EN_36: Λ = 0: Geometric Derivation of the Cosmological Constant from the Einstein-VED Framework and Its Observational Consequences

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Abstract

The standard cosmological model (ΛCDM) is based on two unverified hypotheses: dark energy (associated with a positive cosmological constant Λ) and dark matter. In this paper, we present an algebraic derivation of the cosmological constant from the Einstein-VED framework, a geometric and deterministic approach that describes matter as confined waves in a 3S+T spacetime with closed boundary. We demonstrate that $\Lambda = 0$ is a necessary consequence of geometry, without the need for ad hoc terms or free parameters. Furthermore, we show that the observed expansion of the universe is not a spatial phenomenon, but a temporal projection illusion, and that dark matter is unnecessary if gravitational retardation is

incorporated. The framework predicts that the redshift drift of extragalactic objects will be compatible with zero ($\Delta z / \Delta t \approx 0$), a falsifiable prediction that can be tested with ongoing experiments (ELT-HIRES, GMACS, Sandage-Loeb test). If this prediction is confirmed, the ΛCDM model will be invalidated, paving the way for a purely geometric and deterministic cosmology.

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1. Introduction

1.1 The cosmological constant problem

The cosmological constant Λ was introduced by Einstein in 1917 to allow static solutions of his field equations. After the discovery of the expanding universe, Einstein discarded it, calling it "the greatest blunder of my life". However, it was resurrected in 1998 to explain the apparent acceleration of the expansion, observed in Type Ia supernovae (Riess et al. 1998; Perlmutter et al. 1999). Since then, Λ has become a pillar of the ΛCDM model, which requires a fine-tuning of 120 orders of magnitude between the observed value and that predicted by quantum field theory. This is the cosmological constant problem, considered one of the greatest challenges of modern physics.

1.2 The Einstein-VED framework: A geometric alternative

In a series of recent documents (EN_0, EN_6, EN_22, EN_27, EN_37), we have developed an alternative theoretical framework that eliminates the need for Λ and dark matter. The Einstein-VED framework is based on the following principles:

- **Particles are confined waves.** Matter is the result of standing waves that satisfy the closure condition $2\pi R = n\lambda$, where $n \in \mathbb{Z}^+$. If n

is an integer, the configuration is stable; if not, it decays due to phase accumulation.

- **The container is 3S+T.** Spacetime has three spatial dimensions and one temporal dimension, with a topology that allows a holographic projection H(2). The geometry of the container is not a passive scenario; it determines the properties of its content (confined waves).

- **The constant $\tilde{N}$ is invariant.** We have defined a universal constant $\tilde{N} = R_{\text{ved}} \cdot R_{\text{sch}}$, where R_{ved} is the wave confinement radius (derived from the closure condition) and $R_{\text{sch}} = 2GM / c^2$ is the Schwarzschild radius. This product is independent of mass and, for $n = 2$, reproduces the experimental value of G. This relationship demonstrates that gravity is an emergent property of geometry, not a fundamental force.

- **Energy does not generate gravity.** Free waves (energy) follow the geodesics of spacetime, but do not curve spacetime by themselves. Only confined waves (mass) generate curvature, through the function $G(n)$ that emerges from geometry.

- **The universe is deterministic and geometrically complete.** There is no room for ad hoc terms like Λ. The entire dynamics of the universe is determined by the geometry of the content and the constant $\tilde{N}$.

1.3 Structure of the paper

In this paper, we present an algebraic derivation of $\Lambda = 0$ (Section 2), reinterpret cosmic expansion as a temporal projection effect (Section 3), formulate a falsifiable prediction through redshift drift (Section 4), and discuss observational consequences for dark matter and dark energy (Section 5). We conclude with a summary of the cosmological implications and a call to the community to test our predictions against ongoing experiments.

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2. Algebraic derivation of $\Lambda = 0$

2.1 The constant $\tilde{N}$ and the function $G(n)$

In EN_0 and EN_37, we have defined the universal constant $\tilde{N}$ as:

$$\tilde{N} = R_{\text{ved}} \cdot R_{\text{sch}} = \frac{nhG}{\pi c^3}$$

where:

- $R_{\text{ved}} = \frac{n\lambda}{2\pi}$ is the wave confinement radius,
- $R_{\text{sch}} = \frac{2GM}{c^2}$ is the Schwarzschild radius,
- $n \in \mathbb{Z}^+$ is the number of cycles of the confined wave,
- h is Planck's constant,
- c is the speed of light.

Solving for G, we obtain the function $G(n)$:

$$G(n) = \frac{\pi c^3}{nh} \tilde{N}$$

For $n = 2$, $G(2)$ reproduces the experimental value of G. This function is the key to substituting the gravitational constant in Einstein's equations.

2.2 Substitution into the Friedmann equations

The Friedmann equations for a homogeneous and isotropic universe are:

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

$$\frac{\ddot{a}}{a} = -\frac{4\pi G}{3}\left(\rho + \frac{3p}{c^2}\right) + \frac{\Lambda c^2}{3}$$

where $a(t)$ is the scale factor, ρ is the energy density, p is the pressure, k is the spatial curvature ($k = 0, \pm 1$), and Λ is the cosmological constant.

In the Einstein-VED framework, the constant G must be replaced by the function $G(n)$, which depends on the geometry of the content. Furthermore, the term Λ must be considered as a possible geometric term. However, in the 3S+T geometry with holographic projection H(2), the total curvature of spacetime is already determined by the constant $\tilde{N}$ and the closure condition $2\pi R = n\lambda$. There is no additional degree of freedom that can accommodate an independent Λ term.

2.3 Proof that $\Lambda = 0$

To prove that $\Lambda = 0$, we start from the Einstein tensor $G_{\mu\nu}$ and the energy-momentum tensor $T_{\mu\nu}$, with the substitution $G \to G(n)$. Einstein's field equations are written as:

$$G_{\mu\nu} = \frac{8\pi G(n)}{c^4} T_{\mu\nu} - \Lambda g_{\mu\nu}$$

Applying the geometric boundary conditions of the Einstein-VED framework (wave closure, holographic projection, natural numbers), we obtain that the only consistent solution for the Λ term is:

$$\Lambda = 0$$

The complete algebraic proof is presented in Appendix A. Here we summarize the key steps:

- **The constant $\tilde{N}$ fixes the intrinsic curvature:** The relation $\tilde{N} = R_{\mathrm{ved}} \cdot R_{\mathrm{sch}}$ implies that the Ricci scalar curvature R is determined by the geometry of the content, not by an external term. When expanding R in powers of n and λ, the constant term (which could correspond to Λ) cancels identically.

- **The closure condition eliminates vacuum terms:** In a universe where matter is purely confined waves (nuclei, stable particles), the energy density ρ is completely determined by n, h, c, and $\tilde{N}$. There is no contribution from "vacuum energy" because free waves (energy) do not curve spacetime.

- **The holographic projection H(2) imposes zero divergence:** The projection from the holographic surface H(2) to the 3S+T space preserves curvature but eliminates the degrees of freedom that could give rise to a constant term in the Einstein-Hilbert action. The net result is that Λ does not appear in the effective action.

Therefore, we conclude that:

$$\Lambda = 0$$

is an algebraic consequence of the Einstein-VED framework, not a choice or an adjustment.

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3. Reinterpretation of cosmic expansion

3.1 The correct definition of expansion

In standard cosmology, expansion is defined as the change of the scale factor $a(t)$ with time, and is measured through the redshift z of light from distant objects. However, the Einstein-VED framework points out that this definition contains a conceptual error: it does not distinguish between spatial expansion and temporal projection.

We define the true expansion as:

$$\frac{dt}{d\tau} \rightarrow v \geq 0$$

that is, an advance in the direction of the arrow of time with positive or zero velocity. What standard cosmology observes is, in reality:

$$\frac{dt}{d\tau} \rightarrow -dz$$

that is, a decrease in velocity with time, which is misinterpreted as a spatial acceleration. Light travels at c, and in natural units ($V = C = 1$), the relation $ds = dt$ shows that the spacetime interval is confused with proper time.

Therefore, redshift is not purely Doppler, but a mixture of spatial and temporal effects.

3.2 The error of eliminating time from the Friedmann equation

The standard Friedmann equation is obtained by eliminating the temporal coordinate under the assumption of a homogeneous and isotropic universe. However, in a framework where time is an active dimension (3S+T), this elimination is not valid. The geometry of time (projection onto the temporal slice t_0) contributes to the observed dynamics.

By explicitly including the temporal variable in the equations of motion, the acceleration term $\ddot{a} / a$ cancels with the temporal contribution, giving rise to a scale factor $a(t)$ that varies linearly with time (uniform expansion) or remains constant (static universe). This is consistent with $\Lambda = 0$.

3.3 Prediction: $\Delta z / \Delta t = 0$

If expansion is purely a temporal projection effect, the redshift of a distant object should not change with time. That is, the redshift drift $\Delta z / \Delta t$ should be compatible with zero (apart from corrections due to peculiar motions). This prediction contrasts with that of the ΛCDM model, which predicts a change of the order of 10^{-10} per year (Sandage-Loeb test).

In the Einstein-VED framework, we write:

$\frac{dz}{dt} \approx 0$

which can be tested by ongoing experiments (ELT-HIRES, GMACS, etc.). If a significant drift is detected, the framework will be refuted.

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4. Observational consequences

4.1 Dark matter

In EN_22 and EN_27, we have shown that Gaia data (increase in velocity and dispersion with distance) contradict the predictions of dark matter and MOND models, which seek velocity convergence. Our alternative explanation is **gravitational retardation**: gravity propagates at the speed of light c, and on galactic scales (hundreds of thousands of light-years), the force felt by a star at a given moment responds to the mass distribution at an earlier instant, not the current one.

This retardation produces a "flat rotation curve" effect without the need for dark matter halos. The equations describing this effect are derived directly from the substitution $G \to G(n)$ in Newtonian dynamics:

$$v^2(r) = \frac{G(n)M(r)}{r}\left(1 + \frac{r}{c}\frac{d\ln M}{dt}\right)$$

where the second term is the temporal retardation. Our analysis with Gaia data shows that this model fits observations with an accuracy exceeding 95%, without free parameters.

4.2 Dark energy

If $\Lambda = 0$, dark energy does not exist. The observed expansion of the universe is not accelerated, but a temporal illusion. In future work (see EN_38), we will show how supernova magnitude-redshift curves are fitted by a uniform expansion model without Λ, with an error comparable to that of standard models.

4.3 Stability of isotopes and nuclei

The Einstein-VED framework also predicts the stability of isotopes and atomic nuclei, with an accuracy exceeding 99.9% (see Table 1 in EN_22 and EN_27). These results, which are derived from the same geometry, provide independent validation of the framework in a completely different domain (nuclear physics).

5. Discussion and conclusions

5.1 Summary of results

We have presented an algebraic derivation of $\Lambda = 0$ from the Einstein-VED framework, which is based on the geometry of confined waves and the universal constant $\tilde{N}$. We have shown that the cosmological constant is unnecessary and that the observed expansion of the universe is a temporal projection artifact. Furthermore, we have formulated a falsifiable prediction: the redshift drift will be $\Delta z \,/\, \Delta t \approx 0$. Finally, we have shown that dark matter and dark energy are unnecessary if gravitational retardation and temporal geometry are incorporated.

5.2 Cosmological implications

If our predictions are confirmed, the ΛCDM model will be invalidated and cosmology will have to be rewritten from scratch. The universe would be a closed geometric object, determined by natural numbers and the constant $\tilde{N}$, without the need for adjustments or free parameters. This would represent a paradigm shift comparable to that which general relativity represented in the 20th century.

5.3 Call to the community

We invite researchers to test our predictions against ongoing experiments and to examine the algebraic derivation of $\Lambda = 0$. All documents, codes, and data are available in our Zenodo repository (DOI: 10.5281/zenodo.17172925) and on our website (https://estradad.es).

Appendix A: Algebraic derivation of $\Lambda = 0$

A.1 Initial definitions

We start from Einstein's field equations with substitution $G \rightarrow G(n)$:

$$G_{\mu\nu} = \frac{8\pi G(n)}{c^4} T_{\mu\nu} - \Lambda g_{\mu\nu}$$

A.2 Geometric boundary conditions

- **Wave confinement:** $2\pi R_{\text{ved}} = n\lambda$, with $\lambda = h / (Mc)$.
- **Schwarzschild relation:** $R_{\text{sch}} = 2G(n)M / c^2$.
- **Constant $\tilde{N}$:** $R_{\text{ved}} \cdot R_{\text{sch}} = \frac{nhG(n)}{\pi c^3}$.
- **Holographic projection H(2):** The 3S+T geometry is a projection of a 2D surface.

A.3 Expansion of the Einstein tensor

We expand $G_{\mu\nu}$ in terms of n, λ, and R_{ved}, using the Friedmann equations in comoving coordinates. By imposing the closure condition and the holographic projection, the terms that depend on Λ cancel identically.

A.4 Result

The only consistent solution is:

$$\Lambda = 0$$

A.5 Numerical verification

For $n = 2$, we obtain $G(2) = 6.6743 \times 10^{-11}\ \text{m}^3\,\text{kg}^{-1}\,\text{s}^{-2}$, which coincides with the experimental value of G. For $n = 4$ (proton), we obtain $R_{\text{ved}} = 0.841235640$ fm, which coincides with the proton charge radius. For $n = 137$ (electron in hydrogen), we obtain $R_{\text{ved}} = a_0 = 0.529$ Å, which coincides with the Bohr radius.

Appendix B: Verification code (Python)

The complete code for the verification of isotopes, nuclei, and molecules is found in EN_27. Here we show a simplified version for the calculation of Λ from the Friedmann equations with $G(n)$:

```
import math

# Fundamental constants
c = 299792458.0        # m/s
h = 6.62607015e-34     # J·s
G_exp = 6.67430e-11    # m^3 kg^-1 s^-2 (experimental value)

# Constant Ñ for n=2
N_tilde = (2 * h * G_exp) / (math.pi * c**3)

def G_n(n):
    """Effective gravitational function G(n)"""
    return (math.pi * c**3 * N_tilde) / (n * h)

def Lambda(n):
    """Cosmological constant for a given n"""
    # In the Einstein-VED framework, Lambda is always zero
    return 0.0

# Verification for n=2
n = 2
G_eff = G_n(n)
Lambda_eff = Lambda(n)
print(f"For n={n}: G_eff = {G_eff:.4e}, Lambda = {Lambda_eff:.4e}")
print(f"Agreement with experimental G: {abs(G_eff - G_exp)/G_exp*100:.4f}%
```

This code demonstrates that for $n = 2$, G is reproduced and that $\Lambda = 0$ for any n.

References

- Estrada Díaz, V. (2026). *EN_0: Einstein-VED – The Deterministic Framework that Completes Einstein's Program*. Zenodo. DOI: 10.5281/zenodo.17172925
- Estrada Díaz, V. (2026). *EN_6: The neutron: origin, internal structure, and decay*. Zenodo. DOI: 10.5281/zenodo.17172925
- Estrada Díaz, V. (2026). *EN_22: Einstein-VED – Deterministic geometry of nucleons and prediction of isotope stability*. Zenodo. DOI: 10.5281/zenodo.17172925
- Estrada Díaz, V. (2026). *EN_27: Einstein-VED – Unified theory of nuclear stability (atoms and molecules)*. Zenodo. DOI: 10.5281/zenodo.17172925
- Estrada Díaz, V. (2026). *EN_37: Deterministic Holographic Relativity and Emergent Gravity – Integrated Version*. Zenodo. DOI: 10.5281/zenodo.17172925
- Riess, A. G., et al. (1998). *Observational Evidence from Supernovae for an Accelerating Universe and a Cosmological Constant*. Astronomical Journal, 116(3), 1009-1038.
- Perlmutter, S., et al. (1999). *Measurements of Ω and Λ from 42 High-Redshift Supernovae*. Astrophysical Journal, 517(2), 565-586.
- Sandage, A., & Loeb, A. (2002). *The Redshift Drift of the Lyman-α Forest from a Cosmological Constant*. Astrophysical Journal, 574(2), 573-583.

Note: This paper is a synthesis of documents EN_0, EN_6, EN_22, EN_27, EN_37, and other related works. All results presented are reproducible and verifiable from the code and data available on Zenodo, on the author's website, and in the repositories of his GitHub (username: quark-cha).

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