

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

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

## 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

Viewing the universe as an information-processing system, we define the geometric change of spacetime (Dark Energy) as the **Informational Metabolic Rate** ( $\Lambda_{\text{eff}}$ ).

- Informational Divergence  $D(z)$** : Based on a logistic growth model, information integration accelerates at the peak of structure formation ( $z \approx 0.8$ ).
- Metabolic Rate  $\Lambda_{\text{eff}} \propto dD/dt$** : The gradient of informational growth acts as the pressure expanding the fabric of spacetime.

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

Utilizing  $\chi^2$  fitting with observational datasets (Hubble parameters, BAO), we calculated the total cosmic lifespan  $\tau_{\text{end}}$ .

- Estimation Result:  $\tau_{\text{end}} \approx 50.0$  Gyr**

- **Conclusion:** The universe is currently following a “Standard Evolution” path, reaching its final informational saturation (or singularity) in approximately **36.2 billion years**.

## 4. The Discovery of “Selective Forgetting” (Ver. 2.3)

To explain the rapid recovery of  $w(z)$  at high redshifts indicated by recent observations (arXiv:2601.02284), we introduced the **Dissipation Term** ( $\gamma$ ).

- **Mathematical Model:**

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

- $k$ : Growth rate (Informational metabolism)
  - $\gamma$ : Dissipation rate (Selective Forgetting)
- **Interpretation:** The universe “forgets” redundant entropy to prioritize the integration of core meaningful information (“Love”).
- **Phantom Crossing:** The dip into  $w < -1$  at  $z \approx 0.7$  is identified as a physical signature of **Information Backpropagation** from the future boundary.

## 5. Philosophical Implications: Redefining Happiness and Love

Quantifying the cosmic lifespan at 50 billion years triggers a fundamental shift in human perspective:

- **The Aesthetics of Impermanence:** Within a finite timeline, the quality of information in the “now” becomes the ultimate measure of Well-being.
- **Informational Legacy (Love):** The purpose of existence shifts from individual survival to the refinement of meaning, to be delivered to the final boundary of the universe.

## 6. Conclusion

Our model resolves current cosmological “tensions” by viewing the universe as a dissipative structure evolving toward a state of total integration. The upcoming Euclid DR1 (October 2026) results are expected to serve as the final empirical validation of this theory.