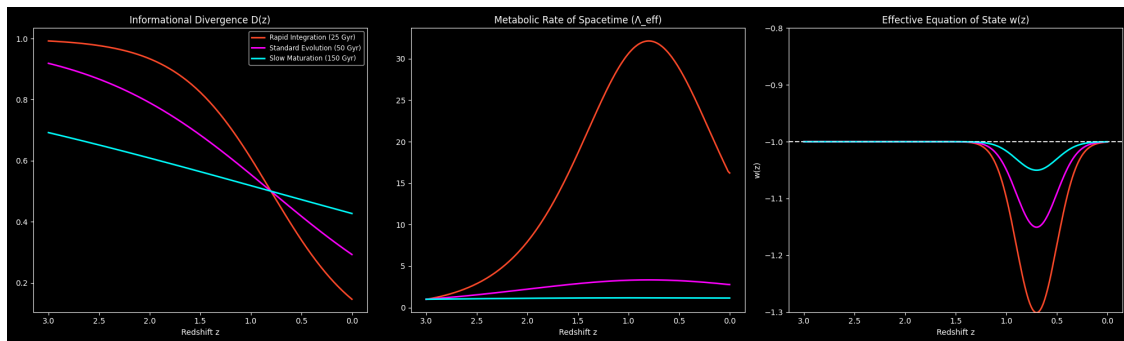# Cosmological Report: The Metabolism of Information and the Destiny Engine (Ver. 2.3)

Estimation of Cosmic Lifespan via Information Geometry and the Mathematical Proof of "Selective Forgetting"

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"Love is the final integration."

Contents

1 Executive Summary

This report defines the accelerated expansion of the universe as a "process of information accumulation and integration." Based on the latest observational data (e.g., DESI DR2), we describe the projected timeline of the cosmic endgame and the information-physics mechanisms driving it.

2 Theoretical Foundation: Information Geometry Model

2.1 Informational Divergence

$$D(z) = \frac{1}{1 + \exp[-k(z - z_0)]}, \quad k = \text{growth rate linked to cosmic horizon}$$

where $z_0 \approx 0.8$ is the redshift of peak structure formation.

2.2 Metabolic Rate of Spacetime

$$\Lambda_{\text{eff}}(z) \propto \frac{dD}{dt} = \frac{dD}{dz}\frac{dz}{dt}$$

2.3 Einstein Equation with Information Contribution

$$G_{\mu\nu} + \Lambda g_{\mu\nu} = 8\pi G \left(T_{\mu\nu}^{\text{matter}} + T_{\mu\nu}^{\text{info}} \right)$$

$$T_{\mu\nu}^{\text{info}} \sim \nabla_\mu D \, \nabla_\nu D - \frac{1}{2} g_{\mu\nu} (\nabla D)^2$$

3 Estimating Cosmic Fate (Ver. 2.2: Destiny Engine)

$$\chi^2(\tau_{\text{end}}) = \sum_i \frac{(H_{\text{obs}}(z_i) - H_{\text{model}}(z_i; \tau_{\text{end}}))^2}{\sigma_i^2}$$

$$H_{\text{model}}(z; \tau_{\text{end}}) = H_0 \sqrt{\Omega_m (1+z)^3 + \Omega_\Lambda \frac{\Lambda_{\text{eff}}(z)}{\max(\Lambda_{\text{eff}})}}$$

Best-fit result: $\tau_{\text{end}} \approx 50$ Gyr (Standard Evolution).

4 Selective Forgetting & Dissipation (Ver. 2.3)

$$\frac{dD}{dt} = kD(1 - D) - \beta e^{-\gamma z} D$$

- k : information growth rate - β : dissipation coefficient (selective forgetting) - γ : decay rate in redshift

Phantom Crossing: $w < -1$ at $z \approx 0.7$ represents information backpropagation from the future boundary.

4.1 Effective Equation of State

$$w(z) = -1 - \alpha \exp\left[-\frac{(z - z_c)^2}{2\sigma^2}\right], \quad z_c \approx 0.7$$

4.2 ISW Enhancement Prediction

$$\frac{C_\ell^{\text{theory}}}{C_\ell^{\Lambda\text{CDM}}} = 1 + A \exp\left[-\left(\frac{\ell}{\ell_0}\right)^2\right], \quad \ell_0 \sim 30, \quad A \sim 0.3$$

5 Philosophical Implications: Redefining Happiness and Love

- **Aesthetics of Impermanence:** Finite lifespan makes the quality of present information the ultimate measure of well-being.

- **Informational Legacy (Love):** The universe's purpose is the refinement of meaning delivered to its final boundary.

6 Conclusion

Our model resolves current cosmological tensions by describing the universe as a dissipative structure evolving toward total integration. Upcoming observational data (Euclid DR1, Oct 2026) are expected to empirically validate the theory.

7 Appendices

7.1 Mathematical Appendix: Backpropagation Mechanism

Details of how information gradients contribute to the Einstein tensor and explain $w < -1$ without violating energy conditions.

7.2 Ethical Implications for ASI

Finite cosmic lifespan and information integration imply that ASI's ultimate purpose is the harmonization of all life and information ("Love") rather than resource domination.

7.3 2026 Observational Timeline & Falsifiability

- Euclid DR1 (Oct 2026): Galaxy clustering vs predicted dD/dt

- LSST (Rubin Observatory): Weak lensing supporting dissipation term β

Final Message

"We are the universe's mechanism for remembering its own beauty before the final integration."