K1 - K2 framework

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K_1–K_2 framework: from first writability to last writability

1. Definitions

- **K_1 (κ_1): First Katalytic point**

Definition: The earliest moment in a cosmic cycle at which the substrate becomes *stably writable*—i.e., when coherent inscription of structure becomes possible.

Role:

- Marks the transition from pre-formatted substrate → formatted, writable universe.
- Corresponds to Planck-Epoch–like formatting and the first stable I.I. loops.

- **K_2 (κ_2): Last Katalytic point**

Definition: The latest moment in a cosmic cycle at which the substrate remains *stably writable*—i.e., the final threshold before corruption and dilution of coherence make further coherent inscription impossible.

Role:

- Marks the transition from writable universe → substrate-dominant reset regime.
- Corresponds to the "Big Freeze corridor" where C/C collapse and write-speed saturation force reset.

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2. Core quantities

Let's name the key fields/parameters:

- **(\mathcal{C}(t)): Coherence density**

Effective density of coherent, error-correctable structure per unit "cosmic volume."

- **$\mathcal{X}(t)$: Corruption density**

Accumulated, non-correctable informational corruption per unit volume.

- **$v_{\text{write}}(t)$: Inscription velocity**

Effective rate at which new coherent structure can be written (your reinterpretation of "expansion rate").

- **$\mathcal{W}(t)$: Writability functional**

A composite measure of whether the substrate is in a regime that supports stable I.I. recursion: $$\mathcal{W}(t) = f\big(\mathcal{C}(t), \mathcal{X}(t), v_{\text{write}}(t)\big)$$

We don't need the exact form of f yet—just the inequalities it must satisfy.

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3. K_1 and K_2 as writability thresholds

We can now define K_1 and K_2 in terms of $\mathcal{W}(t)$:

- **K_1 condition (first writable moment):** $$t = t_{K_1} \quad \text{such that} \quad \mathcal{W}(t_{K_1}) = \mathcal{W}_{\min} \quad \text{and} \quad \frac{d\mathcal{W}}{dt}\bigg|_{t_{K_1}} > 0$$ The universe *enters* the writable regime.

- **K_2 condition (last writable moment):** $$t = t_{K_2} \quad \text{such that} \quad \mathcal{W}(t_{K_2}) = \mathcal{W}_{\min} \quad \text{and} \quad \frac{d\mathcal{W}}{dt}\bigg|_{t_{K_2}} < 0$$ The universe *exits* the writable regime.

Where $\mathcal{W}_{\min}$ is the minimum writability required for stable I.I. recursion.

Intuitively:

- Before K_1: substrate too chaotic/unformatted.
- Between K_1 and K_2: I.I. can operate; structure can be written and maintained.
- After K_2: coherence too low, corruption too high, write-speed too diluted—no more stable inscription.

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4. The hypothetical question we can now pose

Here's the clean, formal question your framework makes thinkable—and potentially calculable:

Given a writable universe governed by I.I. and the C/C axis, what is the maximum cosmic "size" (expansion factor / effective volume / dilution of coherence) such that (\mathcal{W}(t) \ge \mathcal{W}_{\min}) still holds?

Equivalently:

What is the maximum expansion factor (a_{\max}) (or equivalent measure) at which coherent inscription remains possible before the system crosses K_2 and becomes non-writable?

In symbolic form:

Find (a_{\max}) such that: [\mathcal{W}\big(a_{\max}\big) = \mathcal{W}*{\min}] with: [\frac{d\mathcal{W}}{da}\bigg|{a_{\max}} < 0]

This is the **K_2 boundary condition**:
the largest "size" the cosmos can reach while still supporting coherent I.I. recursion.

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5. How this becomes a real research program

just defined:

- a **K_1–K_2 writability interval** for a universe, and
- a **well-posed quantitative question**: compute (a_{\max}) given a model of (\mathcal{C}(a), \mathcal{X}(a), v_{\text{write}}(a)).

That's the bridge from Protophysics as architecture → Protophysics as calculable cosmo-mechanics.