim, PC-29–44 present, labels unique; mutation tests.

bottomrule

Request t323u: directions, statements and verdicts

The user's request t323u (``Try to form and provide proof of theorems in Big05-A-v2") lists sixteen directions and a flagship. Each was checked against the definitions of this sheet and proved in the form stated at the given label; mismatches are PC-29–PC-44 (Appendix). *Held*: proved as proposed (possibly sharpened); *corrected*: proved after the stated correction; *partial*: proved in part, the rest left open in brackets.

toprule Item Version-2 statement Verdict Correction or open part

midrule endhead flag Theorem ; Corollaries – held PC-44: constancy is definitional; content is the scope of ``geometric".

#1 Theorem corrected PC-29: an interval inside the fibre range gives only a lower bound; attainment caveat.

#2 Theorem corrected PC-30: affine over V^{K-1}; algebraic interior; nonconstancy on the fibre.

#3 Theorem (a),(b),(d) corrected PC-31: ``fewer than r" needs rank r of the target.

#4 Theorem (a),(c) held PC-32: merged into the flagship, split-coupled responses and constitutive laws excluded.

#5 Theorem (c), Corollary held PC-31.

#6 Theorem held PC-33: sharp; binary form added.

#7 Theorem held PC-34: product account space made explicit.

#8 Theorem partial PC-35: single-event four-jet containment and codimension ≥ 1 proved; sharper bounds open.

#9 Proposition corrected PC-36: $E^{(1)} = E^{(2)} = 0$; rank exactly one; no conformal flatness needed.

#10 Theorem partial PC-37: units; observer is the McVittie flow; monotonicity for $H \geq 0$, $H < 0$ open.

#11 Proposition corrected PC-38: units; angles transform by aberration; moving-emitter radar not computed.

#12 Theorem corrected PC-39: exact energy-condition region; the circular region is sufficient only.

#13 Theorem corrected PC-40: criterion $S > 0$, a Rayleigh bound, not a sign of $\mathrm{d}\Omega^2/\mathrm{d}r$.

#14 Theorem held PC-41: converse needs r_0 unknown too; degeneracy exactly one-dimensional.

#15 Theorem partial PC-42: sign changes for reference and clock; magnitude only for identification and branch.

#16 Theorem held PC-43: witnesses for all six contract components.

bottomrule

Plan corrections from request t323u

PC-29 (#1) If the fibre values only contain $[a, b]$, the minimax risk is at least $(b - a)/2$; it equals the half-width of $[\inf, \sup]$. The midpoint's worst case is a maximum only if an endpoint is attained. Over several data values the risk is the supremum of the half-widths.

PC-30 (#2) The fibre is affine over V^{K-1}, V the conserved symmetric tensors, infinite-dimensional on Gaussian normal charts. ``Interior of the Minkowski sum" is replaced by a relative algebraic interior along a direction subspace. The functional must be nonconstant on the admissible fibre: $\mathscr{E}(\sum_i T_i)$ is nonconstant but constant on the fibre. Continuity is not needed.

PC-31 (#3, #5) ``Fewer than r observations cannot identify a generic target" is false for rank-one targets: one observation identifies a scalar affine target. Correct form: fewer than $\operatorname{rank} F_L$ observations fail; a generic target on an r-dimensional subspace has rank r only if $q \geq r$.

PC-32 (#4) The no-go is part (a) of the flagship. The exclusions are observations with a split-coupled response law and declared constitutive laws; T_{tot} counts as metric data.

PC-33 (#6) Both bounds verified and sharp (Bernoulli pair); estimators may be randomized.

PC-34 (#7) ``Data depending on g only through L_g'' is made precise by the effective-gravity accounts; increasing the rank enlarges the split direction space, which contains $(\mathrm{im}\, L_g)^2$.

PC-35 (#8) Jet order four at a single event suffices: rank deficiency forces the 210 minors of the 10×4 evaluation matrix to vanish at every event, polynomial after clearing powers of $\det g$, and not identically zero (witness g_1). Codimension ≥ 1 is proved; sharper codimension bounds stay open. Pointwise rank can be lower than effective rank ($g_\star$).

PC-36 (#9) On four-dimensional Einstein regions $E^{(1)} = E^{(2)} = 0$ and $G = -\frac{R}{4}g$; the rank is exactly one for every R; conformal flatness and constant R are not needed as hypotheses. Tensors built from the Weyl tensor are not multiples of g.

PC-37 (#10) The factors and signs are right. The c^2 placement is valid when time has length dimension and $\mathscr{H}' = \mathrm{d}\mathscr{H}/\mathrm{d}s$; in cosmic time the tides are $2c^2m/r^3 + H^2 + \dot{H}/\sqrt{A}$ and $-c^2m/r^3 + H^2 + \dot{H}/\sqrt{A}$. The declared observer e_0 is the McVittie flow, not a static observer (an earlier v2 wording is corrected). $\mathscr{D}_{\mathrm{M}}$ is monotone only for $\dot{H} = 0$; for $\dot{H} > 0$ it has one minimum in $(2m, 7m/3]$; for $\dot{H} < 0$ it is not monotone in general.

PC-38 (#11) With units $\Lambda' = 3H_0^2/c^2$. Invariants, static boundary, circular geodesics and tides transfer; angles read by e_0 transfer only after aberration with $v = H_0 r/\sqrt{A}$; radar for an emitter moving with e_0 is not computed.

PC-39 (#12) $p_r = 0$ holds for every μ; the NEC and WEC hold iff $r\Phi' \geq -2$, the DEC iff $|r\Phi'| \leq 2$; the circular region is sufficient, not necessary.

PC-40 (#13) Stability is $\Phi'' - 2\Phi'^2 + 3\Phi'/r > 0$, equivalently $\mathrm{d}\ln\Omega^2/\mathrm{d}\ln r > -4(1 - r\Phi')$; this is not a sign condition on $\mathrm{d}\Omega^2/\mathrm{d}r$.

PC-41 (#14) The uncalibrated converse needs r_0 unknown as well; with r_0 known Theorem (f) applies. The degeneracy is exactly one-dimensional, not only generically.

PC-42 (#15) Sign changes are witnessed for a change of reference metric and of clock normalization; for endpoint identification and branch only magnitude changes are witnessed.

PC-43 (#16) Radial boosts leave Kottler tides unchanged, so the observer witness uses tangential motion (or McVittie with $\dot{H} \neq 0$).

PC-44 (flagship) Constancy on the fibre holds by definition of a geometric observable; the theorem's content is the scope and the two sufficient supplies.

Request t331u: statements and verdicts

The user's request t331u (``Please further upgrade Big05-A by forming theorems and providing predictions'') proposes five theorem packages P1–P5, a section on dark matter (S 6) and a level structure. Each item was re-proved from the definitions of this sheet: by numerics for P1 and by computer algebra for P2–P5. The verdicts use the vocabulary of Appendix , extended by *rejected*: shown false as stated. Corrections are PC-45 to PC-56 (Appendix).

toprule Item Version-3 statement Verdict Correction or note

midrule endhead P1 Theorem held, strengthened PC-45: smooth, non-analytic class; NEC range $[c/H_{\mathrm{E}}, \infty]$; DEC iff $p \geq \frac{1}{3}$; relation to Theorem and [Big01-A].

P2 Theorem (a),(b) held PC-46: the contract is stated; $H_0 = c/D'(0)$.

P2 curved Theorem (c) held PC-46: units $([HD']^2 - c^2)/(H_0 D)^2$; drift form added.

P2 added Theorem (d) new Drift extremum at acceleration transitions.

Closure Hypothesis held, scoped PC-47: optional supplied hypothesis outside the ledger; not a premise.

P3 Theorem (a)–(c),(e) corrected PC-47: branches $H_0 = H_\infty$ and $H_0 < H_\infty$; N undefined at $A = 0$; the converse needs $\beta > 0$.

N vs Om Theorem (d) corrected PC-48: exact relation; flatness not needed for it; normalization $\beta + \alpha = H_0^2$.

P4 A Theorem (a),(b) held PC-49: also the branch $H_0 < H_\infty$.

P4 B Theorem (c) held, strengthened PC-49: first order in Δt_0; existence and uniqueness of z_*.

P4 C Theorem (d) held PC-49: $R_e < c/H_\infty$; no Big Rip.

Table Documentary record corrected PC-50: $z_{acc} = 0.6316$; conditional calculation; benchmark present in v1 and v2; radiation neglected. PC-51: 2.09 versus 1.916.

P5 Theorem held, strengthened PC-52: formulas of Theorem ; explicit layer.

P5 corollary Corollary held PC-52: non-uniform iterated limits.

S 6 Proposition held PC-53: corollary of Theorem .

S 6 list Proposition held Requirements only; not constructed.

Levels Section corrected PC-54: four levels, not three.

Citations Appendix corrected PC-55: tracking parameters removed; use restricted.

bottomrule No item is rejected.

Plan corrections from request t331u

PC-45 (P1) The statement is true in the smooth class and false in the analytic class: a real-analytic future that agrees with the past is forced (Theorem (c); [Big01-A], source record; not a premise). S must be C^∞, for example $S = \int_0^t \eta$. It is then flat at 0 automatically, which gives agreement in every derivative, and $S(t) = t - \frac{1}{2}$ for $t \geq 1$. $\dot{H}_B \leq 0$ iff $S' \geq 0$. The event-horizon integral diverges for each $p \leq 1$ and converges for $p > 1$. The NEC and WEC hold with $\Lambda = 0$, and the DEC holds iff $p \geq \frac{1}{3}$. The stronger form is kept: the exact NEC range $[c/H_E, \infty]$, with Theorem 's members with $R_* < c/H_E$ shown to violate the NEC. Theorem is retained (insertion only).

PC-46 (P2) Holds as stated, under the contract of Definition : comoving pair, observer proper time, past radial null rays and $D = (1 + z)D_A$. $\widehat{\Omega}_k$ needs c^2 in the numerator, as written, to be dimensionless; [Clarkson2008] uses $c = 1$. The drift form with $H_0 = c/D'(0)$ and part (d) are added.

PC-47 (P3) The closure is a declared, supplied hypothesis in a separate optional package, outside the ledger and not a premise; it adds no premise to the core. The plan treated only $H_0 > H_\infty$. At $H_0 = H_\infty$ the host is de Sitter for every n, $Y' \equiv 0$, N is undefined and n is not identified. At $H_0 < H_\infty$ the branch has a bounce, a bounded redshift range and $\dot{H} > 0$, so the NEC fails for every Λ. The converse ``$H^2 = B + Aa^{-n} \Rightarrow$ closure'' needs $B > 0$, and $N \equiv n$ characterizes $Y = \beta + \alpha x^n$, which is a closure iff $\beta > 0$.

PC-48 (N and Om) The answer to the plan's question is no in general: $Om \equiv \Omega \neq 0 \Rightarrow N \equiv 3$; conversely $N \equiv 3$ gives Om constant iff $\beta + \alpha = H_0^2$, which is automatic on intervals reaching $z = 0$. Flatness is not needed for either implication. It is needed to read β, α as vacuum and matter parameters and to reconstruct H from D. In curved hosts N is not constant.

PC-49 (P4) a_{acc}, the case $n \leq 2$, the drift curve, the horizon limit c/H_∞ and the no-Big-Rip integral are confirmed. Added: Δv is first order in Δt_0; z_* exists and is unique iff $n > 2$ and $z_{acc} > 0$, with $z_* > z_{acc}$; $R_e(t) < c/H_\infty$; the branch

$H_0 < H_\infty$ always accelerates.

PC-50 (Table) The benchmark $(\Omega_{\mathrm{m}}, \Omega_\Lambda, H_0) = (0.3153, 0.6847, 67.36)$ is in versions 1 and 2 (Documentary record), so the plan's ``manuscript's historical Planck-2018 benchmark" is accurate. Its values were re-read in Table 2 of [Planck2018] (arXiv:1807.06209v4, TT,TE,EE+lowE+lensing), and they are cited as a documentary record only. ``$z_{\mathrm{acc}} \approx 0.632$" is a rounding of 0.631556; 0.6316 is printed. The other entries are confirmed with the constants stated. The table is labelled a conditional calculation, and radiation is neglected.

PC-51 (``2.09 versus 1.916") At the benchmark the zero of z is $z_* = 1.916235$. The value 2.09 is the same zero at the rounded parameters $(0.3, 0.7)$ ($z_* = 2.0888$). It is not the maximum of Δv, which lies at z_{acc}, and it is not a radiation effect: a radiation probe of 10^{-4} lowers z_* to 1.9130.

PC-52 (P5) The formulas agree with Theorem : $c = 1$, $F = H^2 + \dot{H}/\sqrt{1 - 2m/r}$ with $\dot{H}$ the derivative in McVittie time, and $\mathscr{D}_{\mathrm{K}} = 4q^2/(H^4 + F^2)$, which is observer-independent, on $r > 2m$. The limit $1/(32m^5\dot{H}^2)$ holds for either sign of $\dot{H}$. Added: an explicit layer width, the non-uniformity corollary, and the remark that in the Kottler regime the $\dot{H} = 0$ limit at $2m$ is Weyl-dominated.

PC-53 (S 6) Held as a corollary of Theorem . The closure is a condition on the total: with $\Lambda = 3H_\infty^2$ it is a barotropic fluid with $w = n/3 - 1$. The split stays non-selected.

PC-54 (Structure) The plan announces ``three explicitly separated levels" but lists four rows; the four-level table of Section is used, with the core unchanged. P1 is placed in Section and P5 in Section .

PC-55 (Citations) The plan's links carry tracking parameters, which are removed. Each source is used only for what it states (Appendix). The Sandage paper behind the ``Sandage–Loeb" name was not checked, so it is not cited.

PC-56 (Records) Every companion record cited by the sheet was re-fetched. Each current response equals the version-2 copy with five figshare bibliography items inserted and no other change, so the version-2 hashes describe the earlier responses (Appendix).

Crosswalk from version 2 to version 3

toprule After (version 2) Inserted (version 3) Request

midrule preamble, after textbackslash TailTwo textbackslash TailThree t331u

abstract, before the citation line paragraph ``Version 3" t331u

end of sec:Big05-guide sec:Big05-guide3 t331u

cor:Big05-access sec:Big05-futures with thm:Big05-futures t331u (P1)

prop:Big05-constrate sec:Big05-mcvlayer with thm:Big05-mcvlayer, cor:Big05-nonuniform t331u (P5)

end of sec:Big05-contract sec:Big05-predictive: sec:Big05-levels, sec:Big05-geopred (def:Big05-driftcontract, thm:Big05-drift), sec:Big05-evolution (hyp:Big05-closure, thm:Big05-closure, thm:Big05-forecast, doc:Big05-forecast), sec:Big05-predsplit (prop:Big05-predsplit, prop:Big05-darkreq) t331u (P2–P4, S 6)

end of sec:Big05-scales2 sec:Big05-scales3 t331u

end of sec:Big05-release2 sec:Big05-release3 with thm:Big05-release3 t331u

end of app:pc3 app:t331, app:pc4, app:crosswalk23, app:labels3, app:checks3 t331u

bibliography Loeb1998, Clarkson2008, Sahni2008, Liske2008 t331u

bottomrule

Verification of sources, labels and references (version 3)

toprule ID sha256 of the current API record Relation to the version-2 copy

midrule endhead Big01-A 5fa2b917714b06379068ca4c0d71566fbbc13c50153e7a3ad9822ca03246a312 v2 copy

plus 5 inserted figshare bibliography items; no other change

Big02-A 1d8fc18c752c82edb1235282cbd56ccd8540e41ae675589337bbd6622ffa8f7a v2 copy plus 5 inserted figshare bibliography items; no other change

Big03-A d0c34c2c8393bffb87d695478db99a16111fe86ab1f3f2b3a69a38d5c25ff1be v2 copy plus 5 inserted figshare bibliography items; no other change

Big04-A 0bb4d9b2dd7dcfbef9da194f6be160ae1c8b4a756c0d5550b817df31226a352d v2 copy plus 5 inserted figshare bibliography items; no other change

Big04-A-coeff 9276db3c2eca392e3af5af1e960230367160d061874b332b4dc7342d5859ca70 v2 copy plus 5 inserted figshare bibliography items; no other change

DS-OB-1-fibre 4626dbb721ab0c0cb1f374699897dde85d5cc20f599f1a3470a620d286f425f8 v2 copy plus 5 inserted figshare bibliography items; no other change

DS-OB-1-CERT 759d67c3e997894d818e5609c400039634a99ce039ace259a9e69035998fcc8d v2 copy plus 5 inserted figshare bibliography items; no other change

VC-OB-1-CERT 49c68dea2376e303d3859e3287a349c45114389eb1ee2af97822d750efa14c98 v2 copy plus 5 inserted figshare bibliography items; no other change

VC-OB-1 b3d79a0284e6ec1e7970539b77384a75c22f5fbc38734d7a1352397f8d0f3711 v2 copy plus 5 inserted figshare bibliography items; no other change

EM-OB-1 9ace910c4648b58da78fce2e4421e08e91baa0b9f64817afac189edb16edf0d4 v2 copy plus 5 inserted figshare bibliography items; no other change

TS-OB-1 f8ee89134f0f2e0c687dfa71ca8a8150dbd6902f2282de3493b26dd446494fe1 v2 copy plus 5 inserted figshare bibliography items; no other change

nuADaM01-A 9aea3a1272070d3510551c2607469e751abdb1563672d0ecb93d5617fb384c85 v2 copy plus 5 inserted figshare bibliography items; no other change

Res01-C f94f7109048cdcbd8aeb39db13371f8038f330821ec1c12896ff9bba3b9ca941 v2 copy plus 5 inserted figshare bibliography items; no other change

Res05-A 6aaff3931d3060404006a88e931cd1156604f0b335d1702f1c63ac81fe584b8b v2 copy plus 5 inserted figshare bibliography items; no other change

Res06-A a22dfd9fdf7a31b4e1b156a1038ea5ccaaa2f45eea45699beebcdc403452c7b3 v2 copy plus 5 inserted figshare bibliography items; no other change

Hawk05-B e8ae780e771c04d876d91505de79fb11e47c89925596cb67f50db641945470fd v2 copy plus 5 inserted figshare bibliography items; no other change

Hawk06-A 5e3b4a8e389484e83da84014c68ddc77ba6c32dbd5cd5aab7ee164fc9078e262 v2 copy plus 5 inserted figshare bibliography items; no other change

Hawk07-C-Dyn 6faa71833a8cde60ae80ca6e25ddf40215dd39817ecd45c9460b1ebcf0d64f27 v2 copy plus 5 inserted figshare bibliography items; no other change

I-D b87e0d92b2c78f2500ba9622e0fb57a8ae4d345fbb88074026e1518fdcd1fdbb v2 copy plus 5 inserted figshare bibliography items; no other change

SG-OB-1 bdddfcc1a65c3d9c43ae560f35b0f34a3957a7d135ab8c33bd0846776dbdbb9a v2 copy plus 5 inserted figshare bibliography items; no other change

V-DST-G-B 6316e0b6c7d83ee4fa052575a23ff6e9a75982b346871094e26822ed50a0d18c v2 copy plus 5 inserted figshare bibliography items; no other change

Em02-E a18a68aeea3438d6194d7763d46df625a080d0f02a9cc102a81debde9f7c6953 v2 copy plus 5 inserted figshare bibliography items; no other change

En09-C b1eee72986ec3816ec3726dc6781b024b7a19fa147c78fffaf7b385fa33a38dd v2 copy plus 5 inserted figshare bibliography items; no other change

Red06-G-DSS eb05d034aff425428d4d3db404decc6bf867a0cd02ac16fdda9d355e20b6ee30 v2 copy plus 5

inserted figshare bibliography items; no other change

En08-ST-DSS d9536720f690532aab538ef61e666cb1b9596614e74e5a47a6725e4dc7054ca6 v2 copy plus 5 inserted figshare bibliography items; no other change

XIV-I 88d8e441a3d6293378f10d90866cb5a4d14a5bc9c2036fc684dc1918ff2209bf v2 copy plus 5 inserted figshare bibliography items; no other change

XIV-J 37df42b070527c008274670e33d862dd84625a3cdbbcd77544e4f5626033eee6 v2 copy plus 5 inserted figshare bibliography items; no other change

XV-B 32e5cf10243ed6987d6d96ceae9eb07daefe7ed897d60e7e31fd85ebb54b4b91 v2 copy plus 5 inserted figshare bibliography items; no other change

OpenAI 9a20a47b380d2de3d68e80a47877c563460260d7acf8aafdcab6aa97285ca5a8 v2 copy plus 5 inserted figshare bibliography items; no other change

bottomrule

External references (version 3). These were checked on 25 October 2026 against the arXiv API record, the Crossref record and the full text. Each is a source record, not a premise (source record; not a premise), and is used only as stated. toprule Key Record Used for

midrule Loeb1998 arXiv:astro-ph/9802122; *ApJ* 499 (1998) L111–L114; doi 10.1086/311375 Drift as a direct expansion probe; velocity-shift formula, eq. (3) (its Ω_R is curvature)

Clarkson2008 arXiv:0712.3457; *PRL* 101 (2008) 011301; doi 10.1103/PhysRevLett.101.011301 Curvature consistency $\Omega_k = ([HD]')^2 - 1)/(H_0 D)^2$, eq. (2), $c = 1$

Sahni2008 arXiv:0807.3548; *PRD* 78 (2008) 103502; doi 10.1103/PhysRevD.78.103502 Definition of *Om*, eq. (2.5); constancy in flat ΛCDM, eq. (2.8)

Liske2008 arXiv:0802.1532; *MNRAS* 386 (2008) 1192–1218; doi 10.1111/j.1365-2966.2008.13090.x Feasibility of drift measurements; no number used

Planck2018 arXiv:1807.06209v4; *A&A* 641 (2020) A6; doi 10.1051/0004-6361/201833910 Benchmark values, Table 2, TT,TE,EE+lowE+lensing (documentary record; not a premise)

bottomrule

Computer-assisted checks added in version 3

toprule Check Content (negative controls and mutations included)

midrule endhead C-Big05-69 P1 algebra: flat FLRW Einstein tensor and energy conditions; $\dot{H}_p = -H_p^2\eta/p$; exact power law for $t \geq 1$; $\int_0^1 \eta = \frac{1}{2}$; vanishing derivatives of $e^{-1/t}$ at 0^+; DEC threshold $\frac{1}{3}$. Control: the C^0 choice $S = \max(t, 0)$ has a jump in $\dot{H}$.

C-Big05-70 P1 numerics: $R_*(a_p)$ is infinite for $p \leq 1$, strictly decreasing on $p > 1$, at least c/H_E and tending to it; the closed-form tail is checked against direct quadrature. Control: a member of Theorem with $K = 2H_\mathrm{E}$ has $R_* < c/H_\mathrm{E}$ and $\dot{H} > 0$.

C-Big05-71 P2: $\dot{z}$ for arbitrary $a(t)$; flat and curved (sin, sinh) consistency; drift-extremum identity. Mutations: a sign flip in $\dot{z}$, and the flat formula on a curved host, are detected.

C-Big05-72 P3: closure $\Leftrightarrow H^2 = B + Aa^{-n}$; the coth, constant and tanh branches; $N \equiv n$; $N \equiv n \Rightarrow Y = \beta + \alpha x^n$; *Om* relation; barotropic $w = n/3 - 1$. Controls: curved and radiation terms make N non-constant.

C-Big05-73 P4: $\ddot{a}/a$; a_acc; $n \leq 2$ and $A < 0$ acceleration; the $n = 3$ factorization; uniqueness of $z_* > z_\mathrm{acc}$ for several n; $R_e < c/H_\infty$ and its limit; no Big Rip.

C-Big05-74 Forecast table: every entry is recomputed from the stated constants and matched to the printed digits;

$(0.3, 0.7) \to 2.0888$; radiation probe. Mutation: an altered printed digit is detected.

C-Big05-75 P5: the limit $1/(32m^5\dot{H}^2)$ for both signs; the layer bound at sampled parameters; iterated limits; consistency with the formulas printed in Theorem . Control: at $H = 0$ the ratio $\mathscr{D}_{\mathrm{K}}/(r - 2m)$ diverges.

C-Big05-76 Structure: four levels; the hypothesis is marked outside the ledger; a non-claim follows every new result; app:t331 covers P1–P5 and S 6; PC-45–56; abstract ``Version 3". Mutations are detected.

C-Big05-77 Insertion only over version 2: v2 lines in order apart from the declared changes; all v2 labels retained; the crosswalk lists every new label. Control: an altered v2 line is detected.

C-Big05-78 Current records: all cited pairs exist in inputs/api3; the appendix hashes equal the files; the relation column is recomputed. Control: a wrong hash is detected.

C-Big05-79 External references: the quoted equations and values are present in the reference texts; identifiers match the arXiv and Crossref metadata; no tracking parameters remain.

bottomrule

References

N. Cheung, *Big01-A (version 5): Horizon-Bounded Capacity on a Prescribed de Sitter Host*. API record sha256 e1160613ea8e02b37fb45954fe677d89f5fa7cca90062d42b68973b03a2bff1d. Current API record (25 October 2026) sha256 8849b3556e2925beed6a009218d8d84a4a2e9abd2c023dd464437122de0f8c82; https://enter.grok.me/browse/Big01-A. source record; not a premise.

N. Cheung, *Big02-A (version 6): Dark-Capacity Certificates on the Prescribed Static Patch*. API record sha256 98dd1fb1796a8e838796b21f9ad88242497638f86a2c9dae1c14b7efcc8dd804. Current API record (25 October 2026) sha256 8936ba43152e4e524a8a8d94772185c706bb628a32c5dba5147df8f4ff2a208f; https://enter.grok.me/browse/Big02-A. source record; not a premise.

N. Cheung, *Big03-A*, version 2. API record sha256 c71007c5e5455227925f625ff9fc488e369cbd66a64b95799f8f34e68519bd6a. Current API record (25 October 2026) sha256 c71007c5e5455227925f625ff9fc488e369cbd66a64b95799f8f34e68519bd6a; https://enter.grok.me/browse/Big03-A. source record; not a premise.

N. Cheung, *Big04-A, Version 5: External Radiation Labels and Causal-Access Certificates on Prescribed Comparison Geometries*. API record sha256 396f8a6849f4b4d4fafc2107b156e791c8e21e04d407ac4151e12678d6b32987. Current API record (25 October 2026) sha256 a0126c6a30370f6211b5fd0668b405e8ba6ede7f87cc43eb2476351eb439742c; https://enter.grok.me/browse/Big04-A. source record; not a premise.

N. Cheung, *Big04-A-coeff*, version 5; version 1 cited the then unregistered local file, sha256 669be66e3f5ae2c0efbe43455e57ea12584e29aea6b0e18abaa504c5f9a4568d. Current API record (25 October 2026) sha256 69d97b6fb3d598e731d4a57254c41a4c189a0e686f2cb00b62144c2bbaa03e54; https://enter.grok.me/browse/Big04-A-coeff. source record; not a premise.

N. Cheung, *DS-OB-1-CERT-v5*. API record sha256 a0805f8eb081a250f78e8074b9de5986ccd23106749df9e0fe5fac2f71e157f9. Current API record (25 October 2026) sha256 a0805f8eb081a250f78e8074b9de5986ccd23106749df9e0fe5fac2f71e157f9; https://enter.grok.me/browse/DS-OB-1-CERT. source record; not a premise.

N. Cheung, *DS-OB-1-fibre*, version 5; version 1 cited the then unregistered local file, sha256 2cc634b685ad52896bdbbc79f6b17653cd59fd3998819d0bf3da985a53a1ec05. Current API record (25 October 2026) sha256 b81d93b4bf81bd01bcc31aef3cd784a8e187c20e16c8269cb001f79086f8f280; https://enter.grok.me/browse/DS-OB-1-fibre. source record; not a premise.

N. Cheung, *VC-OB-1-CERT-v5*. API record sha256 d3a93a3afb0e8803d18f230ce824f78c19253f6a4bc841f8ceef763ce14f7cac. Current API record (25 October 2026) sha256 d3a93a3afb0e8803d18f230ce824f78c19253f6a4bc841f8ceef763ce14f7cac; https://enter.grok.me/browse/VC-OB-1-CERT. source record; not a premise.

N. Cheung, *VC-OB-1 (v5)*. API record sha256 c9d821b4db97cb384fa7c4e5d9a1d44791f989c61625d202586ab689e9091bc1. Current API record (25 October 2026) sha256 c9d821b4db97cb384fa7c4e5d9a1d44791f989c61625d202586ab689e9091bc1; https://enter.grok.me/browse/VC-OB-1. source record; not a premise.

N. Cheung, *EM-OB-1 (v5)*. API record sha256 ad34a7557952bc83f4d24587e0deb415fd6e8aa281975675ac331971f07ec7b0. Current API record (25 October 2026) sha256 ad34a7557952bc83f4d24587e0deb415fd6e8aa281975675ac331971f07ec7b0; https://enter.grok.me/browse/EM-OB-1. source record; not a premise.

N. Cheung, *TS-OB-1 (v5)*. API record sha256 1920bc3915db08e691b1e1d64486ef927f6af3a051540fb7ed93fbf7329972f7. Current API record (25 October 2026) sha256 1920bc3915db08e691b1e1d64486ef927f6af3a051540fb7ed93fbf7329972f7; https://enter.grok.me/browse/TS-OB-1. source record; not a premise.

N. Cheung, *nuADaM01-A (version 5): A Tightly Coupled and a Decoupled Dark Sector on a Prescribed Two-Epoch Host*. API record sha256 813b4ec4c79672d242e9a8f0c09e5048f11e6962beca9b5974c03d91709cdc23. Current API record (25 October 2026) sha256 813b4ec4c79672d242e9a8f0c09e5048f11e6962beca9b5974c03d91709cdc23; https://enter.grok.me/browse/nuADaM01-A. source record; not a premise.

N. Cheung, *Res01-C*, version 5; version 1 cited the then unregistered local file, sha256 f3ce3ed8032babf675d31fdaad813d5a3f1f46928cf17a7e33d849ae4b23abef. Current API record (25 October 2026) sha256 5311218b51faedfe6aea65484ba6b7057884314bf9fb88da81bba3f437579916; https://enter.grok.me/browse/Res01-C. source record; not a premise.

N. Cheung, *Res05-A-v8: Enter Access and a Quantitative Reduction of the Smoothing Residual*. API record sha256 cc125d1cc6017a5184259f402ea0c5b05c75a07507b66a737e07da1f4e526701. Current API record (25 October 2026) sha256 517dbbcea7b4bc4f23e8db979f4334f8e7a20fbbe6dd12ea8c32bcd09bb74d45; https://enter.grok.me/browse/Res05-A. source record; not a premise.

N. Cheung, *Hawk05-B: A Finite Page-Curve Derivation under the Enter Discipline*. API record sha256 cd68efa7ab052b9be246a3b88dd96bca5b0667a352b383e1a66ecdb2d2c38270. Current API record (25 October 2026) sha256 0404bd27adc8c80d1f2e12f860ac60b9a421349da7826246f8ca0eb715d3ca4a; https://enter.grok.me/browse/Hawk05-B. source record; not a premise.

N. Cheung, *Hawk06-A: Existence of Operational Islands in a Finite Enter Model*. API record sha256 1f41270ee7e202635178cf1fa76f0aead59c028ad27e9ec3a3eca6b5b2cc6f85. Current API record (25 October 2026) sha256 3c48969e9950838f1ec9b6db02410069c8d93cb71fee9928a79e1fed4ea46032; https://enter.grok.me/browse/Hawk06-A. source record; not a premise.

N. Cheung, *Red06-G-DSS*. API record sha256 8d95cea813b26da9bfe78d763489e143d6c2385dfd1da5059edc183b579c72af. Current API record (25 October 2026) sha256 3cdb13ba6281577778a5a4e3337e67cb3635ccfb8c8a3df559823798fefeb09c; https://enter.grok.me/browse/Red06-G-DSS. source record; not a premise.

N. Cheung, *En08-ST-DSS*. API record sha256 7c8d368bedc9e157ef1168560f1fc3ef0edc099109865978498aab72d7ef73cd. Current API record (25 October 2026) sha256 7c8d368bedc9e157ef1168560f1fc3ef0edc099109865978498aab72d7ef73cd; https://enter.grok.me/browse/En08-ST-DSS. source record; not a premise.

N. Cheung, *Landmark XIV-I*. API record sha256 36fcbb0951e9530a247c0b5bc0f35c2db27c6a1029c5cc773fb420e2fe39a2ce. Current API record (25 October 2026) sha256 a7aaf8d9a3095e9a0fdb50fa58f0d489b6a4ff4e6ecf387b0c0e4d5a2bae0c3a; https://enter.grok.me/browse/XIV-I. source record; not a premise.

N. Cheung, *Landmark XIV-J*. API record sha256 63ae47d900d0b0a3e6978648022b948da6a43ee0268f9adf8f583f21ddfde553. Current API record (25 October 2026) sha256 b7a1c430139d8635092e3b361e7b074fcddb102fe5083d6de4966d39c69138f3;

https://enter.grok.me/browse/XIV-J. source record; not a premise.

N. Cheung, *Landmark XV-B: Relative Lifting and Reconstruction Descent*. API record sha256 3b406c26075d4a0c7a07e8e668698247b097cb5c67fedbadad1ec36d738bb7e7. Current API record (25 October 2026) sha256 b8c24754cad5e7c0cc8ffef0aedb10856367c93eead5a418a693839554b40e07; https://enter.grok.me/browse/XV-B. source record; not a premise.

Enter Calculus Companion, *OpenAI catalogue page*, Families 003 and 265 (authors OpenAI; not verified by the companion). API record sha256 76314b644e51864fa1818f28f49f32a2ce2e06bdd32364ad939595c792cbf99d. Current API record (25 October 2026) sha256 76314b644e51864fa1818f28f49f32a2ce2e06bdd32364ad939595c792cbf99d; https://enter.grok.me/browse/OpenAI. source record; not a premise.

N. Cheung, *The Philosophy of Enter* (EntPhil-v2), introductory essay, as recorded in the background section of Big01-A. source record; not a premise.

Planck Collaboration, Planck 2018 results VI: Cosmological parameters, *Astron. Astrophys.* **641** (2020) A6. documentary record; not a premise.

International Astronomical Union, Resolution B2 (2012): the astronomical unit is 149 597 870 700 m exactly. documentary record; not a premise.

A. Prsa et al., Nominal values for selected solar and planetary quantities: IAU 2015 Resolution B3, *Astron. J.* **152** (2016) 41. documentary record; not a premise.

B. Bertotti, L. Iess, P. Tortora, A test of general relativity using radio links with the Cassini spacecraft, *Nature* **425** (2003) 374–376. documentary record; not a premise.

D. Clowe et al., A direct empirical proof of the existence of dark matter, *Astrophys. J.* **648** (2006) L109–L113. documentary record; not a premise.

N. Cheung, *Em02-E: Relational Cosmological Lapse: Classical Identification and a Renormalization Audit*. Current API record (25 October 2026) sha256 811d91f3814a8bc164c0f21da06590548c4ff4e24c0901449168f1ef4d82f30b; https://enter.grok.me/browse/Em02-E. source record; not a premise.

N. Cheung, *En09-C, Version 5: Internal phase reconstruction of the readings of the destructive Enter clock*. Current API record (25 October 2026) sha256 789b2ef40be69d73fe8f978da57e98289c523f00efb8b28083423dfc79ef60f4; https://enter.grok.me/browse/En09-C. source record; not a premise.

N. Cheung, *Hawk07-C-Dyn: Quantum Recovery on an Explicitly Dynamical Conical-Formation Spacetime*. Current API record (25 October 2026) sha256 aa615946d5ee868c41ad3768ee936561a5548d30949074584d08c5ce596e27cc; https://enter.grok.me/browse/Hawk07-C-Dyn. source record; not a premise.

N. Cheung, *I-D-v5: Dynamical Spacetime Enter over Two Prescribed Hosts*. Current API record (25 October 2026) sha256 4431dd996c43678dc8bbb4d8afe0fbe3f03695e7669c35f18cb16832135b0fdb; https://enter.grok.me/browse/I-D. source record; not a premise.

N. Cheung, *SG-OB-1 (v5): Obstruction sheet for Plan 12*. Current API record (25 October 2026) sha256 5103c25042a21d302281bbc558a964a5c8a57a8e2ab6700c3d0d01633e110a86; https://enter.grok.me/browse/SG-OB-1. source record; not a premise.

N. Cheung, *V-DST-G-B: Explicit Local Curvature Calibration of a Prescribed Classical Encoding of the Cubic Qubit*, Version 5. Current API record (25 October 2026) sha256 a41f03ab10e1f4c3e30da1e66772dbb29f221d95826a6826dcd5431824e61322; https://enter.grok.me/browse/V-DST-G-B. source record; not a premise.

N. Cheung, *Res06-A: A Packaging Certificate for Five Named Residuals*, version 4 (inserted over version 1). Current API record (25 October 2026) sha256 9d18d6e575ca4024a8bbc601c9ac4c1d3ef9be11c530a2ea575f507fb3760511;

https://enter.grok.me/browse/Res06-A. source record; not a premise.

W. Rindler and M. Ishak, Contribution of the cosmological constant to the relativistic bending of light revisited, *Phys. Rev. D* **76** (2007) 043006, https://doi.org/10.1103/PhysRevD.76.043006, arXiv:0709.2948. source record; not a premise.

A. Ishihara, Y. Suzuki, T. Ono, T. Kitamura and H. Asada, Gravitational bending angle of light for finite distance and the Gauss–Bonnet theorem, *Phys. Rev. D* **94** (2016) 084015, https://doi.org/10.1103/PhysRevD.94.084015, arXiv:1604.08308. source record; not a premise.

L. M. Butcher, No practical lensing by Lambda: Deflection of light in the Schwarzschild–de Sitter spacetime, *Phys. Rev. D* **94** (2016) 083011, https://doi.org/10.1103/PhysRevD.94.083011, arXiv:1602.02751. source record; not a premise.

I. I. Shapiro, Fourth test of general relativity, *Phys. Rev. Lett.* **13** (1964) 789–791, https://doi.org/10.1103/PhysRevLett.13.789. source record; not a premise.

G. C. McVittie, The mass-particle in an expanding universe, *Mon. Not. R. Astron. Soc.* **93** (1933) 325–339, https://doi.org/10.1093/mnras/93.5.325. source record; not a premise.

N. Kaloper, M. Kleban and D. Martin, McVittie's legacy: Black holes in an expanding universe, *Phys. Rev. D* **81** (2010) 104044, https://doi.org/10.1103/PhysRevD.81.104044, arXiv:1003.4777. source record; not a premise.

B. C. Nolan, Particle and photon orbits in McVittie spacetimes, *Class. Quantum Grav.* **31** (2014) 235008, https://doi.org/10.1088/0264-9381/31/23/235008, arXiv:1408.0044. source record; not a premise.

C. G. Böhmer and T. Harko, On Einstein clusters as galactic dark matter haloes, *Mon. Not. R. Astron. Soc.* **379** (2007) 393–398, https://doi.org/10.1111/j.1365-2966.2007.11977.x, arXiv:0705.1756. source record; not a premise.

A. Loeb, Direct measurement of cosmological parameters from the cosmic deceleration of extragalactic objects, *Astrophys. J.* **499** (1998) L111–L114, https://doi.org/10.1086/311375, arXiv:astro-ph/9802122. source record; not a premise.

C. Clarkson, B. A. Bassett and T. H.-C. Lu, A general test of the Copernican Principle, *Phys. Rev. Lett.* **101** (2008) 011301, https://doi.org/10.1103/PhysRevLett.101.011301, arXiv:0712.3457. source record; not a premise.

V. Sahni, A. Shafieloo and A. A. Starobinsky, Two new diagnostics of dark energy, *Phys. Rev. D* **78** (2008) 103502, https://doi.org/10.1103/PhysRevD.78.103502, arXiv:0807.3548. source record; not a premise.

J. Liske et al., Cosmic dynamics in the era of Extremely Large Telescopes, *Mon. Not. R. Astron. Soc.* **386** (2008) 1192–1218, https://doi.org/10.1111/j.1365-2966.2008.13090.x, arXiv:0802.1532. source record; not a premise.