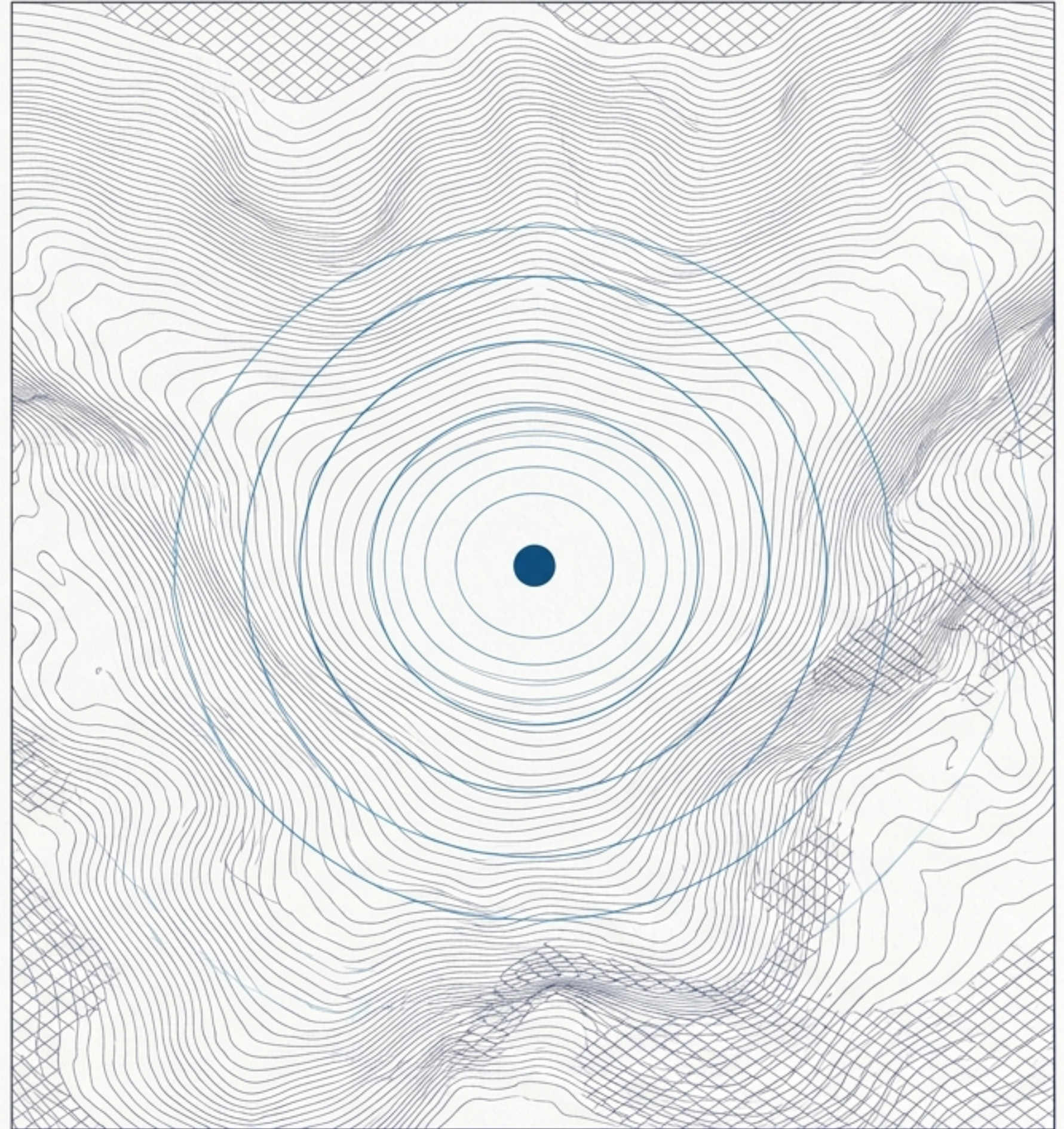


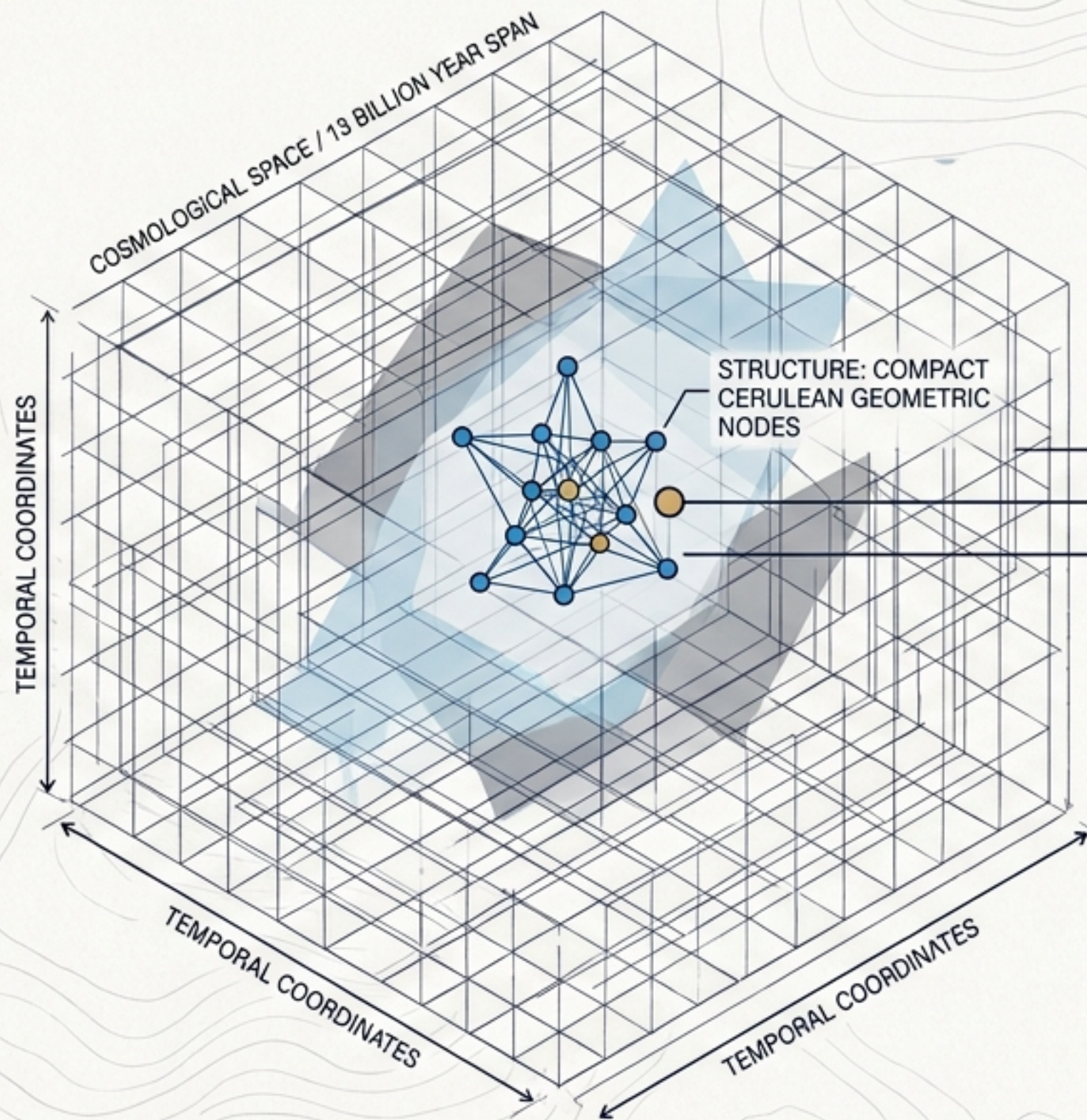
THE COSMIC PALIMPSEST

Information Geometry and
the Inverse Accessibility
of the Early Universe

An analysis of LAP1-B and the
epistemology of preserved systems.



An Anomaly at the Edge of Observable Time

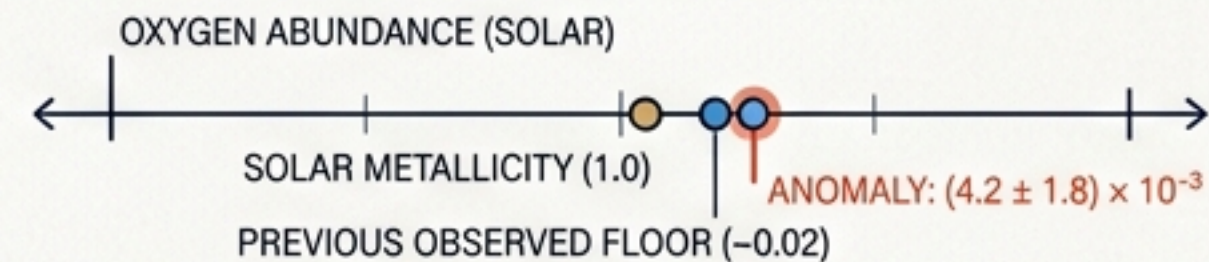


Epoch: Redshift $z \approx 6.6$



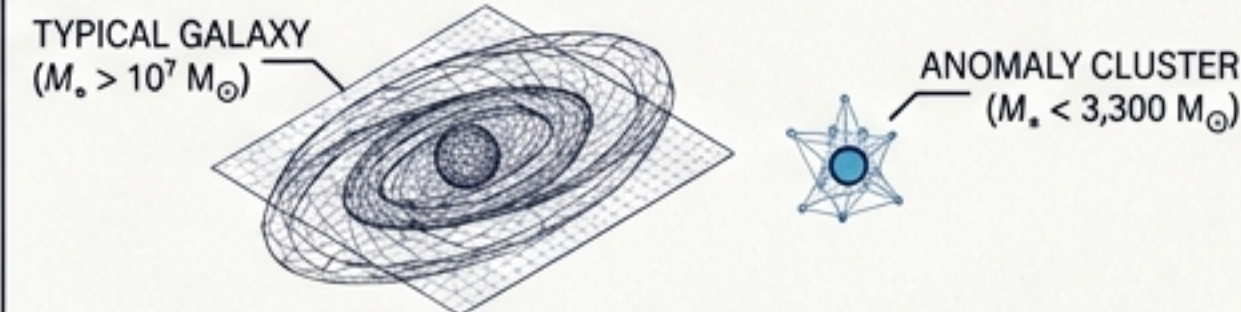
(~800 Myr after the Big Bang). An observational epoch, not a contemporaneous state.

Primitivity: Oxygen abundance $(4.2 \pm 1.8) \times 10^{-3}$ solar



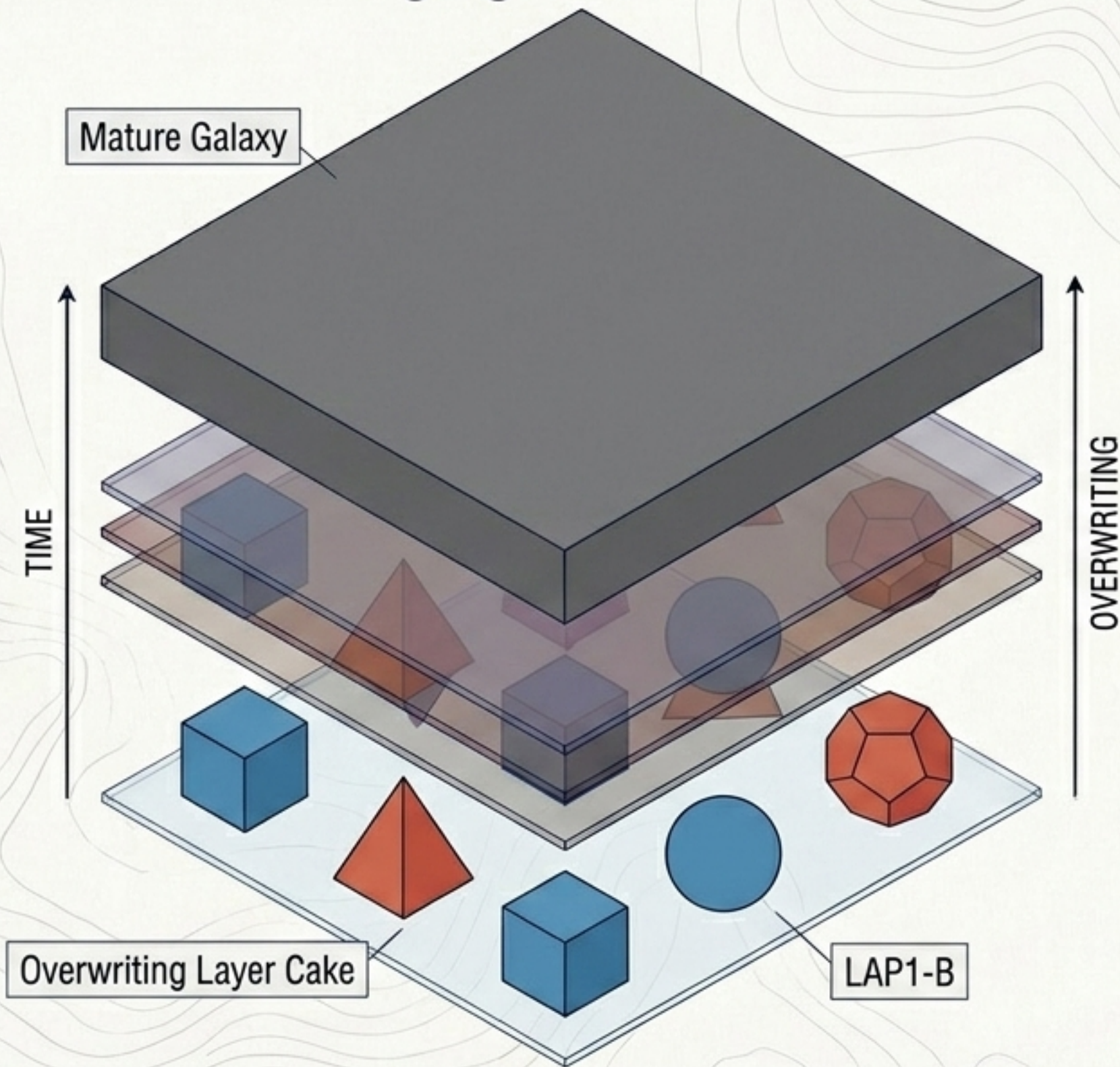
Radically below the previously observed 2% metallicity floor.

Sparsity: Stellar mass $M_* < 3,300 M_\odot$



Luminous matter equivalent to a star cluster, not a galaxy.

The Illusion of Chemical Evolution is Chemical Averaging



“

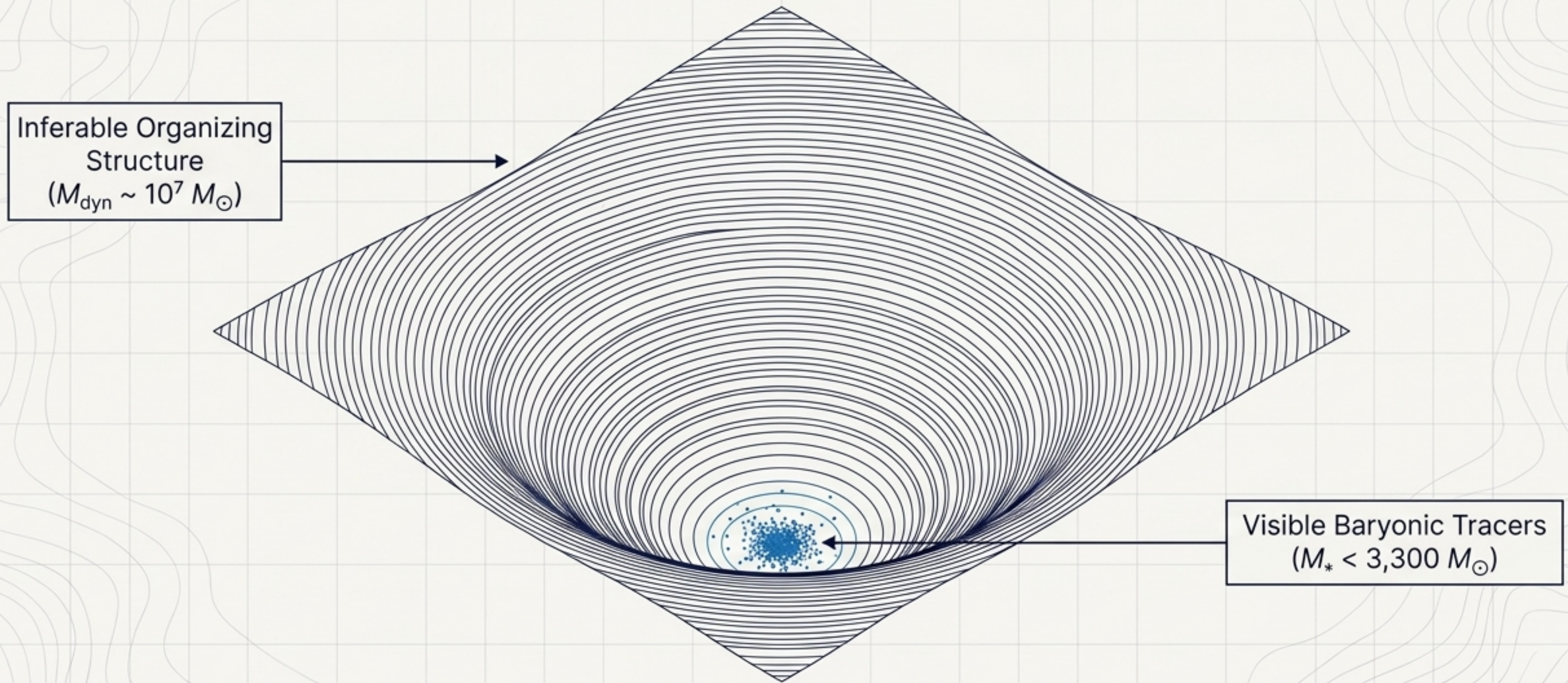
Principle 1: Systems that have undergone the fewest averaging operations retain the highest density of recoverable information per observable degree of freedom.

Successive star formation stirs, dilutes, and overwrites the abundance record. True chemical evolution destroys historical resolution.

The Information Geometry of Matter

	Mature Galaxies	Primitive Systems (e.g., LAP1-B)
Chemical Complexity	High (Integrated averages over many events)	Low (First-order records)
Historical Resolution	Low (Trajectories irrecoverable without independent records)	High (Event log partially intact)
State Space	Large and entangled	Small and sparse
Event Legibility	Opaque	Transparent (Sparse historical encodings)

Luminous Baryons Function as Sparse Tracers

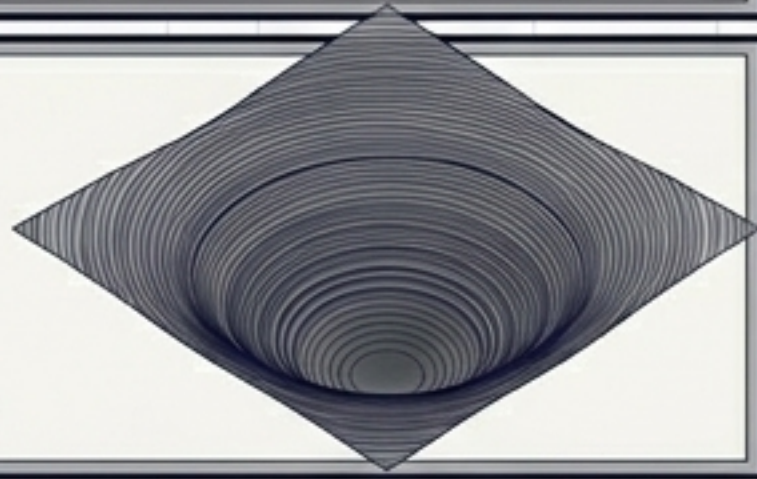


The luminous component is not the dynamically dominant constituent. It has not modified the dark matter potential well it inhabits. It merely marks the absolute minimum of the constraint basin.

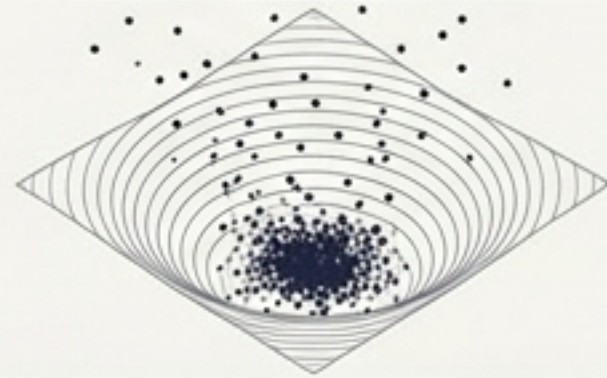
Two Interpretations of Structural Origin

Standard Halo Interpretation (Λ CDM)

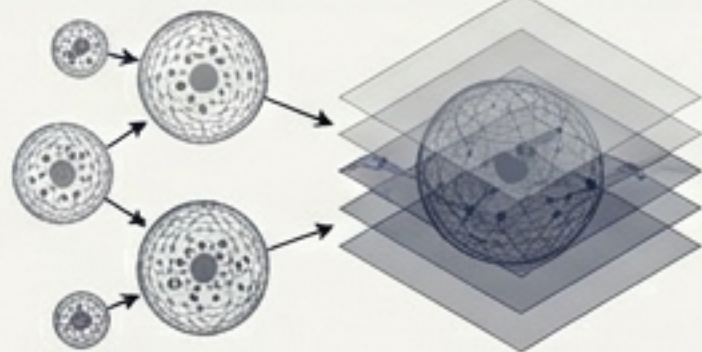
Role of Dark Matter
A pre-existing container



Role of Baryons
Substance that condenses to fill the container

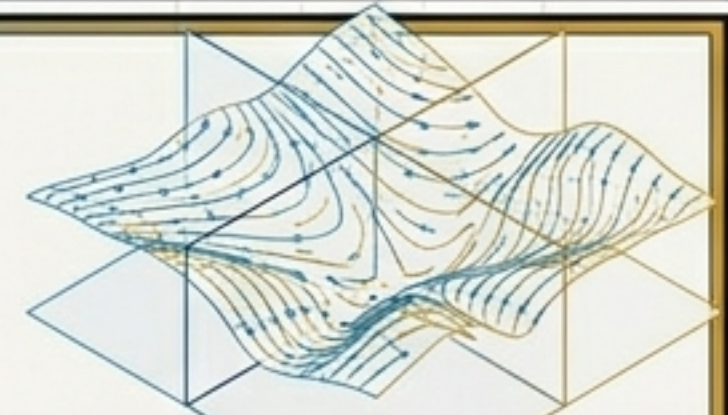


System Origin
Hierarchical Accumulation
(bottom-up merging)

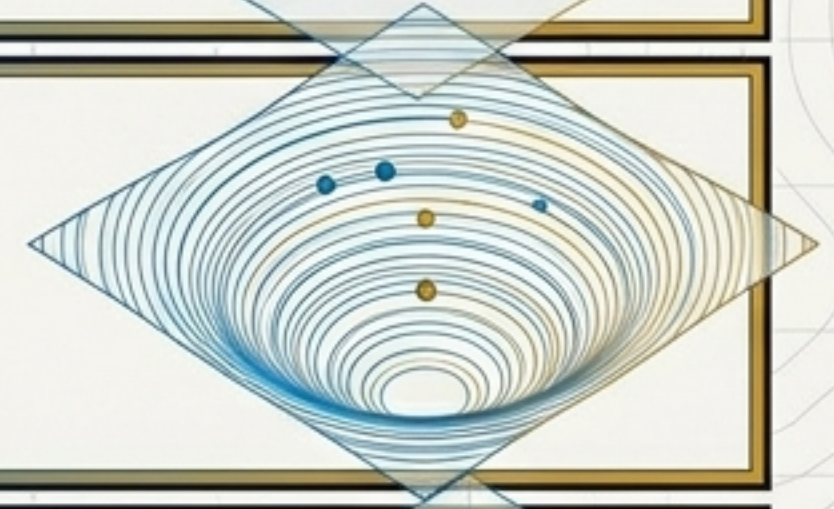


Constraint-Basin Reinterpretation (RSVP/SIED)

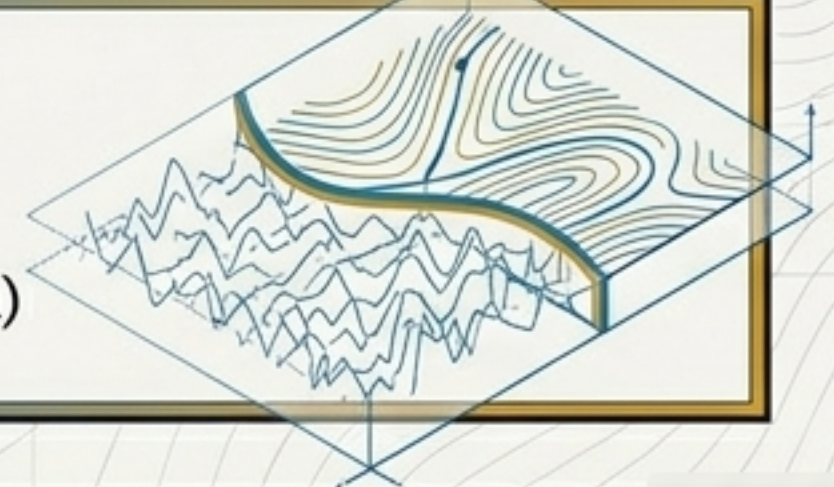
Role of Dark Matter
An effective organizing field



Role of Baryons
Sparse probes revealing the geometry of a larger flow field

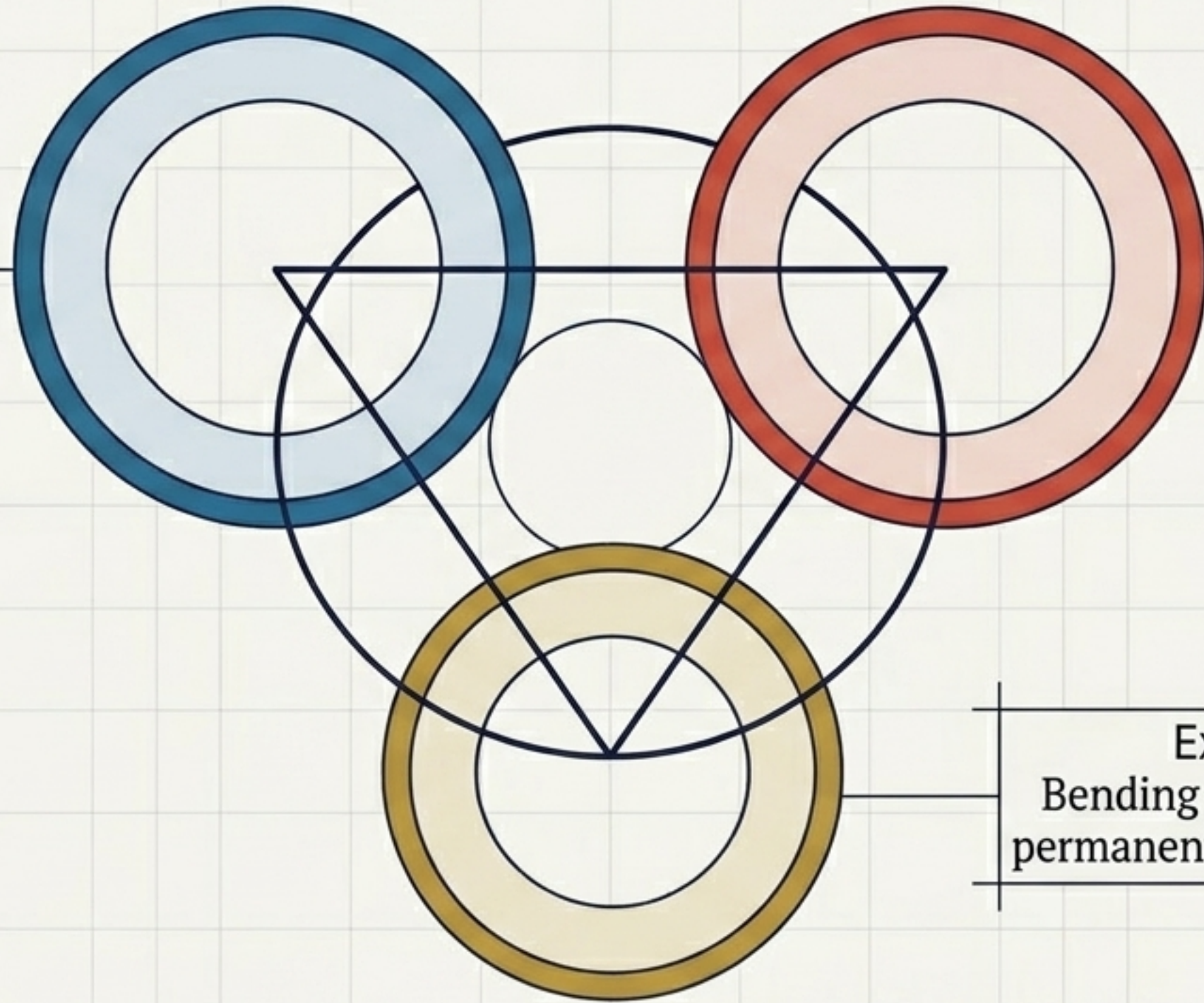


System Origin
Regulated Instability
(threshold phase separation)



The Architecture of Observability

Emergence.
The physics of scale and
regulated instability.

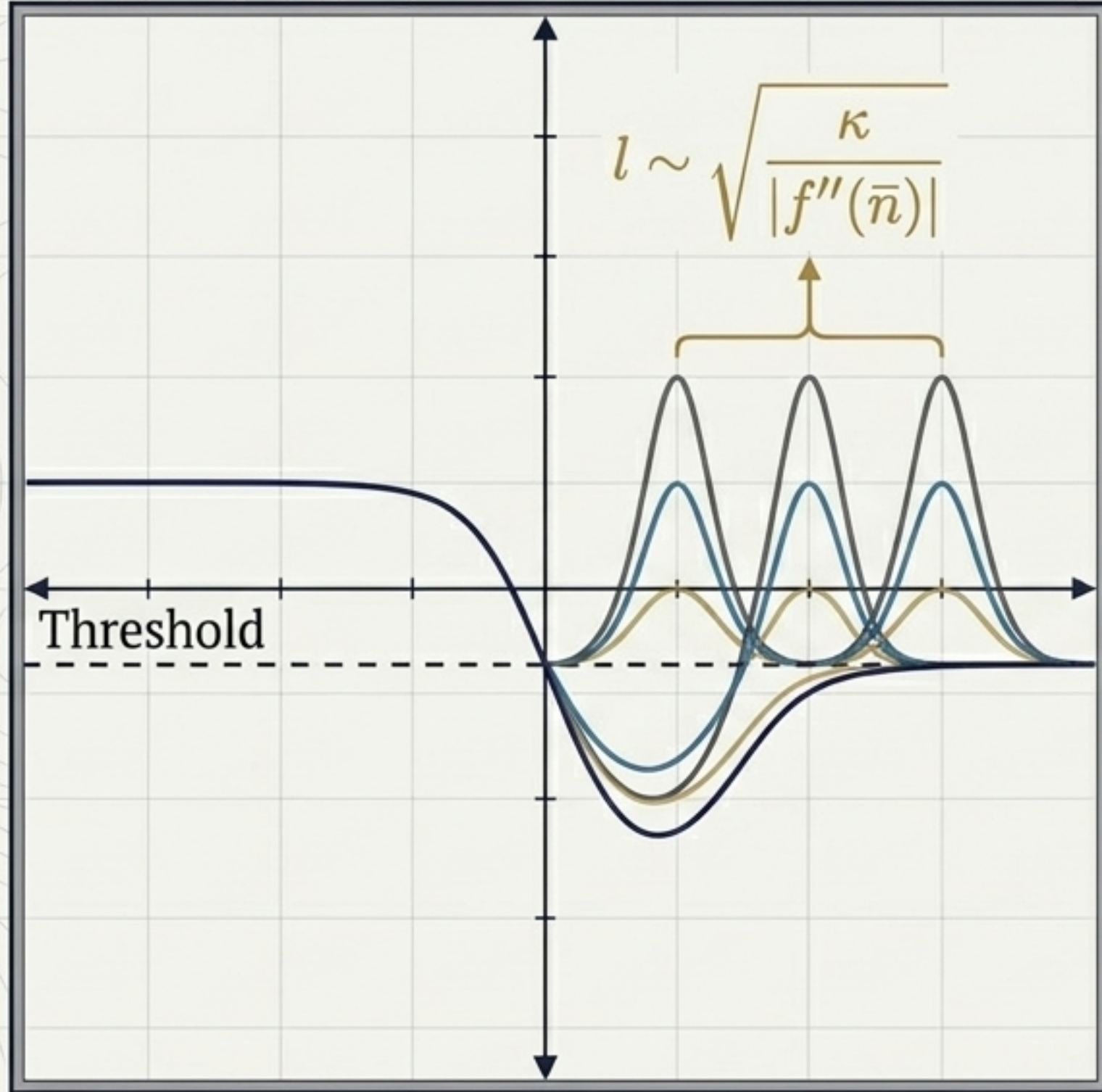


Preservation.
Freezing the clock via
environmental quenching.

Extraction.
Bending space to amplify
permanently hidden signals.

Deep observational access requires the simultaneous coincidence
of three independent physical operators.

Operator I: Emergence via Regulated Instability

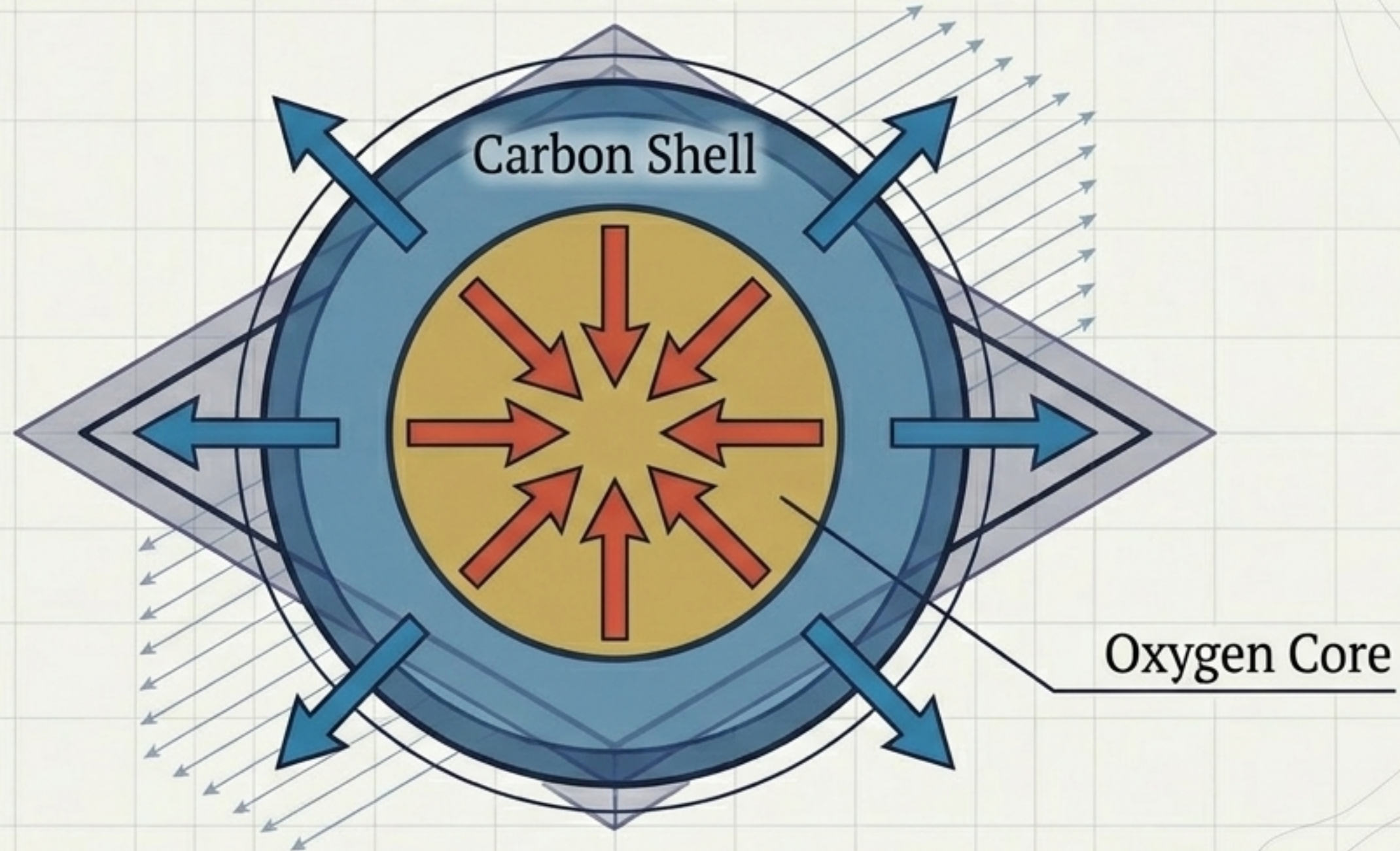


Structure does not always emerge through gradual hierarchical accumulation. Under the SIED formalism, a homogeneous background loses local stability and spontaneously separates into coherent domains at a mathematically preferred scale.

LAP1-B is not a fragment that failed to grow; it is a preferred mode that irrupted at its natural correlation length.

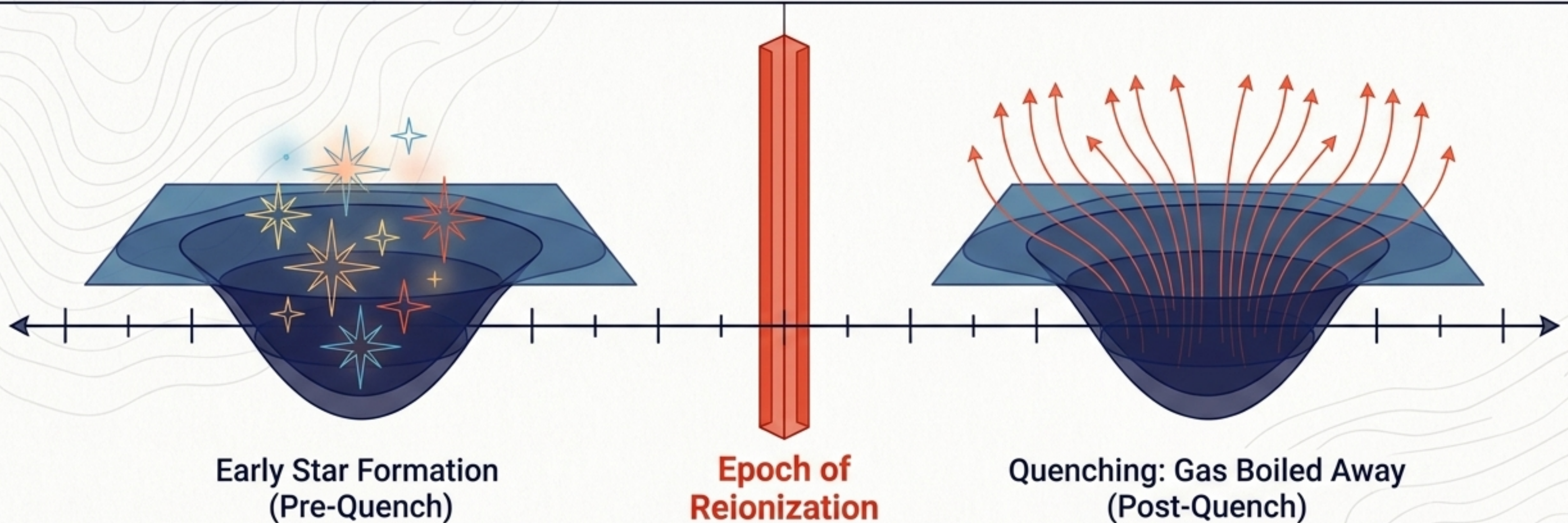
Reading the Physical Event Log

Faint Population III Supernovae act as a physical “propagation filter.”



Explosion energy is too low to expel the inner layers. Oxygen falls back into the remnant, while Carbon escapes. The resulting high C/O ratio is not just a composition—it is an intact geometric record of a selective dynamical asymmetry from the universe’s earliest epochs.

Operator II: Temporal Preservation via Quenching



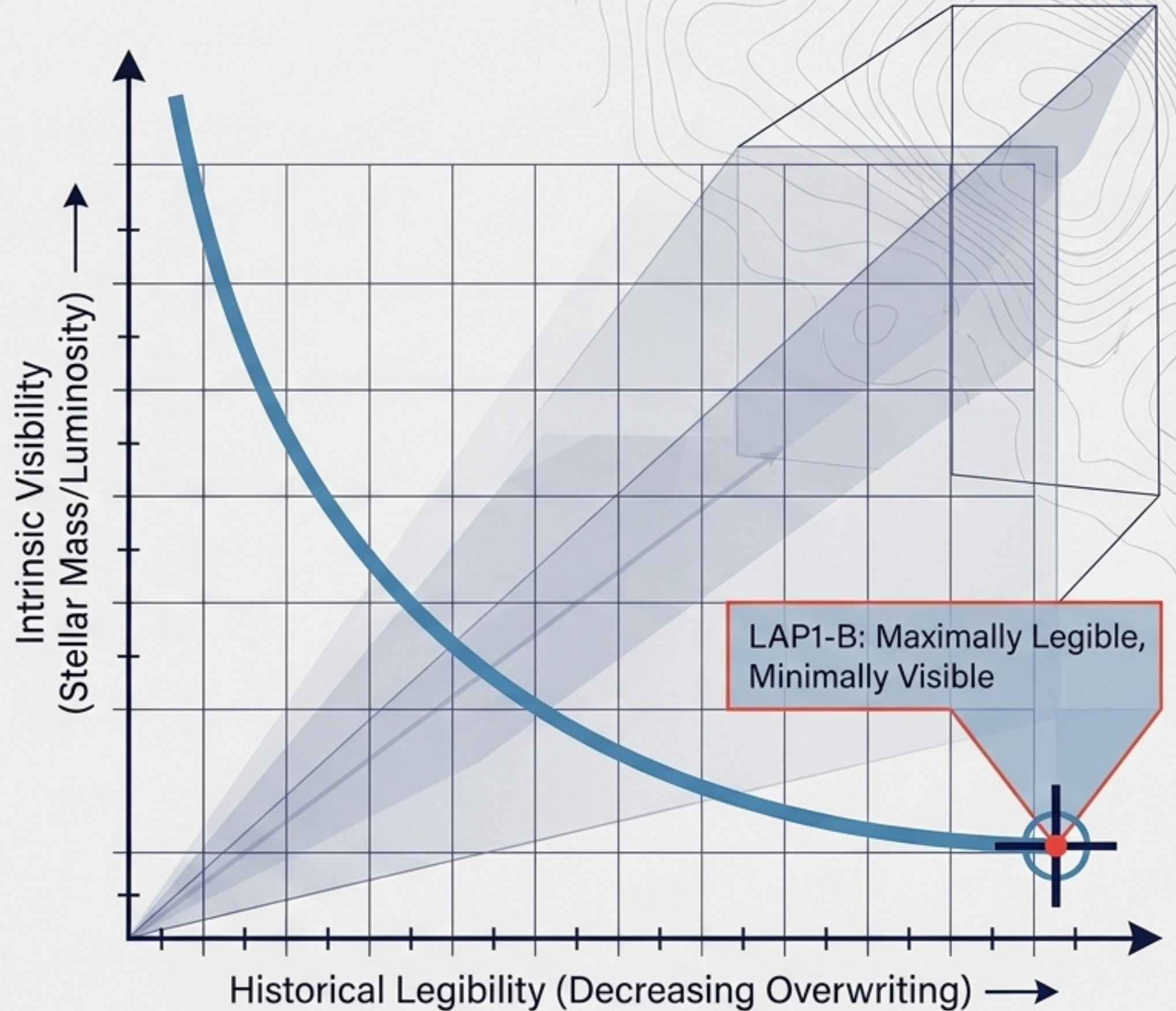
Reionization acted as both an archive and a **blackout**. For shallow halos like LAP1-B, ultraviolet radiation permanently suppressed subsequent star formation.

It **drops the pin** on the **event log**, ensuring **no further chemical history** is written over the primitive record.

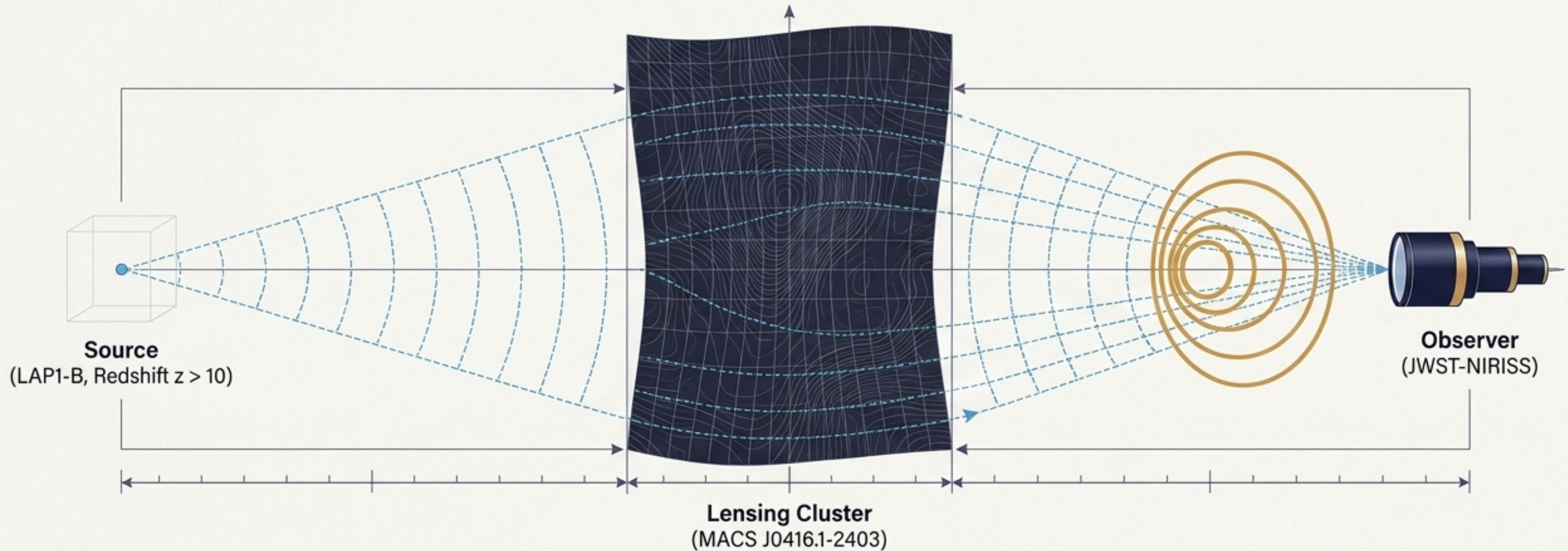
The Epistemological Cost of Preservation

The very sparsity that preserves the internal legibility of primitive structures inherently suppresses their observational visibility.

A galaxy small enough to survive reionization without overwriting its history is, at cosmological distances, too faint for direct observation.



Operator III: Spatial Extraction via Lensing



Observational access cannot be resolved by improved detector sensitivity alone. It requires geometric mediation.

The **gravitational lens** functions as a **sparse-inference operator**—amplifying LAP1-B's apparent flux by a factor of ~ 100 , bringing a permanently inaccessible source across the observational threshold.

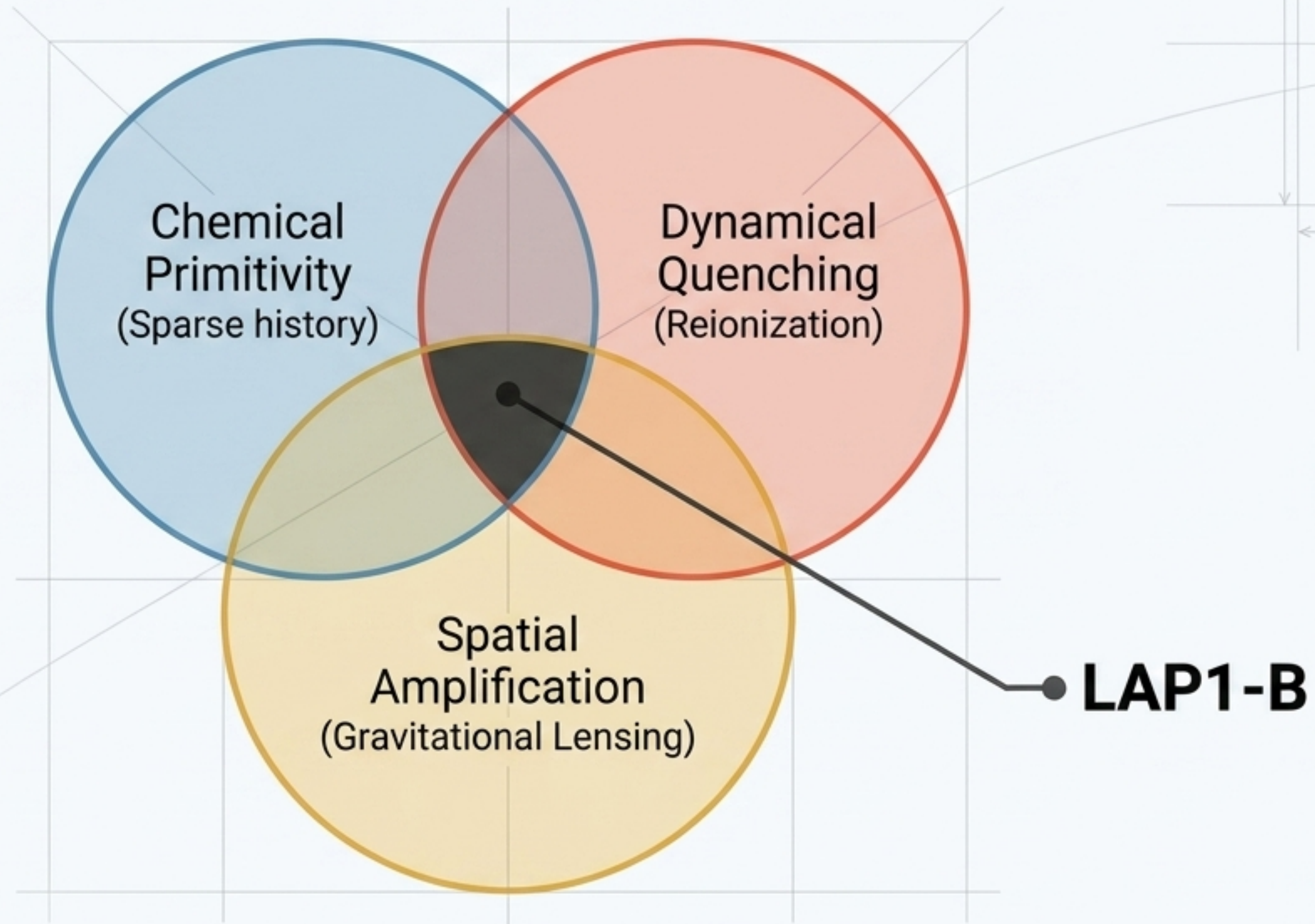
Principle 3

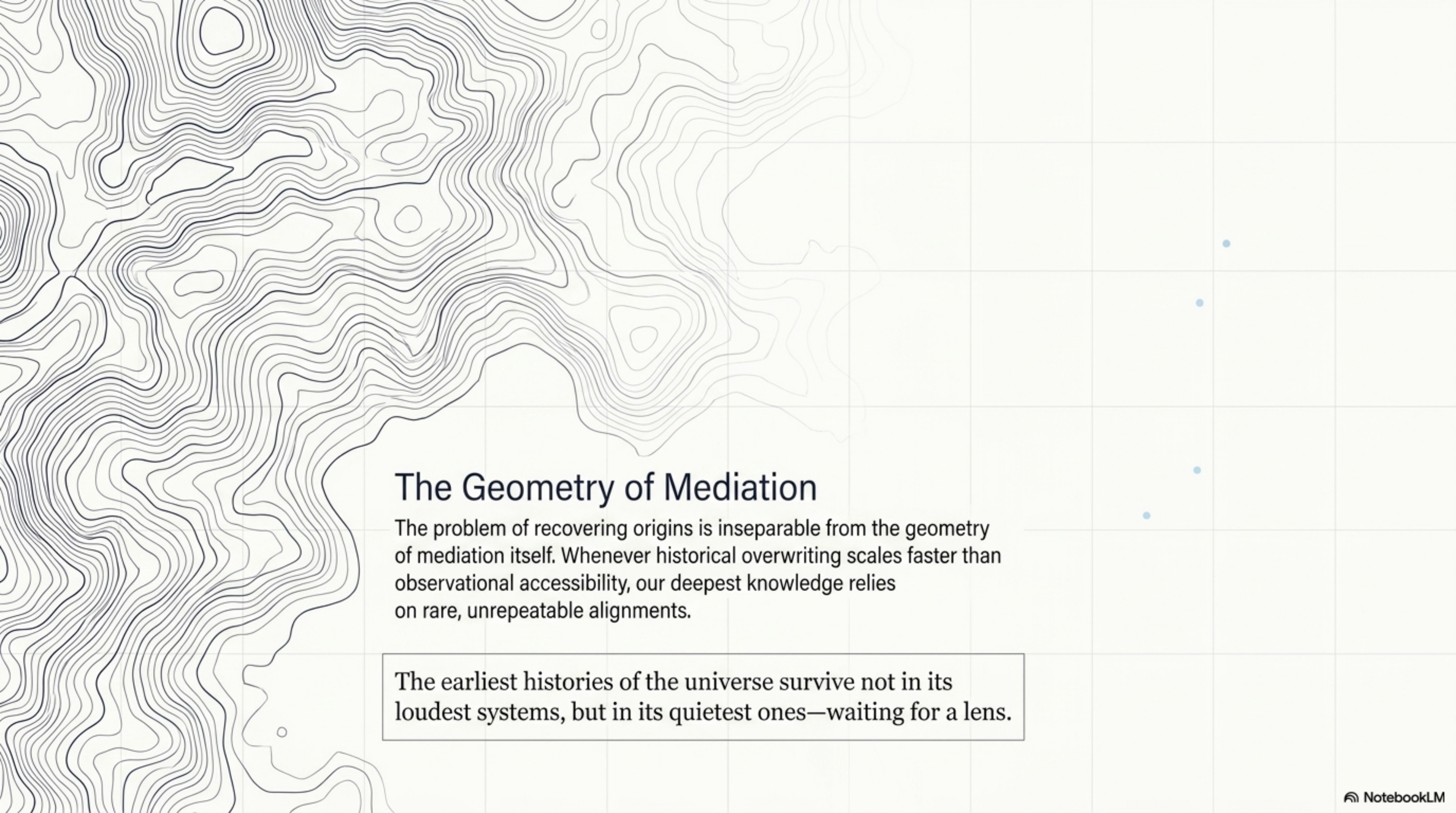
The systems retaining the highest density of recoverable historical information are frequently those least accessible to direct observation.

The Inverse Accessibility of Primitive Structure.

The Coincidence of Independent Conditions

The failure of any single condition renders observation impossible.
The fossil record is heavily populated, but geometrically locked.



The background of the slide is a light gray grid. On the left side, there is a complex, wavy pattern of black contour lines, resembling a topographic map. On the right side, there are several small, light blue dots scattered across the grid, resembling a star field or a sparse data set.

The Geometry of Mediation

The problem of recovering origins is inseparable from the geometry of mediation itself. Whenever historical overwriting scales faster than observational accessibility, our deepest knowledge relies on rare, unrepeatable alignments.

The earliest histories of the universe survive not in its loudest systems, but in its quietest ones—waiting for a lens.