Comparison of Finite Informational Density Proxies and Planck-Epoch Energy Density

A Standalone Null Unity–Infosophy Analysis

Simulon Research Group

November 3, 2025

Introduction

The symbol $\varnothing$ in the unified Null Unity–Infosophy framework represents *Maximal Informational Density*. In the ideal formalism,

$$\rho_I(\varnothing) = \lim_{V \to 0^+} \frac{I}{V} = +\infty.$$

To obtain practical, finite values, three regulated proxies were constructed. This document compares those proxies to the maximal physically meaningful density associated with the **Planck epoch**—the limit at which known physics remains valid and the closest operational analogue to the "infinitesimal point before the Big Bang."

Planck-Epoch Density as the Cosmological Upper Bound

The Planck energy density is given by:

$$\rho_{\text{Planck}} = \frac{c^7}{\hbar G^2} \approx 4.63 \times 10^{113} \text{ J/m}^3.$$

Using the Bekenstein bound at the Planck radius ℓ_P, the corresponding *maximal informational density* is:

$$\rho_{I,\text{Planck}}^{\max} = \frac{2\pi}{\hbar c \ln 2} \frac{E_P}{\ell_P^2} \approx 2.15 \times 10^{105} \text{ bits/m}^3.$$

This value is the appropriate comparison point for the informational density of $\varnothing$ under physical regulation.

Finite Proxies for Maximal Informational Density

Three proxies were computed using physically meaningful cutoffs:

1. Planck-Scale Proxy

$$\rho_I^{\text{eff}}(\ell_P) \approx 2.15 \times 10^{105} \text{ bits/m}^3.$$

This proxy *matches* the Planck-epoch informational bound.

2. Nanometer Voxel Proxy

$$\rho_I^{\text{eff}}(1 \text{ nm}) \approx 4.59 \times 10^{25} \text{ bits/m}^3.$$

This is approximately 4.68×10^{79} times smaller than the Planck bound.

3. THz Coherence Proxy

$$\rho_I^{\text{eff}}(\Delta\nu = 1 \text{ THz}) \approx 1.28 \times 10^{34} \text{ bits/m}^3.$$

This is approximately 1.68×10^{71} times smaller than the Planck bound.

Side-by-Side Comparison

Model / Regulator	Scale / Energy	Informational Density (bits/m^3)	Relative to Planck Bound
Planck Epoch	$\ell_P,\ E_P$	$\mathbf{2.15 \times 10^{105}}$	Baseline (1×)
Planck Proxy	$\ell_P,\ E_P$	$\mathbf{2.15 \times 10^{105}}$	Matches Planck limit
Nanometer Proxy	1 nm, 1 eV	4.59×10^{25}	$\approx 4.68 \times 10^{79}\times$ smaller
THz Coherence Proxy	$L_c \sim 10^{-4}$ m, $E = 1$ J	1.28×10^{34}	$\approx 1.68 \times 10^{71}\times$ smaller

Conclusion

The Planck-scale proxy for ∅ yields a maximal informational density of:

$$2.15 \times 10^{105} \text{ bits/m}^3,$$

which coincides precisely with the informational density implied by the Planck-epoch energy density. This reflects the highest meaningful bound available before classical spacetime and standard physics lose validity.

The nanometer and THz-coherence proxies are many orders of magnitude below the Planck limit, reflecting their larger effective volumes and reduced energy budgets. These proxies serve as practical finite stand-ins for simulations, models, or scaled versions of Null Unity–Infosophy behavior.