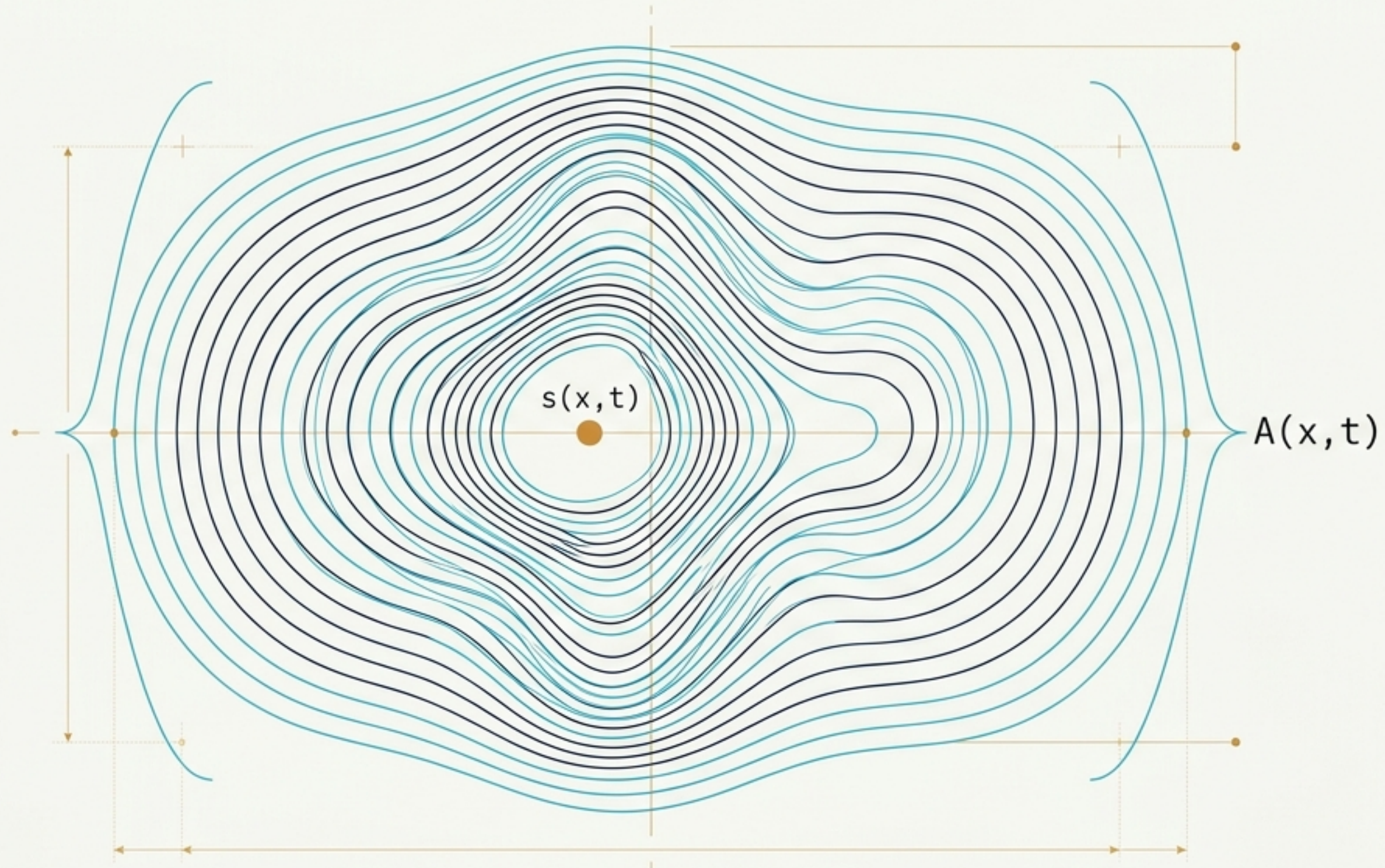


# The Geometry of Admissibility

Constraint, reachability, and relaxation across biological, cognitive, industrial, and cosmological systems.

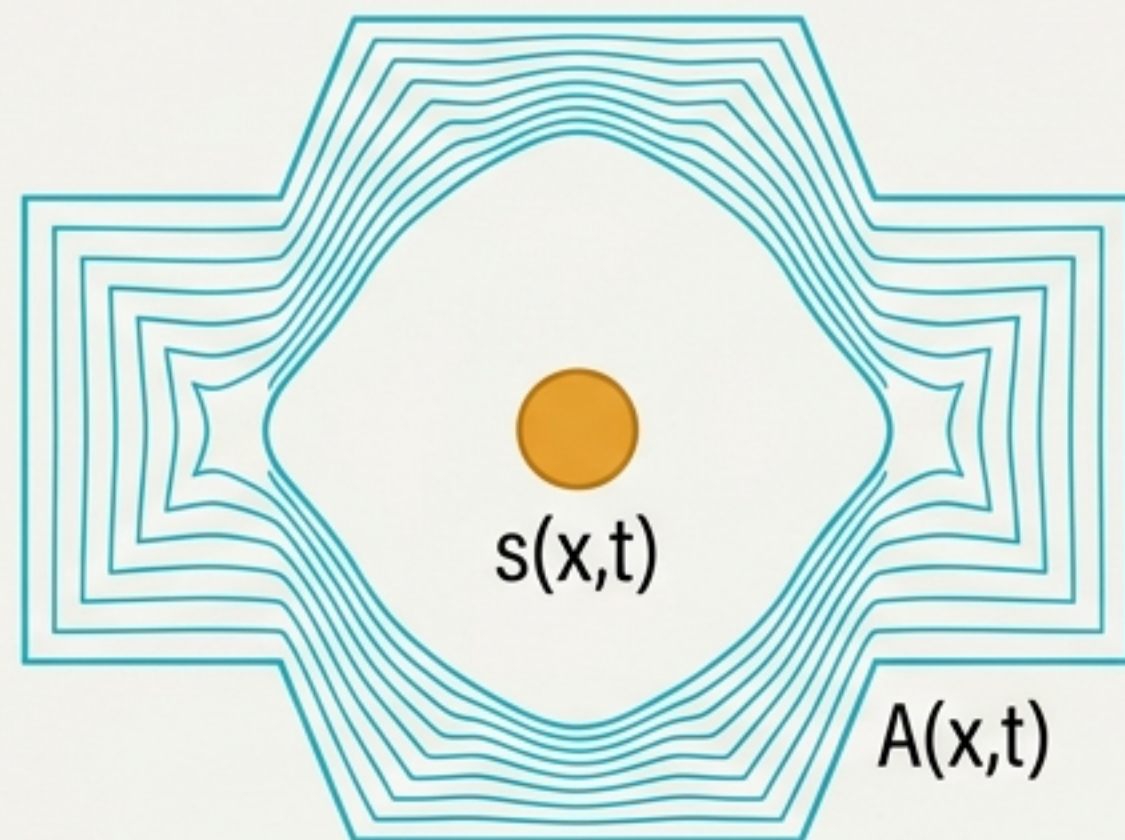


Function is determined by the boundaries of reachability, not the current configuration.



#### The Traditional View

- Focuses on the state and velocity.
- What is the system doing?



#### The Admissibility View

- Focuses on the shape, bottlenecks, and boundaries of the field.
- What can the system still do?

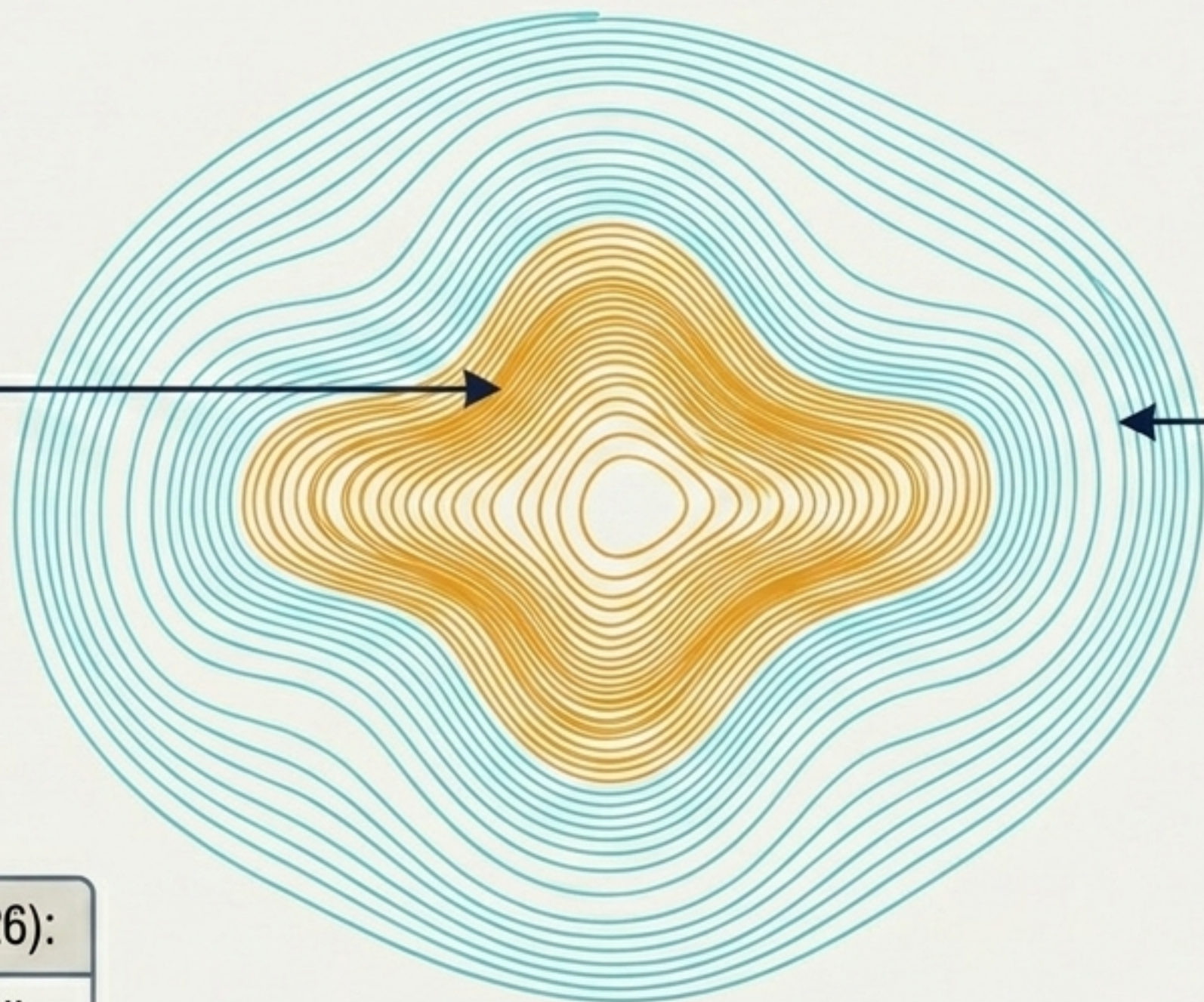
**The relevant question is never what the system is doing, but always what it can still do.**

Every system splits into High-Constraint and Free components.

$A_H$  (The Core)

High-Constraint Component

- Narrow
- Slow-relaxing
- Threshold-mediated
- History-sensitive



$A_F$  (The Cloud)

Free Component

- Wide
- Fast-relaxing
- History-insensitive

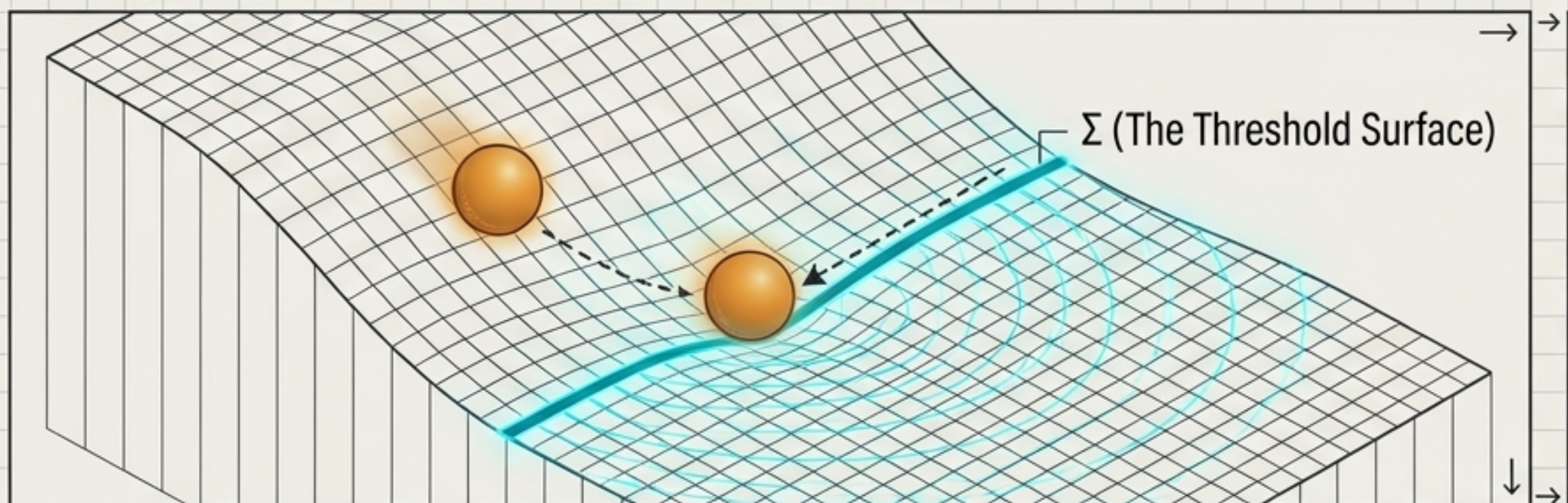
**Cortical Proof** (Driessen et al., 2026):

67% of unit pairs are homeostatically regulated ( $A_H$ ).

33% of unit pairs are not ( $A_F$ ).

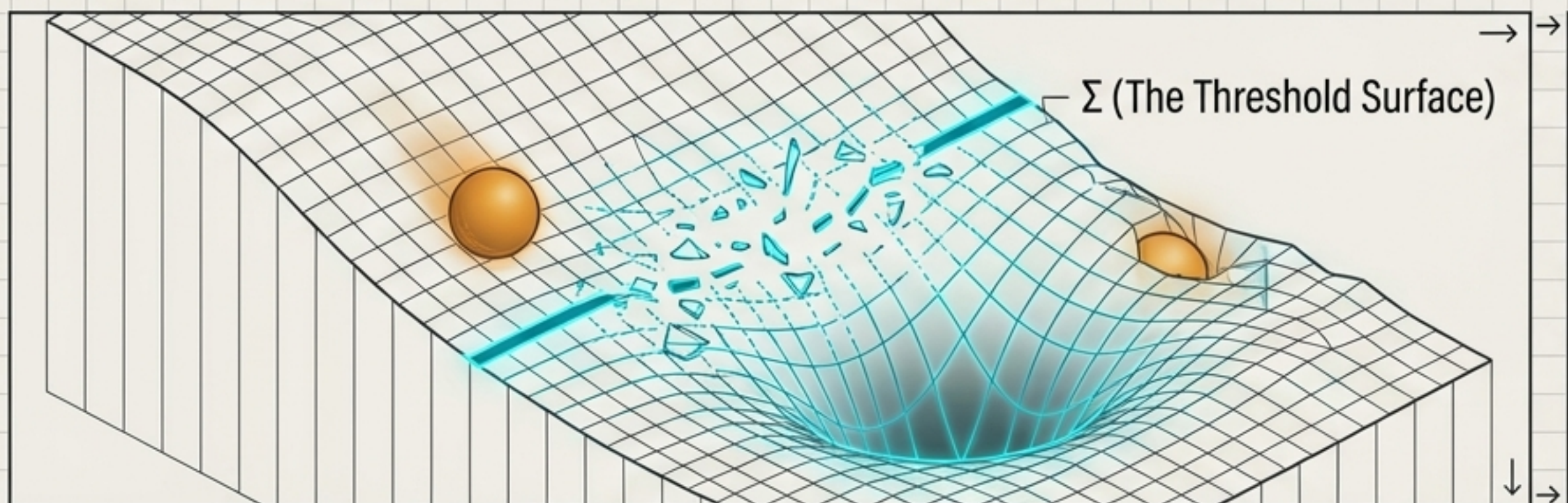
$$A(x, t) = A_H \cup A_F$$

# Constraint cannot be reduced smoothly; it requires threshold traversal.



## RELAXATION

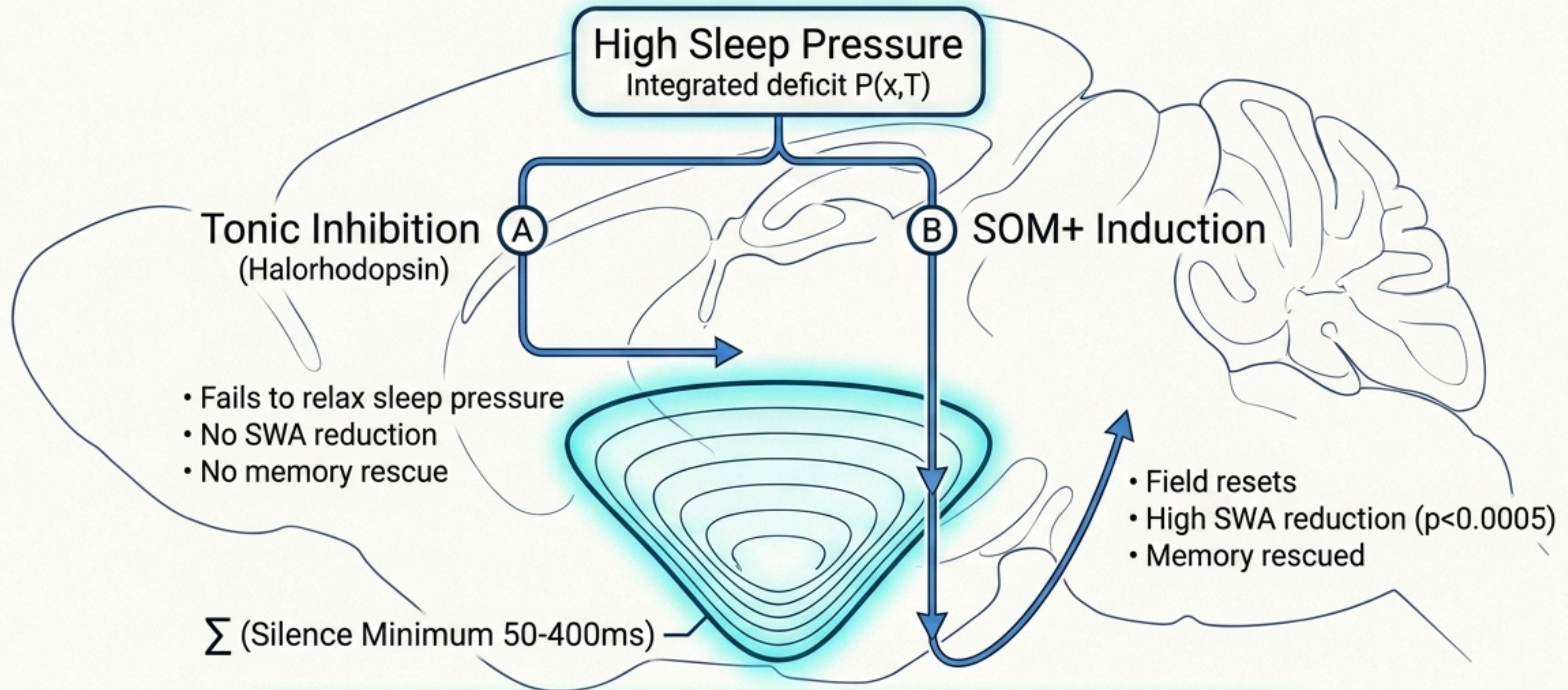
- Trajectory crosses  $\Sigma$  and returns.
- Field expands reversibly.



## COLLAPSE

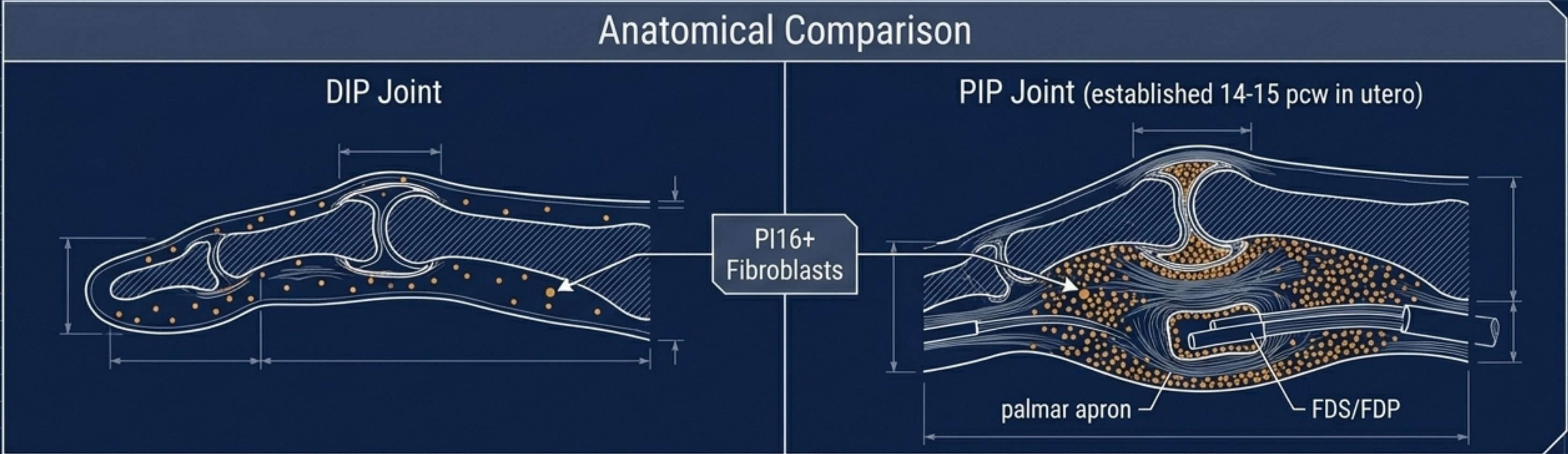
- Mechanism maintaining  $\Sigma$  inverts.
- Field shrinks irreversibly.

# Sleep is a local phase operation, not a global state.

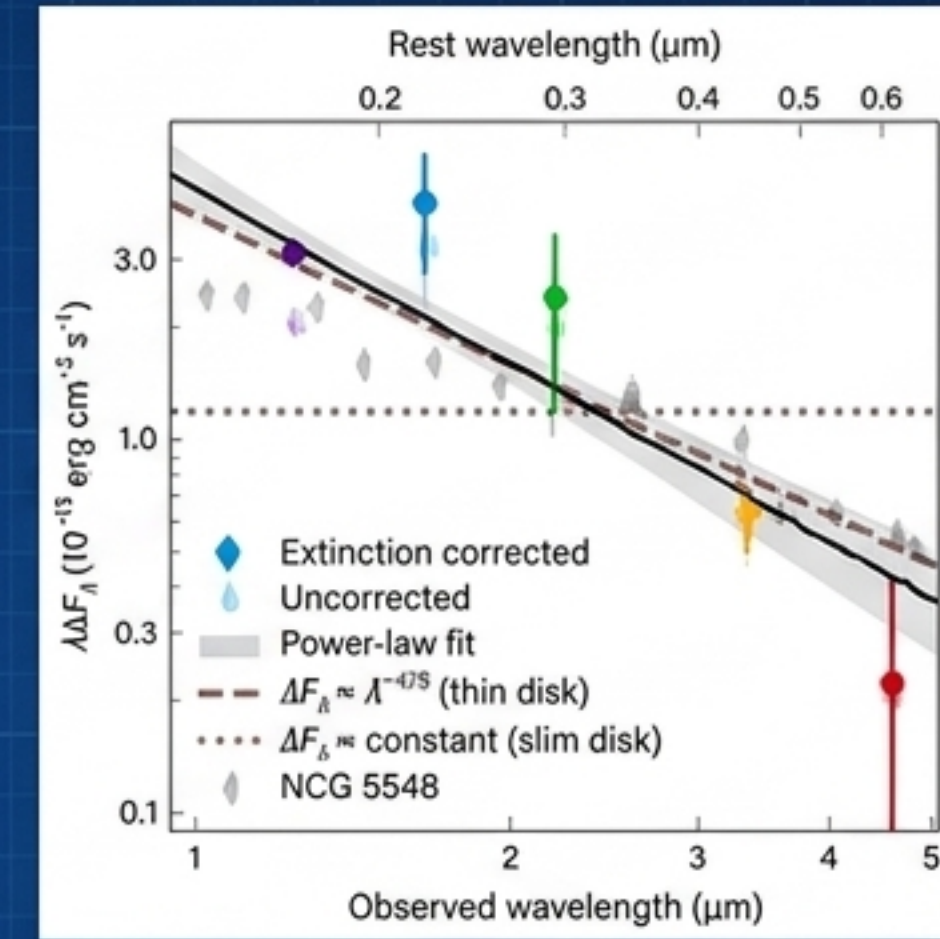
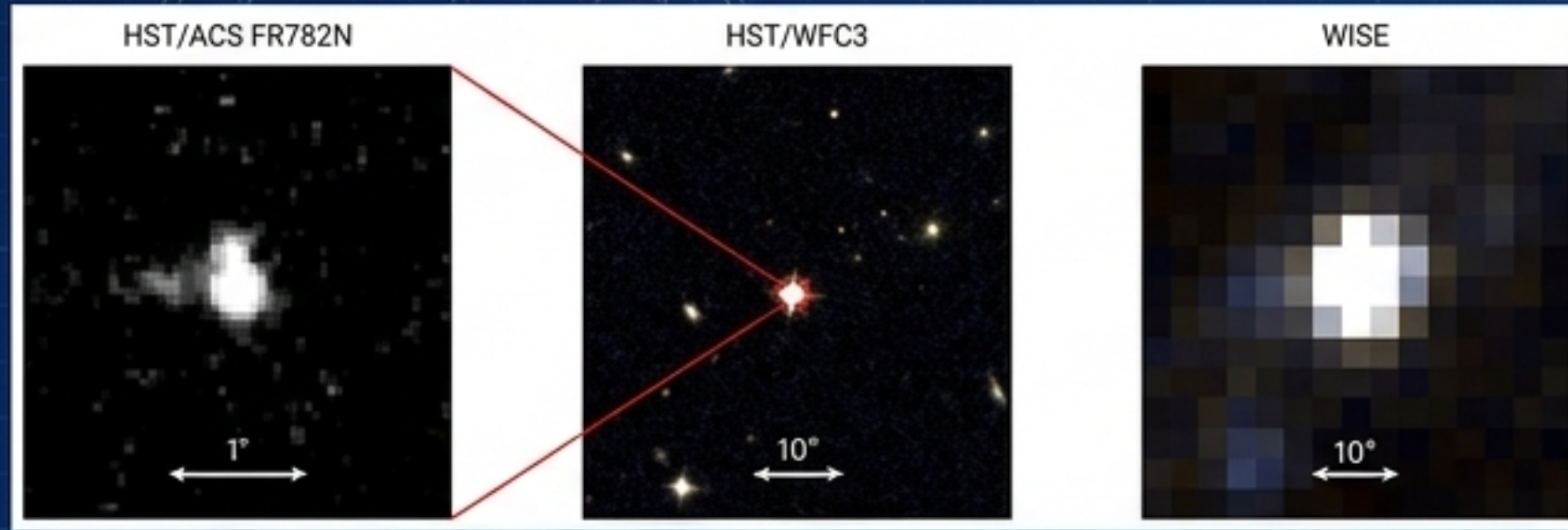


The trajectory pattern, not the magnitude of firing reduction, determines whether  $A_H$  expands.

# The PIP joint is vulnerable because of what it was, not what it is.



Admissibility geometry scales from milliseconds to light-years.



### The Threshold ( $\Sigma$ ):

Quasar J0439+1634 sits at 60% Eddington ratio.

Safely below the thin-to-slim disk transition threshold.

### The Proof:

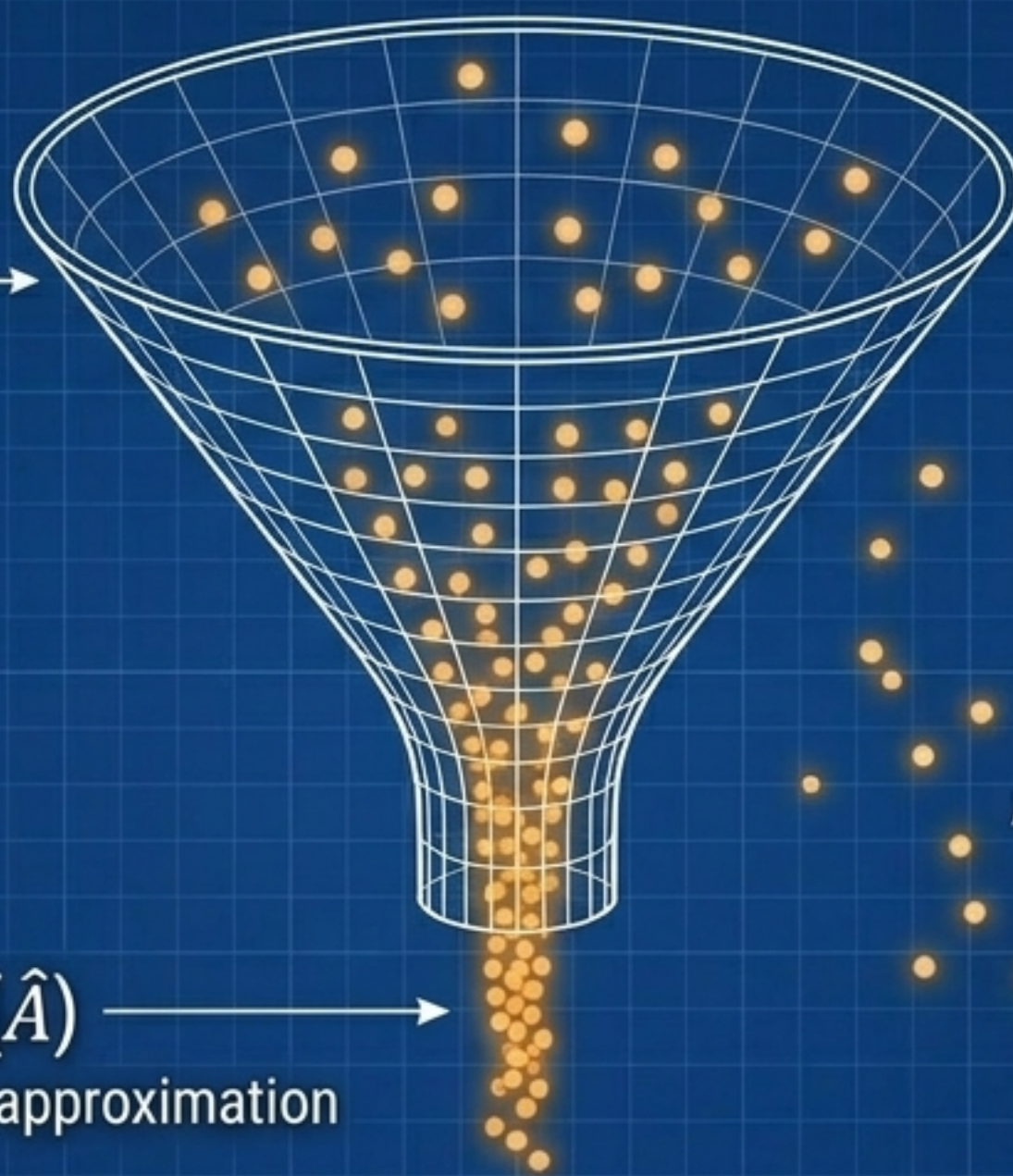
Variable SED spectral slope is  $-1.58 \pm 0.25$ .

Perfectly matches the geometrically thin, highly constrained admissibility field prediction of  $-4/3$ .

**Relaxation Wave:** Corona perturbations propagate through the accretion disk at light speed ( $\tau \propto \lambda^{4/3}$ )

To plan efficiently is to compress the admissibility field.

Full Model-Based Planning  
Explicit computation of full field  $A$



CLIO PROJECTION

$$\pi : A \rightarrow \hat{A}$$

The Residual ( $A \setminus \hat{A}$ )  
Pavlovian responses to  
unexpected stimuli

Model-Free Habit ( $\hat{A}$ )

The compressed, low-dimensional approximation

### The Discrete Mathematical Discontinuity

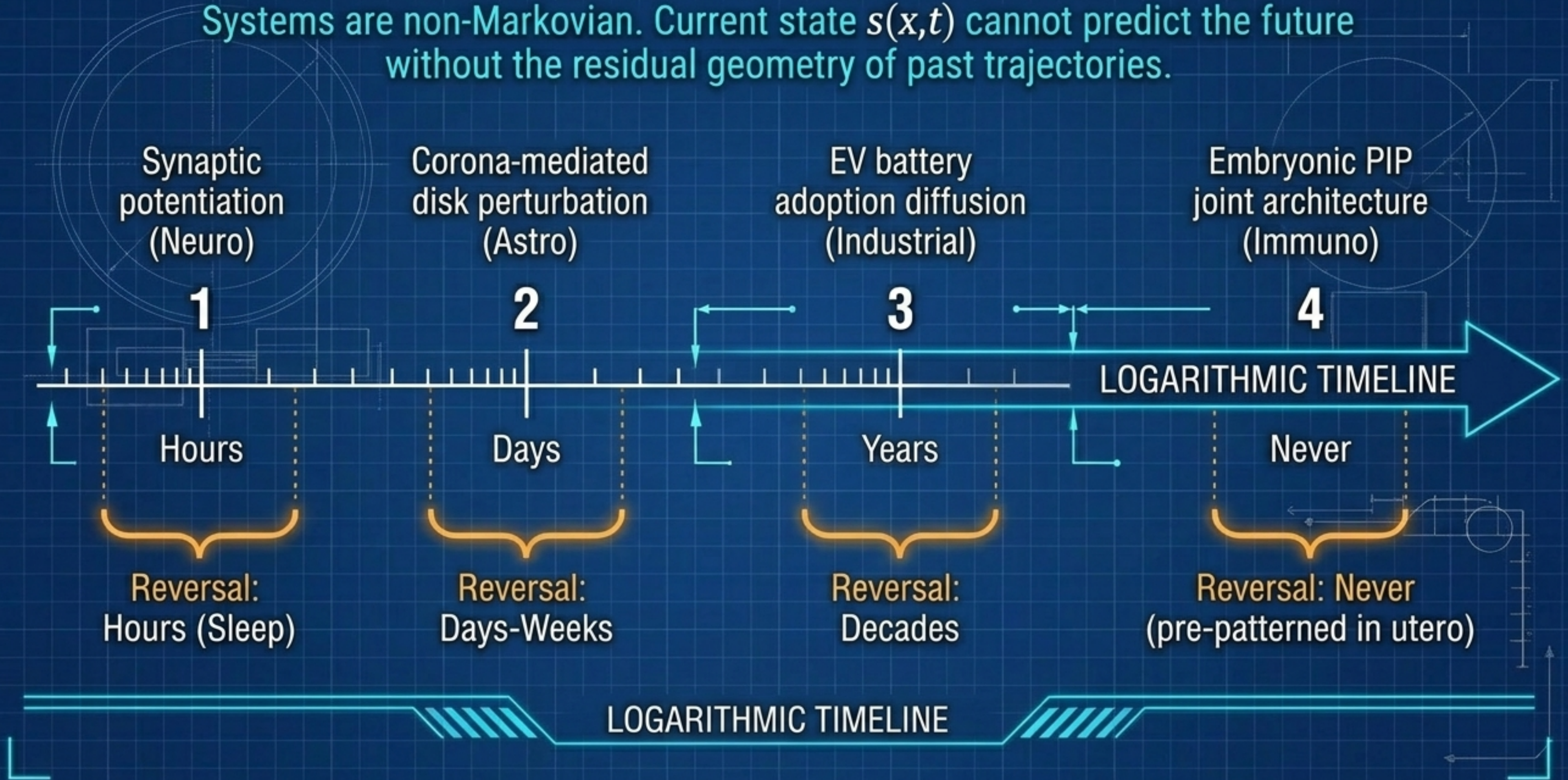
Pavlovian-instrumental transfer (PIT) requires a forward planning depth of  $D \geq 2$ .  
At  $D < 1.99$ , matrix multiplication fails to bridge the gap. Transfer is zero.

# Six disciplines. One mathematical structure.

<u>Domain</u>	<u>Phenomenon</u>	<u>The Threshold (<math>\Sigma</math>)</u>	<u>The Mechanism</u>	<u>Result</u>
Cortical (Neuro)	Sleep Homeostasis	Global Silence (50-400ms)	SOM+ Networks	Relaxation
Joints (Immuno)	Arthritis Tropism	Cytokine Threshold	PI16+ Fibroblasts	Collapse
Quasar Disks (Astro)	Light Reverberation	Thin-to-Slim Transition	Eddington Ratio	Field Propagation
Agent Planning (RL)	Habit Formation	Depth $D \geq 2$	CLIO Projection	Compression
SAGE-net (Genomics)	Regulatory Grammar	MAF $\approx 0.05$	Reference Models	Bipartite Split
Battery Network (Industrial)	EV Recycling Viability	Interprovincial Coord.	Hotspot Diffusion	Dynamic Relocation

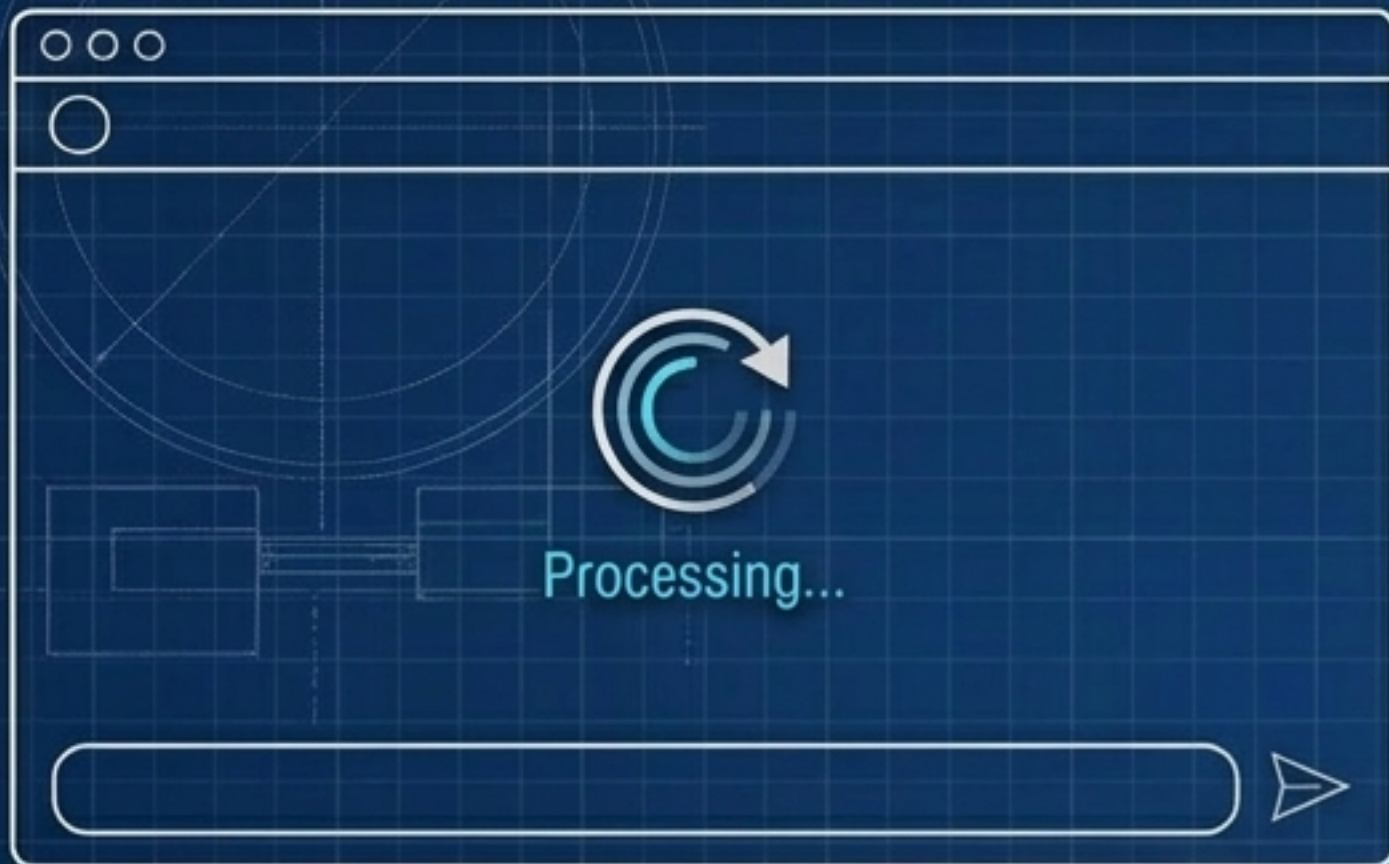
# The past is written into the geometry of what can happen next.

Systems are non-Markovian. Current state  $s(x,t)$  cannot predict the future without the residual geometry of past trajectories.



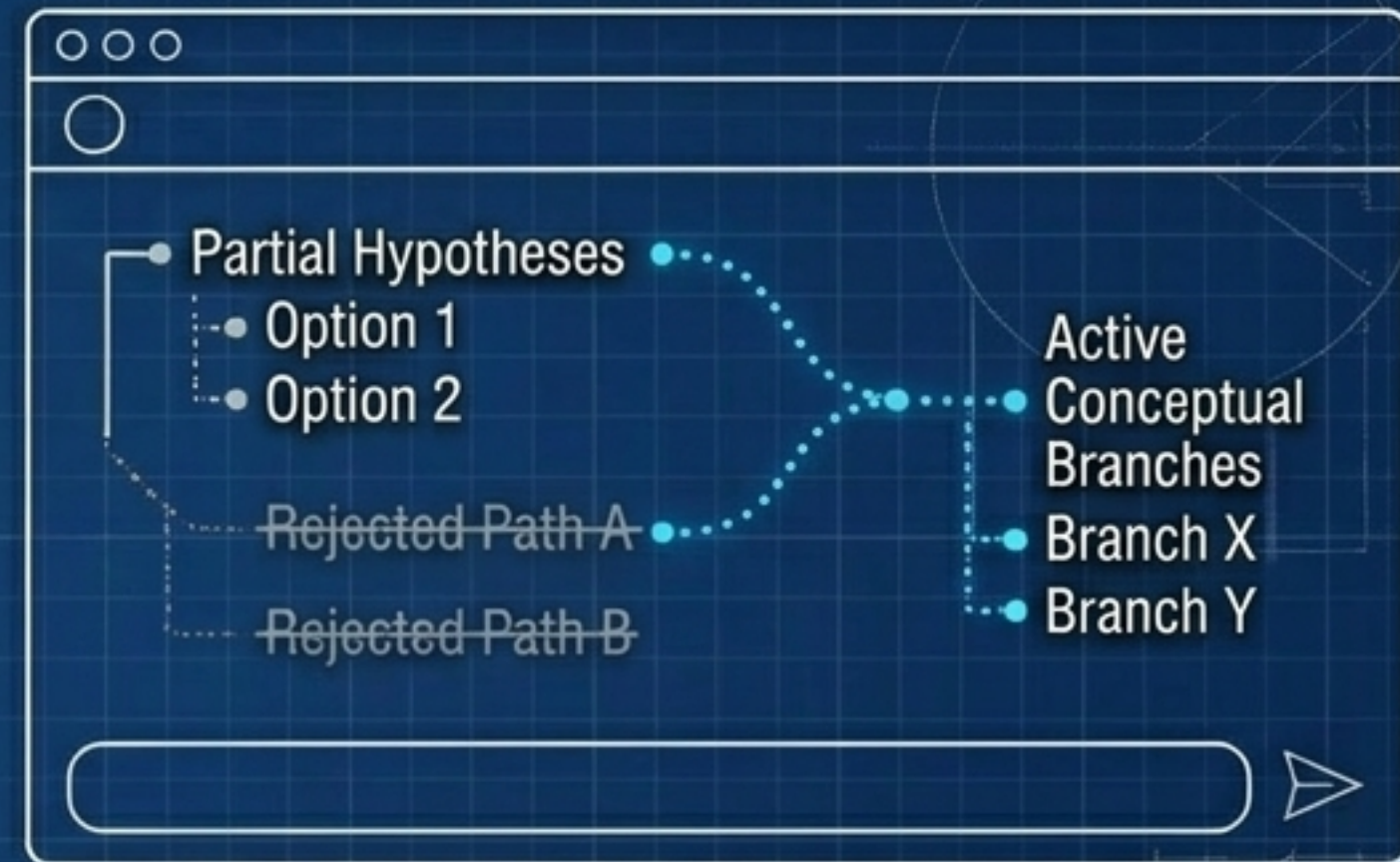
# Stop exposing state. Start exposing reachability.

## Dead Waiting



Exposes state (s = thinking).  
Hides the field (A).  
A collapsed field to a single node.

## Productive Waiting



Exposes reachability (A).  
Users can interact, correct, and prune the tree before heavy computation finishes.

The informational value of an interface is proportional to its representation of reachable future states, not its current state.

# A theory is only as strong as its falsifiable edges.

## Neuroscience

Graded tonic inhibition will never reduce SWA without crossing the discrete  $\Sigma$  silence boundary.

## Immunology

PIP joint collapse rate under stress is strictly monotonic to baseline embryonic PI16+ density.

## Reinforcement Learning

The  $D \geq 2$  depth threshold for Pavlovian-instrumental transfer is a hard, mathematical discontinuity.

## Astrophysics

Population-level measurement of the  $\tau$ - $\lambda$  slope at  $z > 4$  will show statistically significant deviation from  $4/3$ .



# The Open Mathematical Problem

Under what exact conditions does a threshold surface ( $\Sigma$ ) form, and when does a perturbation trigger irreversible collapse rather than relaxation?

$$\frac{\partial A(x, t)}{\partial t} = f[A(x, t), s(x, t)] + \int_{\Omega} K(x, x') v(x', t) dx'$$

Admissibility geometry is not a metaphor. It is the structural mathematics of reality—from cortical circuits to the cosmic dawn.