EN_31: On the Sign of the Cosmological Redshift

A Falsifiable Prediction of Zero Dark Energy

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Base work: Zenodo · My theories · Einstein-VED
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Abstract

The standard cosmological model (ΛCDM) interprets cosmological redshift as evidence of spatial expansion. This paper demonstrates that such interpretation inverts the arrow of time in the definition of expansion. In classical and relativistic physics, expansion requires $dr / dt > 0$ with $dt > 0$ (distances increasing toward the future). Cosmology observes redshift from the past ($dt < 0$) and labels it as expansion. This sign error forces the introduction of a positive cosmological constant Λ to compensate. A direct, model-independent prediction follows: if ΛCDM is correct, the redshift drift dz / dt_0 should be positive for distant galaxies; if the correct interpretation is that redshift measures temporal depth, then $dz / dt_0 < 0$. The Sandage-Loeb test, already in progress with ESPRESSO, ELT-ANDES and SKA1-mid, will discriminate between both signs within a decade.

Furthermore, a previous algebraic derivation (Einstein-VED) shows that $\Lambda = 0$ emerges from first principles when G is derived geometrically, leaving no residual degree of freedom. ΛCDM does not correct dynamics — it corrects a sign error in the definition of expansion.

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1. The Physical Definition of Expansion

In classical physics and in special and general relativity, the term *expansion* applied to a distance $r(t)$ between two objects means:

$$\frac{dr}{dt} > 0 \quad \text{with} \quad dt > 0$$

The condition $dt > 0$ is not trivial. It establishes that expansion is a **future-directed** property. When we say "the universe expands", we mean that if we wait a positive amount of time into the future, distances will be larger.

This is not a convention. It follows from the causal structure of space-time: the future is physically distinguishable from the past. There is no symmetry that allows us to invert dt without changing the meaning of the word "expansion".

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2. What Standard Cosmology Actually Observes

Cosmological surveys (JWST, SDSS, DESI) observe:

- Distant galaxies with redshift $z > 0$

- The light was emitted at cosmic time $t_{\text{em}} = t_0 - \Delta t$, with $\Delta t > 0$
- Therefore: $dt = t_{\text{em}} - t_0 = -\Delta t < 0$

The standard interpretation is:

$$z = \frac{\lambda_{\text{obs}} - \lambda_{\text{em}}}{\lambda_{\text{em}}} \approx \frac{v}{c} \quad \text{(for small } z \text{)}$$

where $v = dr / dt$ is a recession velocity.

But **the observed v is derived from light emitted in the past**. The quantity actually measured is:

$$\frac{dr}{dt}\Big|_{dt<0}$$

Standard cosmology then writes:

$$\frac{dr}{dt} > 0 \quad \text{with} \quad dt < 0$$

and calls this "expansion".

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3. The Sign Inversion

Let us make the inversion explicit:

Concept	Classical/Relativistic physics	Standard cosmology
Time direction	$dt > 0$ (future)	$dt < 0$ (past)

Concept	Classical/Relativistic physics	Standard cosmology
Measured quantity	dr / dt (future prediction)	dr / dt (past observation)
Sign of expansion	$dr / dt > 0,\ dt > 0$	$dr / dt > 0,\ dt < 0$
Status	Definition	**Sign error**

This is not a matter of interpretation. If we apply the same sign convention consistently, what cosmology calls "expansion" is actually:

$$\frac{dr}{dt}\Big|_{dt<0} = -\ \frac{dr}{d(-t)}\Big|_{d(-t)>0}$$

That is, it is the **time reversal** of a future-directed contraction.

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4. Why Λ Appears Necessary (and Why It Is an Artifact)

The Friedmann equations with a cosmological constant are:

$$\left(\frac{\dot{a}}{a}\right)^2 = \frac{8\pi G}{3}\rho + \frac{\Lambda}{3}$$

If one mistakenly assumes that a past-directed $dr / dt > 0$ implies future-directed acceleration, then:

- Observations of high-z supernovae (Perlmutter, Riess, 1998) show dimmer-than-expected magnitudes

- This is interpreted as "the expansion is accelerating"
- $\Lambda > 0$ is introduced to match the sign

But if the correct interpretation is that z measures **temporal depth** (not spatial distance), then:

- No acceleration is needed
- $\Lambda = 0$ is the natural value
- The apparent dimming is explained by a different $r(t)$ relation without Λ

Therefore: Λ **does not correct the dynamics.** Λ **corrects the sign error in the definition of expansion.**

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5. The Falsifiable Prediction: Redshift Drift

The Sandage-Loeb test (Sandage 1962, Loeb 1998) measures the time derivative of the cosmological redshift:

$$\dot{z} \equiv \frac{dz}{dt_0}$$

where t_0 is observer time.

5.1 Prediction of ΛCDM

In ΛCDM with $\Lambda > 0$ and accelerating expansion:

- $\dot{z} > 0$ for $z \lesssim 2$
- $\dot{z} = 0$ at $z \approx 2$
- $\dot{z} < 0$ for $z \gtrsim 2$ (but small in magnitude)

For very high z (e.g., $z \sim 14$, as observed by JWST), ΛCDM predicts:

$$\dot{z}_{\Lambda\text{CDM}} \sim +10^{-9} \text{ year}^{-1} \quad \text{(positive, small)}$$

5.2 Prediction of This Framework

If redshift measures **temporal depth** — that is, the difference in proper time between observer and emitter — then:

$$z \propto \Delta t_{\text{lookback}}$$

As observer time t_0 increases, the lookback time to a given galaxy **decreases** because the universe ages. Therefore:

$$\frac{dz}{dt_0} < 0 \quad \text{for all } z$$

No sign change. No zero crossing. Strictly negative.

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6. The Experiment That Decides

The test is already in progress:

Instrument	Start	Target	Sensitivity
ESPRESSO (VLT)	2018	Lyman-α forest	$\dot{z} \sim 10^{-9}$
ANDES (ELT)	~2030	High-z galaxies	$\dot{z} \sim 10^{-10}$
SKA1-mid	~2027	21 cm line	$\dot{z}$ at $z \sim 1$–3

Crucially: the Sandage-Loeb test is **model-independent**. It does not assume a distance ladder. It does not assume a Hubble constant. It directly measures $\dot{z}$ using atomic lines (hydrogen, Lyman-α, 21 cm) — absolute frequency standards.

No circularity. No calibration chain. Only: measure $\lambda(t_0)$ and $\lambda(t_0 + \Delta t)$.

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7. The Two Possible Outcomes

Outcome	ΛCDM	This framework
$\dot{z} > 0$ at high z	Supported	Falsified
$\dot{z} < 0$ at high z	Falsified	Supported
Λ	> 0 required	$= 0$ algebraically

Before 2030, data from ELT-ANDES or SKA1-mid will decide.

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8. Algebraic Derivation that $\Lambda = 0$ (Einstein-VED)

In the base work **Einstein-VED** (Zenodo: 18816405) it is shown that:

- Matter is confined wave energy
- Stability requires an integer n in the wave equation
- The minimal stable configuration is $n = 2$

- From $n = 2$, the gravitational constant G emerges **geometrically**, without free parameters

The Einstein equations are:

$$G_{\mu\nu} + \Lambda g_{\mu\nu} = \frac{8\pi G}{c^4} T_{\mu\nu}$$

If G is fully determined by geometry (no free parameter), then the left-hand side is **completely constrained**. There is no remaining degree of freedom to absorb a non-zero Λ.

Therefore:

$$\Lambda = 0 \quad \text{algebraically}$$

This is not a conjecture. It is a consequence of deriving G from first principles, as shown in the complete documents available at estradad.es/catalogo.php.

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9. Conclusion

ΛCDM rests on a sign error: interpreting a past-directed $dr / dt > 0$ as future-directed expansion. This error forces the introduction of a positive cosmological constant.

Two independent tests converge:

1. **Observational:** The Sandage-Loeb redshift drift will show $\dot{z} < 0$ for all z, falsifying accelerating expansion and supporting $\Lambda = 0$.
2. **Algebraic:** Deriving G from geometry (Einstein-VED) leaves no room for Λ; $\Lambda = 0$ emerges necessarily.

Λ does not correct the dynamics of the universe. Λ corrects a sign error in the definition of expansion.

References

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