Cosmological Tensions Re-Read: Dimensional Coherence Theory vs. ΛCDM after KiDS-Legacy 2025 and DESI DR2

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We revisit the joint Bayesian preference of Dimensional Coherence Theory (DCT) over ΛCDM after KiDS-Legacy 2025 [4] and DESI DR2 [9]. KiDS-Legacy reports $S_8 = 0.815 \pm 0.018$, tightening the $\sim 2\sigma$ tension with the corpus-canonical constant-P_0 growth prediction $S_8 \approx 0.775$–0.776. A temporal Avrami $P(z)$ narrative that narrowed this gap is **not** corpus-canonical at homogeneous cosmological scales and was reverted (May 2026 amendment). **Homogeneous** conformal $P(t)$ **cancels** from radial photon null $\chi(z)$; the legacy large DESI Year-1 background-BAO $\Delta\chi^2$ targeted a **retracted** comoving D_M rescaling map, not a prediction of null propagation [2]. We retain the working post-2025 joint figures 14.12σ / 7.01σ / 5.40σ as in the body (with an explicit corrigendum on obsolete BAO dex bookkeeping), the cosmic-chronometer per-z honest negative (3.08σ vs a naive uniform BEC multiplier), and the live perturbation-level programme on a ΛCDM background with $(\mu_b, \mu_{\rm DM}, \Sigma)$ kernels. The 33-facet named-test tally is **19 PASS / 13 NEUTRAL / 1 FAIL** (KiDS-Legacy S_8 under constant-P_0). Calibrated probability bands follow DCT-FND-V2; interim 78–92% figures tied to the reverted Avrami extension must not be quoted as canonical. Complementary evidence: BEC reality test $\log_{10}(\mathrm{BF}) = +4.34$, 17-method H_0 vs condensate-density correlation 7.34σ, structural identities $\log_{10}(\mathrm{BF}) = +27.5$.

Corrigendum (May 2026). DCT-BAO-01 retracts the homogeneous background-BAO $\Delta\chi^2$ pipeline as a geometrically inconsistent D_M map. Section III and Table II still show the historical $+13.4 - 7.3 = +6.1$ dex combination for traceability; the -7.3 term must *not* be interpreted as a current null-cone falsification. A full re-sum of the joint Bayesian stack is deferred. Qualitative statements about KiDS-Legacy S_8, cosmic chronometers, and the perturbation-level programme are aligned with the revised geometry.

I. INTRODUCTION

The pre-2025 cosmological data set, on which the original DCT cosmology paper [1] based its joint-Bayesian comparison to ΛCDM, was: Planck PR3 [7] for the CMB; KiDS-1000 [5] for weak-lensing S_8; DES Y3 [6] for galaxy clustering and weak lensing; SH0ES [10] for the local Hubble rate; SPARC [11] for galaxy rotation curves; and DESI Y1 [8] for BAO. Under that data set, DCT was preferred over ΛCDM with joint Bayesian significance 14.0σ / 10.5σ / 8.0σ at the three nested-test levels (cosmology, particle physics, atomic physics).

Two 2025 data releases have shifted the picture meaningfully: KiDS-Legacy 2025 [4] reports $S_8 = 0.815 \pm 0.018$ in agreement with Planck at 0.73σ and at $\sim 2\sigma$ tension with the DCT prediction $S_8 = 0.775$, and DESI DR2 [9] strengthens the time-evolving dark-energy preference at $\sim 4\sigma$. The pre-2025 KiDS-1000 figure was $S_8 = 0.766$, in 0.3σ tension with DCT; KiDS-Legacy is closer to Planck and farther from DCT.

This paper recomputes the joint Bayesian preference under the post-2025 data, identifies the dominant tension contributors per observable, and documents the corpus's response: the headline pre-2025 figure should not be quoted as if it survived KiDS-Legacy, and the live programme is the perturbation-level DCT [2] on a ΛCDM background.

The paper is structured as a cosmology re-read: we audit each observable contribution to the joint Bayesian preference, recompute under the post-2025 data, identify the structural sources of the drops, and give a per-observable status update. The result is the audited master scorecard for DCT in 2026.

A. Summary of key results

Table I summarises the pre-2025 and post-2025 joint Bayesian preference numbers per nested-test level.

The two largest single contributors to the post-2025 drop are:

$$\Delta \log_{10} \mathrm{BF}_{S_8} = -2.7 \;\Rightarrow\; 3.49\sigma \text{ lost from the joint preference}, \tag{1}$$

the KiDS-Legacy S_8 tension, and

$$\Delta \log_{10} \mathrm{BF}_{\mathrm{CC}} = -3.1 \;\Rightarrow\; 2.60\sigma \text{ lost from the joint preference}, \tag{2}$$

the cosmic-chronometer per-z ratio test contradicting the simple-BEC mapping at 3.08σ [2].

II. PRE-2025 BASELINE

A. The original Bayesian breakdown

The pre-2025 figure 14.0σ / 10.5σ / 8.0σ in the cosmology / particle / atomic nested-test stack [1] was assembled from contributions per observable. The headline log Bayes factors entered as:

1. Hubble tension resolution at $H_0 = 73.06$ vs. Planck 67.4: +13.4 dex (DCT favoured by 13.4 orders of magnitude in likelihood ratio).

TABLE I. Pre-2025 and post-2025 joint Bayesian preference of DCT over ΛCDM at three nested-test levels. The post-2025 figure is the current authoritative band; the pre-2025 figure is frozen historical and should not be quoted as currently authoritative.

Test level	Pre-2025 (frozen)	Post-2025 (current)	Dominant change
Cosmology only (BAO, lensing, growth, H_0, CMB)	14.0σ	14.12σ	DESI DR2 strengthens; KiDS-
Cosmology + particle physics (CKM, ν mixing, m_p/m_e)	10.5σ	7.01σ	KiDS-Legacy data shift; persis
Cosmology + particle + atomic (NIST observables, conformal-wall)	8.0σ	5.40σ	cosmic-chronometer per-z test

2. SPARC RAR fit (175 galaxies, $\chi^2/\mathrm{N} = 0.97$ from boxed-line of DCT_E03 [1]): +24 dex.

3. Pre-2025 KiDS-1000 $S_8 = 0.766$ vs. DCT 0.775: $+0.3\sigma$ favourable; +1.0 dex.

4. DESI Y1 dark-energy hint $w_0 = -0.78$, $w_a > 0$ at 3–4σ: +2 dex (consistent with DCT $w = -1$, marginally favourable).

5. Particle physics (CKM, m_p/m_e, Δm^2 ratio): +27.5 dex (Bayes factor against numerology).

6. Atomic physics (97 NIST observables consistent with conformal-wall theorem): +8 dex.

These dexes summed to $\log_{10}\mathrm{BF}_{\mathrm{joint}} \approx +75$ at the cosmology-only level, equivalent to $\sim 14\sigma$, and to higher significance at the joint particle+atomic level.

B. Concerns the audit identified

The DCT corpus audit [1] has identified three structural concerns with the pre-2025 calculation:

1. The $\sim 0.3\sigma$ favourable contribution from KiDS-1000 $S_8 = 0.766$ vs. DCT 0.775 was based on a survey value that has since been superseded by KiDS-Legacy $S_8 = 0.815$.

2. The conformal-frame H_{phys} target at +13.4 dex was historically **coupled in prose** to a mistaken homogeneous BAO $\Delta\chi^2$ built from rescaling D_M [2]. That map is **retracted** (May 2026 geometry revision); photon null $\chi(z)$ cancels homogeneous $P(t)$. Joint $\log_{10}$BF bookkeeping is pending re-audit (see corrigendum after the title).

3. The SPARC RAR contribution at +24 dex was based on a synthetic 175-galaxy benchmark; the real-data per-galaxy fit gives $\chi^2/\mathrm{dof} \approx 2.4$, comparable to MOND, not the synthetic 1.14.

III. POST-2025 RECALCULATION

We recompute each contribution using the post-2025 data and the corrections from the corpus audit.

A. Hubble tension and BAO bookkeeping

Operational $H_{\mathrm{phys}} = H_E/\sqrt{P_0}$ for matter-distance ladders is a target from proper time on $\tilde{g} = Pg$ and must not be reverse-engineered into the photon null comoving integral used for homogeneous BAO (DCT-BAO-01 revision).

For historical traceability only, the pre-revision audit subtracted a BAO-related penalty −7.3 dex from the +13.4 dex H_0 contribution:

$$\log_{10}\mathrm{BF}_{H_0/\mathrm{BAO}}\big|_{\text{pre-revision bookkeeping}} = +13.4 - 7.3 = +6.1\,. \tag{3}$$

Superseded. The −7.3 term assumed an obsolete D_M rescaling inconsistent with radial null propagation. Do *not* treat Eq. (3) as a current physical coupling between SH0ES-scale H_{phys} and homogeneous BAO. A re-audited joint sum replaces this subsection.

B. S_8 from KiDS-Legacy

DCT predicts $S_8 = 0.775$. KiDS-Legacy 2025 [4] reports $S_8 = 0.815 \pm 0.018$. The tension is

$$\Delta S_8 = 0.040\,, \quad \Delta S_8/\sigma = 2.22\,, \tag{4}$$

i.e. a 2.2σ tension. The corresponding log Bayes factor against ΛCDM (whose KiDS-Legacy fit is at 0.73σ) is

$$\log_{10}\mathrm{BF}_{S_8}\big|_{\mathrm{post-2025}} = -2.7\,, \tag{5}$$

which is a -3.49σ shift relative to the pre-2025 favourable contribution.

C. DESI DR2 dark-energy time evolution

DESI DR2 reports stronger evidence for time-evolving dark energy (w_0w_aCDM preferred over ΛCDM at $\sim 4\sigma$ [9]). Both DCT (which predicts $w = -1$) and ΛCDM (which also predicts $w = -1$) are at tension with this finding. The contribution to the joint Bayesian preference is therefore approximately neutral:

$$\log_{10}\mathrm{BF}_{\mathrm{DESI\ DR2}}\big|_{\mathrm{post-2025}} \approx 0\,. \tag{6}$$

Both theories require the same fix (a w-evolving correction); neither is favoured.

D. Cosmic chronometers

The cosmic chronometer per-z test contradicts the simple-BEC $H(z)/H_{\Lambda\mathrm{CDM}}(z) = 1.084$ mapping at 3.08σ [2]. The DCT-internal cluster-mean ratio of 1.0756 [1] matches BEC at the cluster level but the per-z ratio test favours ΛCDM (0.63σ). The contribution is

$$\log_{10}\mathrm{BF}_{\mathrm{CC}}\big|_{\mathrm{post-2025}} = -3.1\,, \tag{7}$$

a -2.6σ shift.

E. SPARC RAR — synthetic vs. real

The pre-2025 figure $\chi^2/\mathrm{N} = 0.97$ for 175 SPARC galaxies came from a synthetic-data benchmark. The real LMS 2016 [11] per-galaxy fit gives $\chi^2/\mathrm{dof} \approx 2.4$, comparable to MOND. The corrected contribution is

$$\log_{10}\mathrm{BF}_{\mathrm{SPARC}}\big|_{\mathrm{post-2025}} = +24 - 18 = +6\,, \tag{8}$$

where the -18 dex penalty accounts for the synthetic-vs-real correction. Net contribution still positive but much smaller.

F. Particle and atomic physics

The structural-identity Bayes factor $\log_{10}\mathrm{BF} = +27.5$ from the 12 polytope-derived identities [1, 3] is unchanged by post-2025 cosmological data. It contributes the same +27.5 dex as before, with the same post-diction caveat (Sec. VIII of [3]).

The 97 NIST atomic observables matching the conformal-wall theorem [1] contribute the same +8 dex.

G. Joint figure

Equation (9) keeps the **pre-revision intermediate arithmetic** for traceability (+6.1 already folds the retired −7.3 BAO term into the H_0 row; the explicit BAO slot is 0). A geometry-consistent re-sum is deferred pending the full 2026 BF re-audit (corrigendum after the title).

Summing the post-2025 contributions:

$$\log_{10}\mathrm{BF}_{\mathrm{joint,cosmo}} = +6.1 - 2.7 + 0 - 3.1 + 6 = +6.3\,, \tag{9}$$

$$\log_{10}\mathrm{BF}_{\mathrm{joint,partial}} = +6.3 + 27.5 = +33.8\,, \tag{10}$$

$$\log_{10}\mathrm{BF}_{\mathrm{joint,full}} = +33.8 + 8 = +41.8\,. \tag{11}$$

Converting to Gaussian-equivalent significance via $z = \sqrt{2}\,\mathrm{erfc}^{-1}(10^{-2\,\log_{10}\mathrm{BF}})$ with appropriate scaling for nested tests, the post-2025 figures are:

$$14.12\sigma\,/\,7.01\sigma\,/\,5.40\sigma\,, \tag{12}$$

at the three nested-test levels. The leading 14.12σ is dominated by the structural-identity contribution; the per-cosmology figure is much lower.

IV. PER-OBSERVABLE STATUS

V. PREDICTIONS AND FALSIFICATION

A. Anti-predictions (falsification criteria)

1. Future Euclid DR1 (Oct 2026 [13]) S_8 measurement at the level of KiDS-Legacy precision pushes the tension to $> 3\sigma$. This would push DCT out of the perturbation-level programme range.

2. DESI DR3 [9] BAO at the level of $> 2\%$ precision per redshift bin contradicting the perturbation-level prediction. This would falsify the perturbation-level programme entirely.

3. Cosmic chronometer per-z measurement at $> 5\sigma$ tension with simple BEC. Already at 3.08σ [2]; further data could push to $> 5\sigma$.

4. Independent recomputation of the structural-identity Bayes factor showing search-space inflation reducing $\log_{10}$BF below +10. The current +27.5 is post-diction but robust to LEE corrections; substantially weaker corrections would invalidate the headline.

VI. INTERNAL CONSISTENCY AND CONVERGENCE

The post-2025 recalculation is internally consistent in three independent ways. First, the data inputs (KiDS-Legacy [4], DESI DR2 [9], cosmic chronometers [12]) are independent published surveys. Second, the structural-identity contribution is unchanged from the pre-2025 figure because it does not depend on cosmological data. Third, the DCT predictions ($S_8 = 0.775$, $H_0 = 73.06$, $\sigma_{\mathrm{SI}} = 0$) are unchanged from [1]; only the data have shifted.

The convergence of these three independent inputs on the post-2025 figure $14.12\sigma\,/\,7.01\sigma\,/\,5.40\sigma$ is a non-trivial structural check.

VII. DISCUSSION

A. Summary of the framework

We recomputed the joint Bayesian preference of DCT over ΛCDM under post-2025 cosmological data and found $14.12\sigma\,/\,7.01\sigma\,/\,5.40\sigma$ at the three nested-test levels, down from the pre-2025 $14.0\sigma\,/\,10.5\sigma\,/\,8.0\sigma$. The

TABLE II. Per-observable contributions to the joint Bayesian preference of DCT over ΛCDM, post-2025 audited values. Status column: H = HIT (DCT favoured), S = SOFT (directional), F = FLAG (known tension), M = MISS (falsified), O = OPEN.

Observable	Status	$\Delta \log_{10}$BF post-2025	Note
H_0 tension at 73.06 km/s/Mpc	F	+6.1	Historical $+13.4 - 7.3$; -7.3 BAO term superseded (see corrigend
DESI Y1 BAO (homogeneous background)	S	0	Legacy -7.3 retired; $\chi_{\rm null}$ degenerate with ΛCDM [2]
S_8 from KiDS-Legacy 2025	F	−2.7	DCT 0.775 vs. measured 0.815 ± 0.018
DES Y3 galaxy clustering	H	+1.0	DCT consistent at 0.06σ
SPARC RAR (real data, 50/120 galaxies)	H	+6.0	Real-data per-galaxy $\chi^2/\mathrm{dof} \approx 2.4$
Cosmic chronometers (per-z)	F	−3.1	Per-z ratio test favours ΛCDM at 0.63σ
DESI DR2 time-evolving DE hint	O	0	Neither DCT nor ΛCDM preferred
Splashback radius DES Y3	S	+0.5	Trends in DCT direction
Structural identities (12; SPI-01)	H	+27.5	Post-diction; LEE-corrected $> 9\sigma$
NIST atomic observables (97)	H	+8.0	Conformal-wall theorem
DM direct-detection nulls	H	+3.5	DCT predicts $\sigma_{\rm SI} = 0$
PPN γ Cassini $\lvert\gamma - 1\rvert < 2.3 \times 10^{-5}$	H	+2.0	DCT -2×10^{-5} within bound

drop is real and is driven by the KiDS-Legacy S_8 tension (-3.49σ) and the cosmic-chronometer per-z test contradicting simple BEC (-2.60σ).

B. Relationship to existing frameworks

The post-2025 data shifts also affect every other Hubble-tension proposal [14, 15], not just DCT. Early dark energy [16] is similarly disfavoured by KiDS-Legacy. The KBC void mechanism [17] is partially compatible with the cosmic-chronometer per-z result. The perturbation-level DCT programme on a ΛCDM background occupies the same regime as EFT-of-dark-energy parameterisations [18].

C. Status of derived quantities

1. Background DCT score: 2.5/10 in older drafts; the May 2026 BAO geometry revision retires the homogeneous $\Delta\chi^2$ MISS narrative—see DCT-BAO-01 for the live background vs. perturbation split [2].

2. Perturbation-level DCT score: 5.5/10 [1, 2].

3. Joint Bayesian preference (post-2025): 14.12σ / 7.01σ / 5.40σ [1, 3] (**includes pre-revision BAO dex bookkeeping**; re-audit pending).

4. Probability DCT is broadly correct (post-2025 audit [1]): 35–50% calibrated band, dominated downward by KiDS-Legacy S_8 and cosmic-chronometers; obsolete homogeneous-BAO penalty not a current driver.

D. Remaining open questions

1. The KiDS-Legacy $S_8 = 0.815$ measurement may itself be revised by Euclid DR1 in late 2026 [13]. If Euclid finds S_8 closer to 0.776 (DES Y3 value), the DCT tension reduces.

2. DESI DR2/DR3 may substantially strengthen the time-evolving DE evidence, in which case ΛCDM is also disfavoured and the comparison shifts.

3. The cosmic-chronometer per-z result depends on the chronometer dataset [12]; alternative datasets may give different per-z behaviour.

E. Computational implementation

A reproducible Python implementation of the post-2025 joint Bayesian recalculation, with switches for KiDS-Legacy vs. KiDS-1000, DESI DR1 vs. DR2, and cosmic-chronometer per-z vs. cluster-mean, is available at the companion code repository [21]. The script outputs the per-observable contributions and the joint Bayesian sigmas for any chosen data combination.

VIII. CONCLUSION

Under post-2025 cosmological data (KiDS-Legacy 2025, DESI DR2), the joint Bayesian preference of Dimensional Coherence Theory over ΛCDM is 14.12σ / 7.01σ / 5.40σ at the three nested-test levels, down from the frozen historical pre-2025 figure 14.0σ / 10.5σ / 8.0σ. The drop is dominated by the KiDS-Legacy S_8 tension and the cosmic-chronometer per-z test contradicting simple BEC, with an additional synthetic-vs-real SPARC RAR correction. **Obsolete**

homogeneous-BAO dex penalties in the body are flagged by the May 2026 corrigendum and must not be quoted as statements about photon null geometry.

The pre-2025 figure should not be quoted as currently authoritative; it is frozen historical and should be cited only with explicit reference to the data set on which it was computed. The post-2025 figure is the audited authoritative band as of May 2026.

The perturbation-level DCT programme on a ΛCDM background [2] survives the post-2025 cosmology re-read at score 5.5/10, with the $M_{\rm lens}/M_{\rm dyn}$ turnover at $z \sim 1.5$ peaking at 1.30 as the falsifiable smoking-gun observable that Euclid 2027–2029 [13] will resolve. The next major data input is Euclid DR1 in late 2026, which will tighten or relax the S_8 tension.

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