De Sitter or Metric D? The Background Metric, Decided

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It Is All One — Notes. July 2026 (readable edition)

Abstract. Two geometries claim the honor of being this series' background: Willem de Sitter's celebrated 1917 solution, and metric D, the geometry this series derived from the observed redshift law. This note decides between them — by computation and then by observation, not by preference. The two are proven to be genuinely different spacetimes (no change of coordinates connects them); the century-old confusion about what redshift law de Sitter predicts is untangled in plain language (the answer depends on whether the matter moves or stands still); and two independent observational executions — the supernova brightness record and the strange fact that very distant objects look *bigger*, not smaller — both return the same verdict. Every symbol is introduced before use.

1. The Question, and Its Famous History

In 1917 de Sitter wrote down a universe with no matter at all, only a cosmological constant, in a static form where the geometry weakens with distance as $1 - r^2/R^2$. The 1920s then fought a celebrated confusion — "the de Sitter effect" — over what redshift the solution predicts. Sources held *static* in it show a redshift growing as the *square* of distance. But Lemaître showed in 1925 that the same spacetime, re-sliced along freely falling observers, gives an *exponential* law in time. Both answers are correct — about de Sitter. The redshift law depends on what the matter is doing inside the geometry.

This series ran the same question in the opposite direction: it *fixed the law from observation* — one factor of e of stretching per Hubble radius of proper distance, for matter that stands still — and derived the geometry that delivers it. The result is metric D. The two claimants must now meet head-on: mathematics first, then geometry, then the sky.

2. The Geometry: Genuinely Different Spacetimes

Could metric D be de Sitter in disguise — the same spacetime in unfamiliar coordinates? Computation answers absolutely: no. The test is the Ricci scalar — a number, computable at every point of a geometry, that no change of coordinates can alter, the geometric analogue of a fingerprint. De Sitter's fingerprint is the same number everywhere (that is what "maximally symmetric" means). Metric D's fingerprint *varies with radius* (companion script, computed symbolically). A geometry whose fingerprint varies cannot be re-dressed as one whose fingerprint doesn't. Different spacetimes, different symmetries, different sources — the comparison is real, not notational.

3. The Reconciliation: One Law, Two Kinematics

The exponential redshift law is not in dispute — *whose matter obeys it* is what divides the two geometries. In de Sitter, static sources show the quadratic law, and the exponential law belongs to matter that *recedes* through the static frame — the reading that became steady-state cosmology. In metric D, the matter stands still and the exponential law is pure gravitational redshift: the graded lapse of the Ledger note, climbing instead of fleeing. One law, opposite kinematics: **de Sitter moves the matter; metric D moves the meter.**

The series' own commitments choose sides before any data is consulted. The eternity postulate's bookkeeping, the Tolman equilibrium behind the measured temperature history, and the FIRAS constraint that shell matter be quasi-static (under about 600 km/s — the Four Calculations note) all demand matter that stands still. And with static matter fixed, the two geometries predict *different skies* — so the sky can vote.

4. Execution by Observation

First execution — the supernova record. Compare each candidate's predicted dimming against the standard model's, in magnitudes (the astronomer's logarithmic brightness unit; ±0.1 mag is the calibration slack documented in the cosmology paper). Metric D: −0.18, −0.23, −0.21 at redshifts 0.5, 1, 2 — a nearly constant offset, largely absorbable into calibration. De Sitter with *comoving* matter (the steady-state reading): +0.27, +0.56, +1.09 — a growing divergence no calibration can absorb; this is, historically, part of how steady-state cosmology died. De Sitter with *static* matter: two full magnitudes wrong by z = 0.5 — not a candidate at all.

Second execution — the turnaround. In our sky, objects of fixed size shrink with distance only up to a point; beyond redshift about 1.6 they begin to look *larger* again, because deep geometry magnifies. The standard model produces this turnaround; metric D produces it with no adjustable parameter, at exactly $z = e - 1 \approx 1.72$ (the Four Calculations note). Both readings of de Sitter produce *no turnaround, ever* — apparent sizes shrink monotonically forever. The turnaround is observed. Verdict rendered twice, independently.

(One test is deliberately set aside as neutral: the temperature history $T = T_0(1+z)$ is delivered by every static metric via Tolman equilibrium *and* by comoving de Sitter kinematically — all candidates pass it, so it cannot referee this match. This note's verdict has since been promoted to the foundations: see Allgemeine Feldtheorie §4a and the companion note Tolman from Staticity, where the same conclusion is derived from P1's W-circle and the audit is reclassified accordingly. The judgement recorded here was the corpus's first statement of it.)

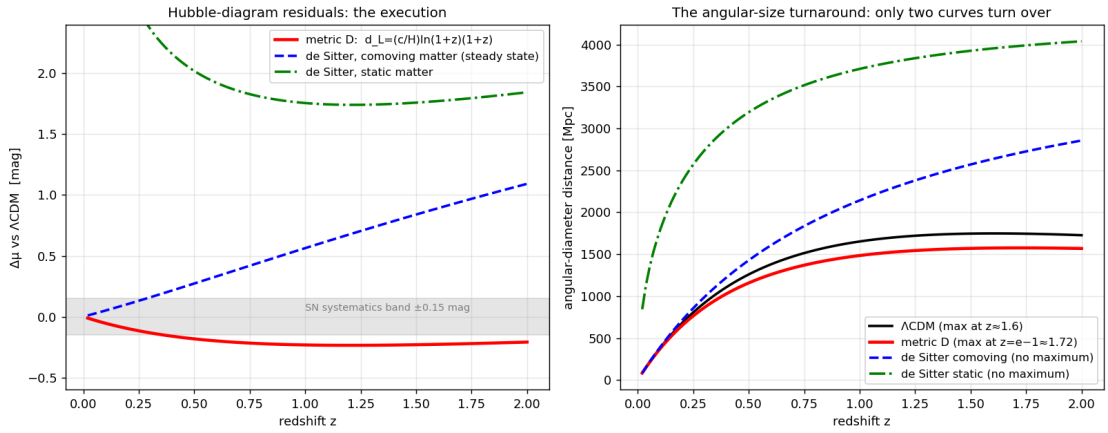

Figure 1. Left: Hubble-diagram residuals against the standard model — de Sitter static (worst), de Sitter comoving (fails past z ≈ 0.5), metric D (constant small offset). Right: the angular-size turnaround — present in the data, in the standard model, and in metric D; absent in both de Sitter readings.

5. Verdict

On the field equations, de Sitter is right: it is the unique maximally symmetric vacuum with a cosmological constant — no medium, no center, ten symmetries, the cheaper and cleaner geometry. Nothing in this note diminishes that. On the sky, metric D is right: with the matter this series requires — and observation supports — both readings of de Sitter are excluded by the supernova record, and both lack the observed turnaround, while metric D passes each test parameter-free. The price of being right on the sky is already booked in the foundations: the tension medium, and the surrendered center.

The relation between the two, stated once for the series: **metric D is what the de Sitter idea becomes when one insists that matter stand still and the exponential law survive.** De Sitter remains in the series where he belongs — as the local constant-curvature approximation, as the reference for the top rung's horizon temperature, and as the great ancestor whose law this series kept while replacing his kinematics. The background metric of the It Is All One series is metric D — decided by computation, not preference.

References

W. de Sitter, Proc. Roy. Acad. Amsterdam 19, 1217 (1917) and 20, 229 (1917); G. Lemaître, J. Math. Phys. 4, 188 (1925); H. Bondi and T. Gold, MNRAS 108, 252 (1948); F. Hoyle, MNRAS 108, 372 (1948); companion symbolic and numerical computations; and the papers of this series (Paper 1 §7.3; the cosmology paper; the Four Calculations note; the Postulates; the Ledger of the Way). *(Citations from memory; the literature-verification pass applies.)*