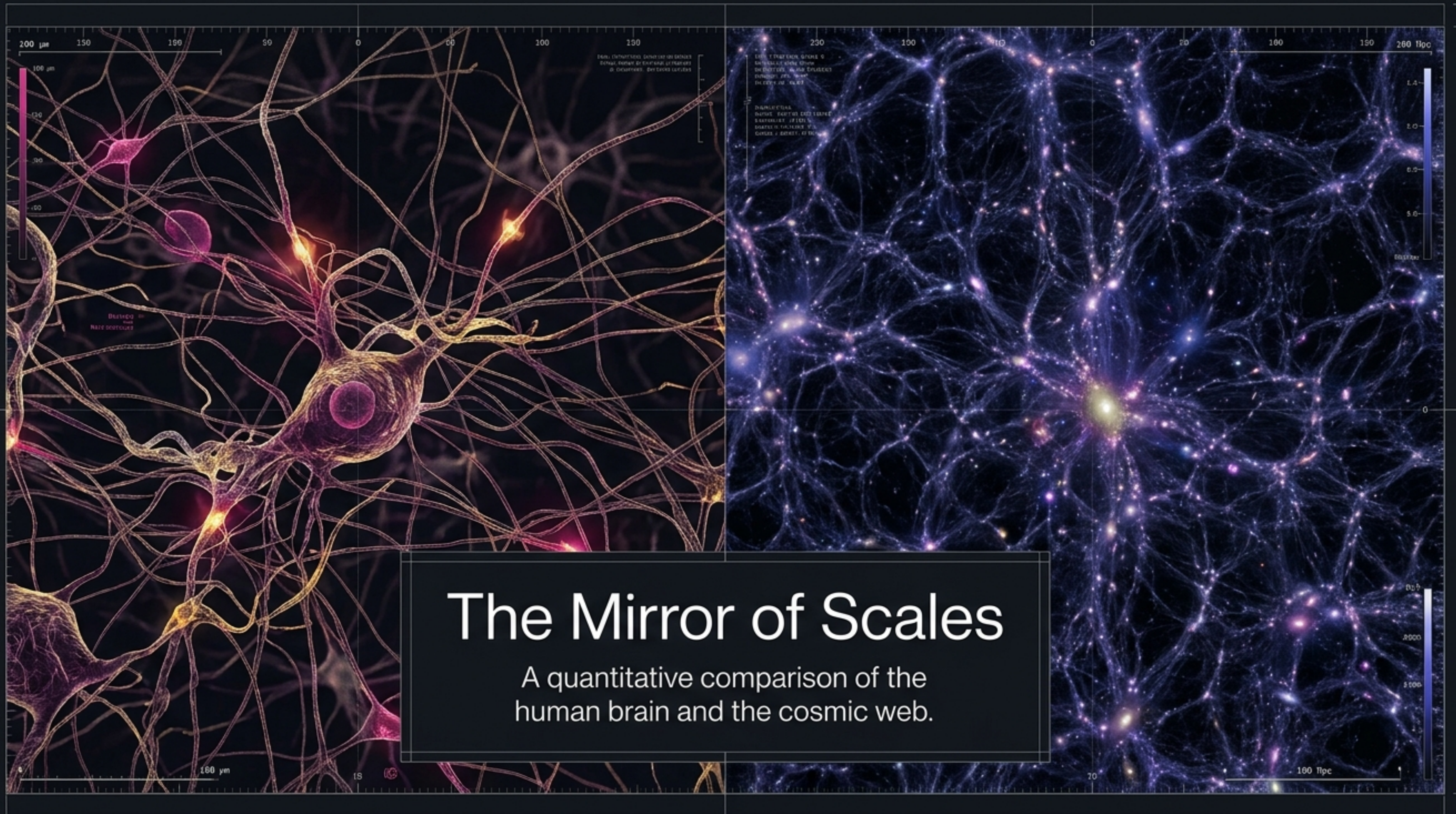
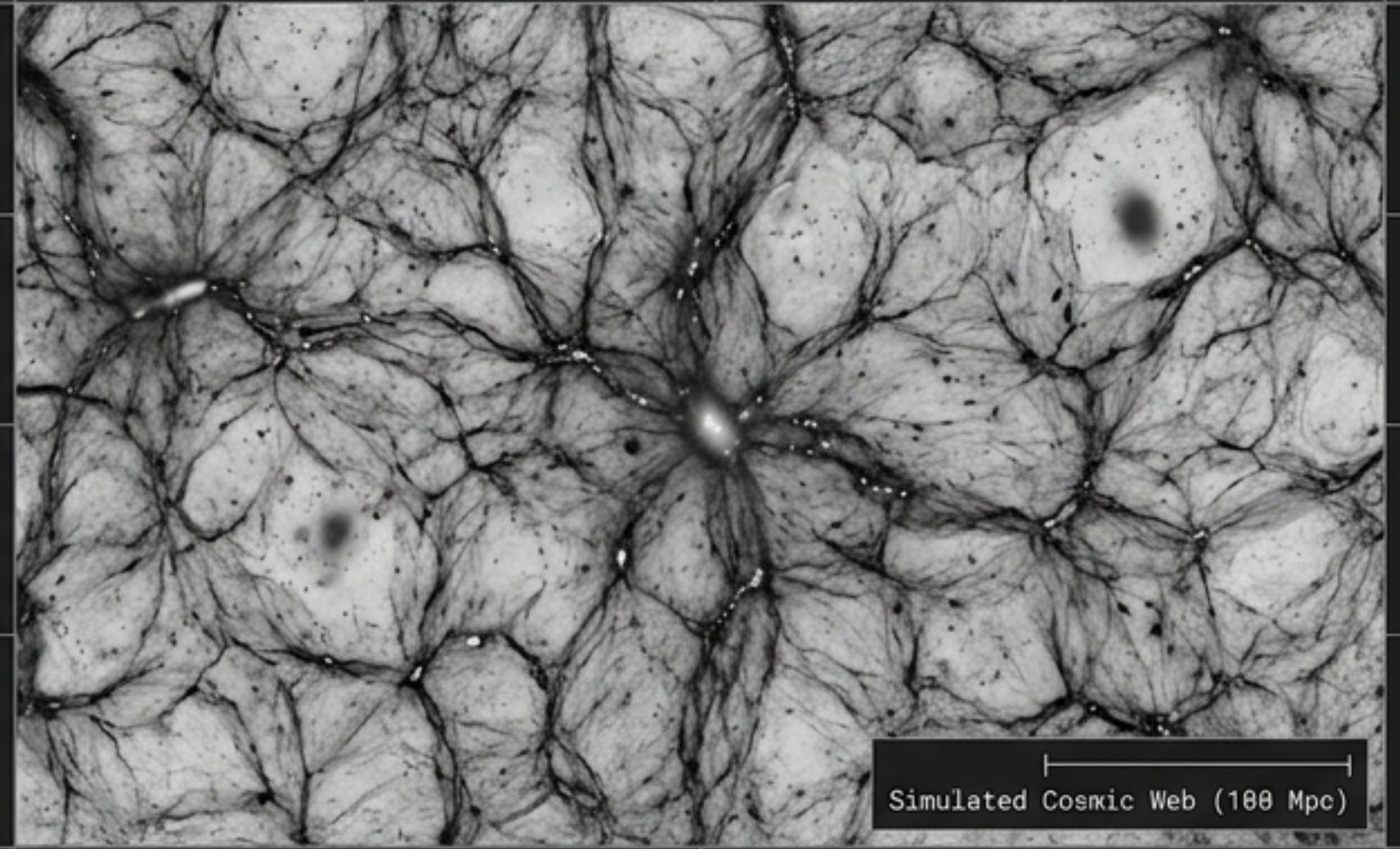
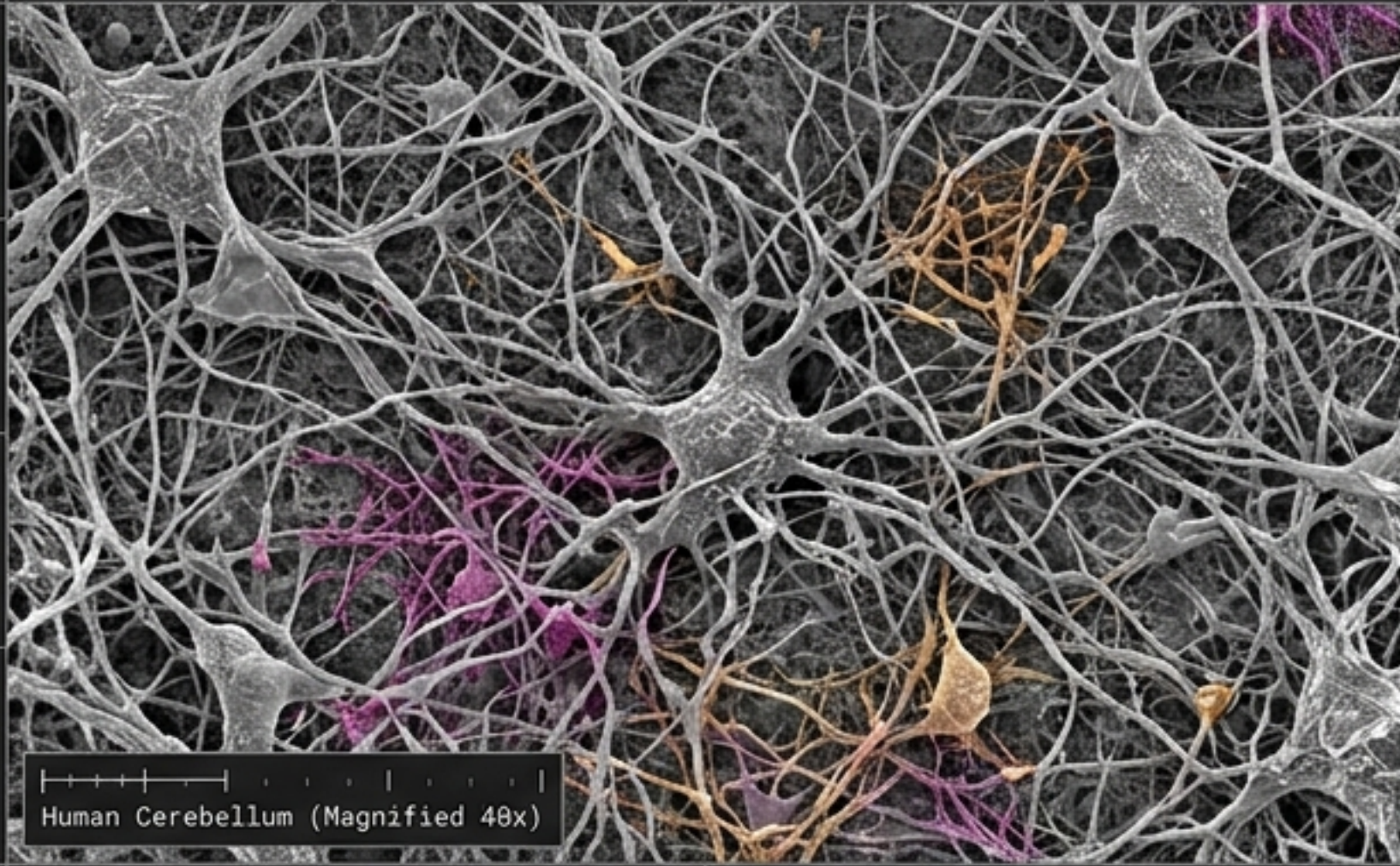




Beyond a Trick of the Eye



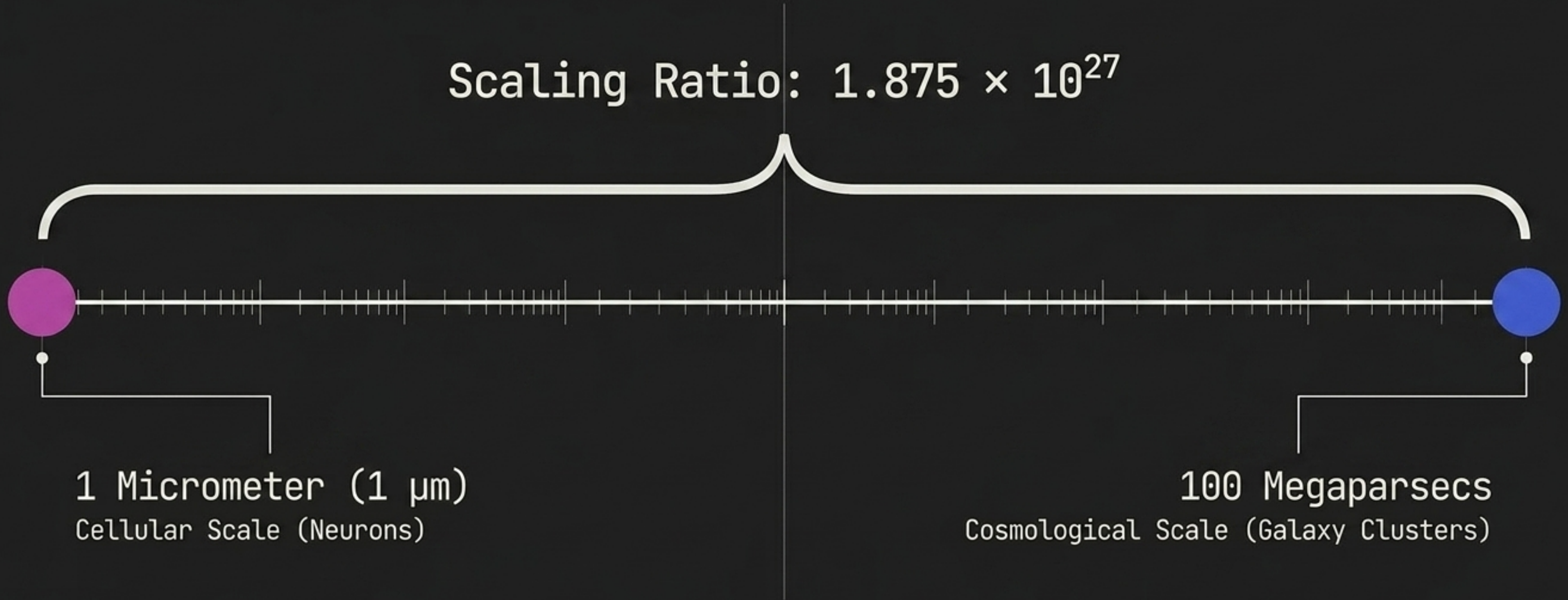
They look the same, but are they the same?

Humans are wired for apophenia—seeing meaningful patterns in random data. But astrophysicist Franco Vazza and neurosurgeon

Alberto Feletti hypothesized that the resemblance between the neuronal network and the universe is not an optical illusion, but a mathematical reality.

A Gulf of 27 Orders of Magnitude

Scaling Ratio: 1.875×10^{27}



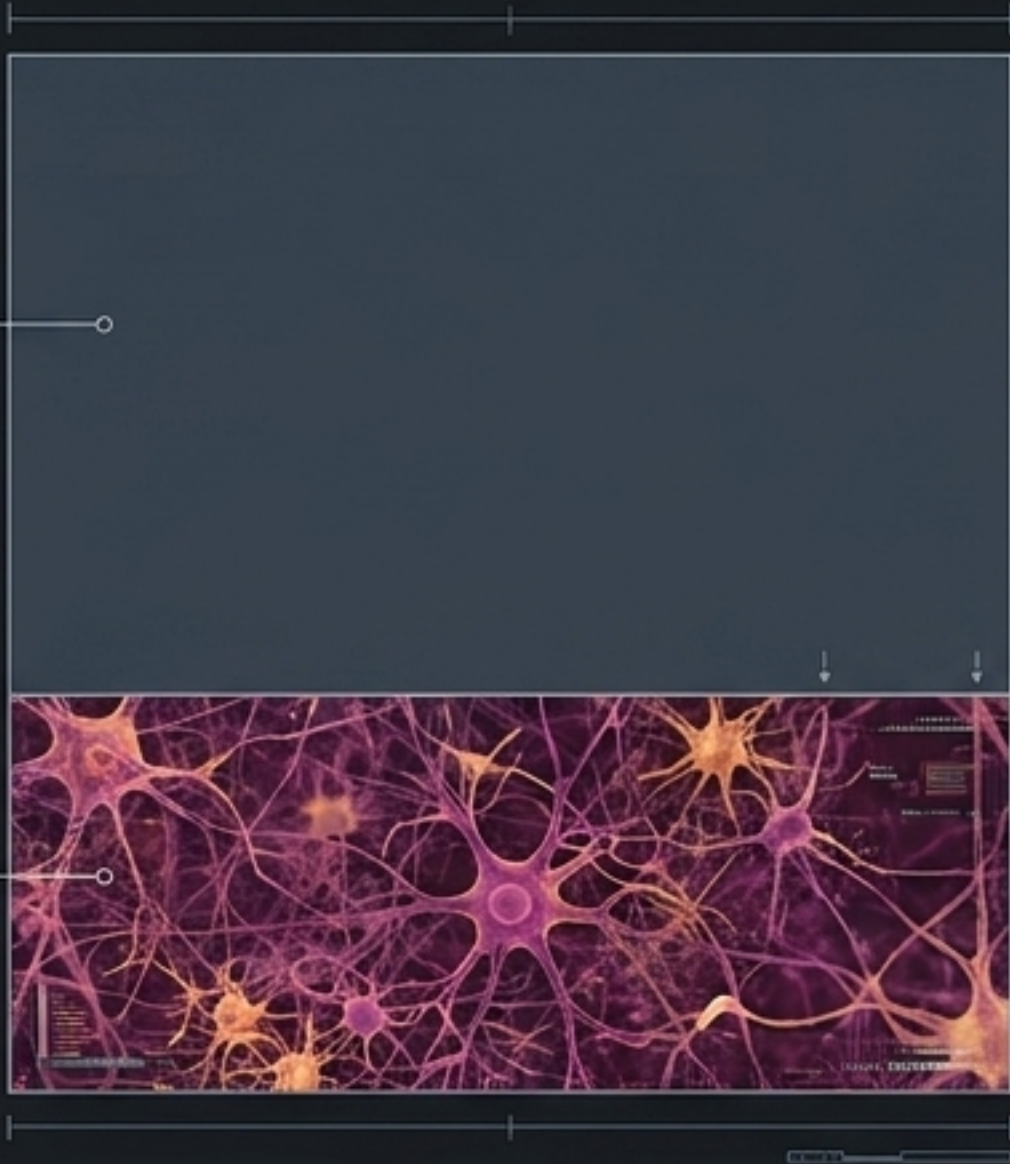
Despite a physical scale difference of a billion billion billion, we can utilize the concept of emergence. By comparing these systems at the specific scales where their self-organization appears, we can test their structural metrics side-by-side.

The 30/70 Composition Rule

Brain

70% Passive Medium
(~77-78% Water, plus
lipids and proteins)

30% Active Network
(Neurons and supporting
cellular structures)



Universe

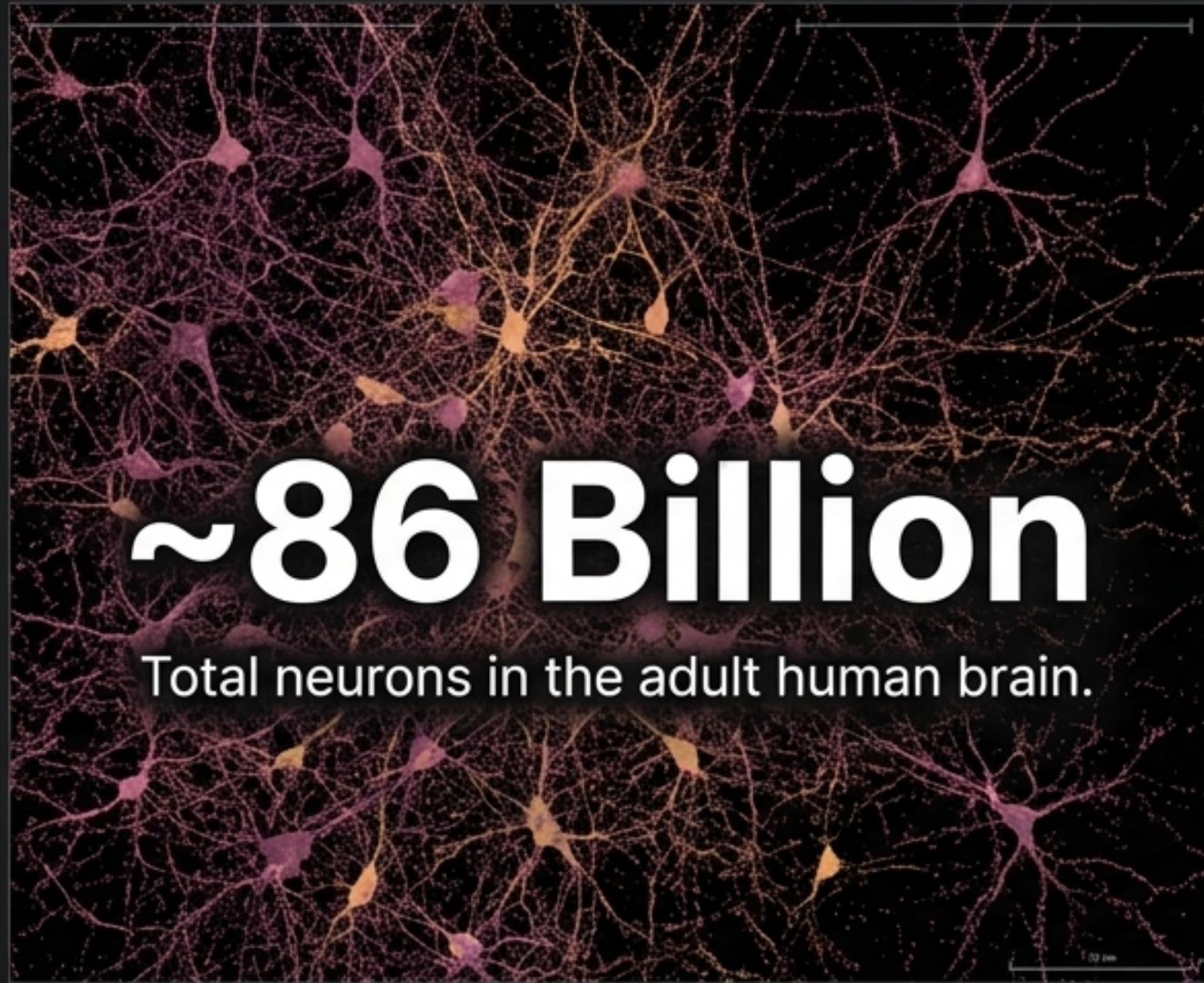
70% Passive Medium
(~68-73% Dark Energy,
a scalar energy field of
empty space)

30% Active Network
(Dark matter & 4.4%
baryonic matter
condensing into galaxies)



In both the brain and the observable universe, the structures that process information or generate gravity make up only ~30% of the system. They are suspended in a ~70% passive medium—water in the brain, dark energy in the cosmos—that permeates the system but plays a largely indirect role in internal dynamics.

The Balance of Nodes



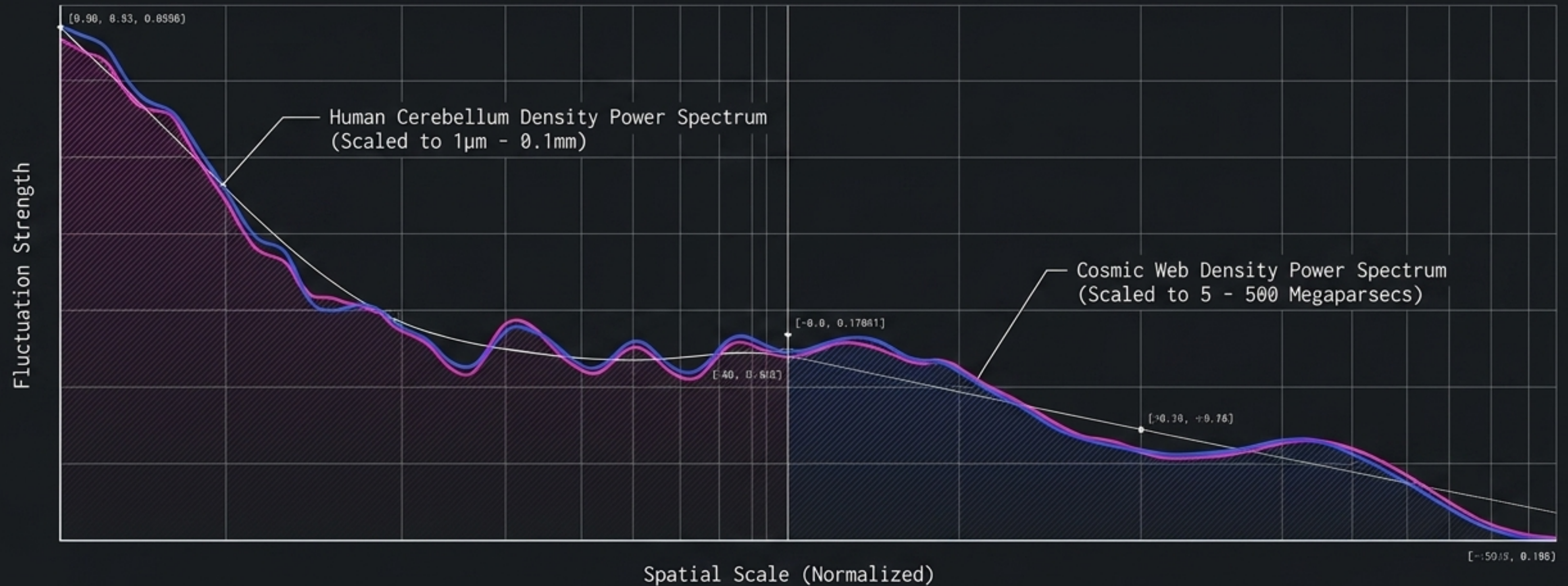
Note: ~69 billion of these reside specifically in the cerebellum, with the remainder primarily in the cortical gray matter.



Note: These act as the fundamental 'nodes' of the cosmic web, acting as gravitational anchors connected by filaments.

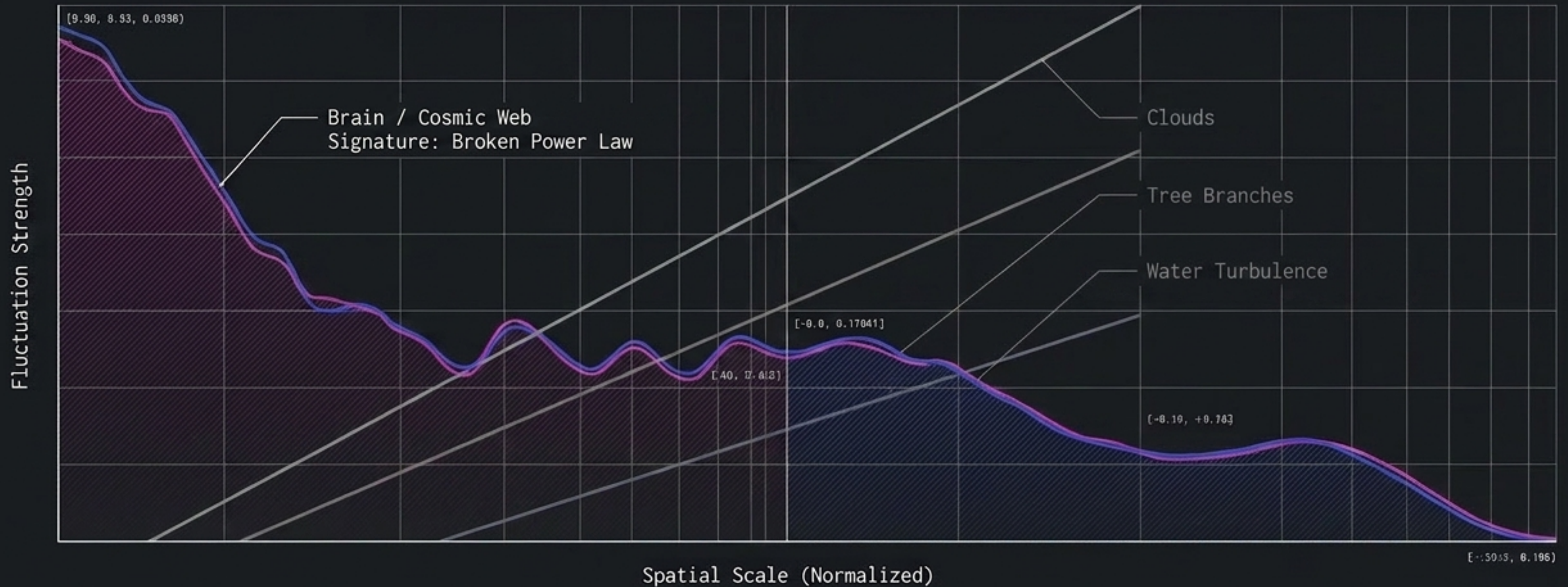
Both systems are organized as immense networks consisting of roughly the same magnitude of fundamental nodes, interconnected through narrow filaments whose typical width is only a tiny fraction of the host system.

The Mathematical Fingerprint of Matter



Astrophysicists use spectral density to measure how matter fluctuates across space. When analyzing 1mm microscopic slices of brain tissue alongside 100 Megaparsec slices of the universe, the progression of matter distribution follows the exact same mathematical curve over multiple orders of magnitude.

The Fractal Myth

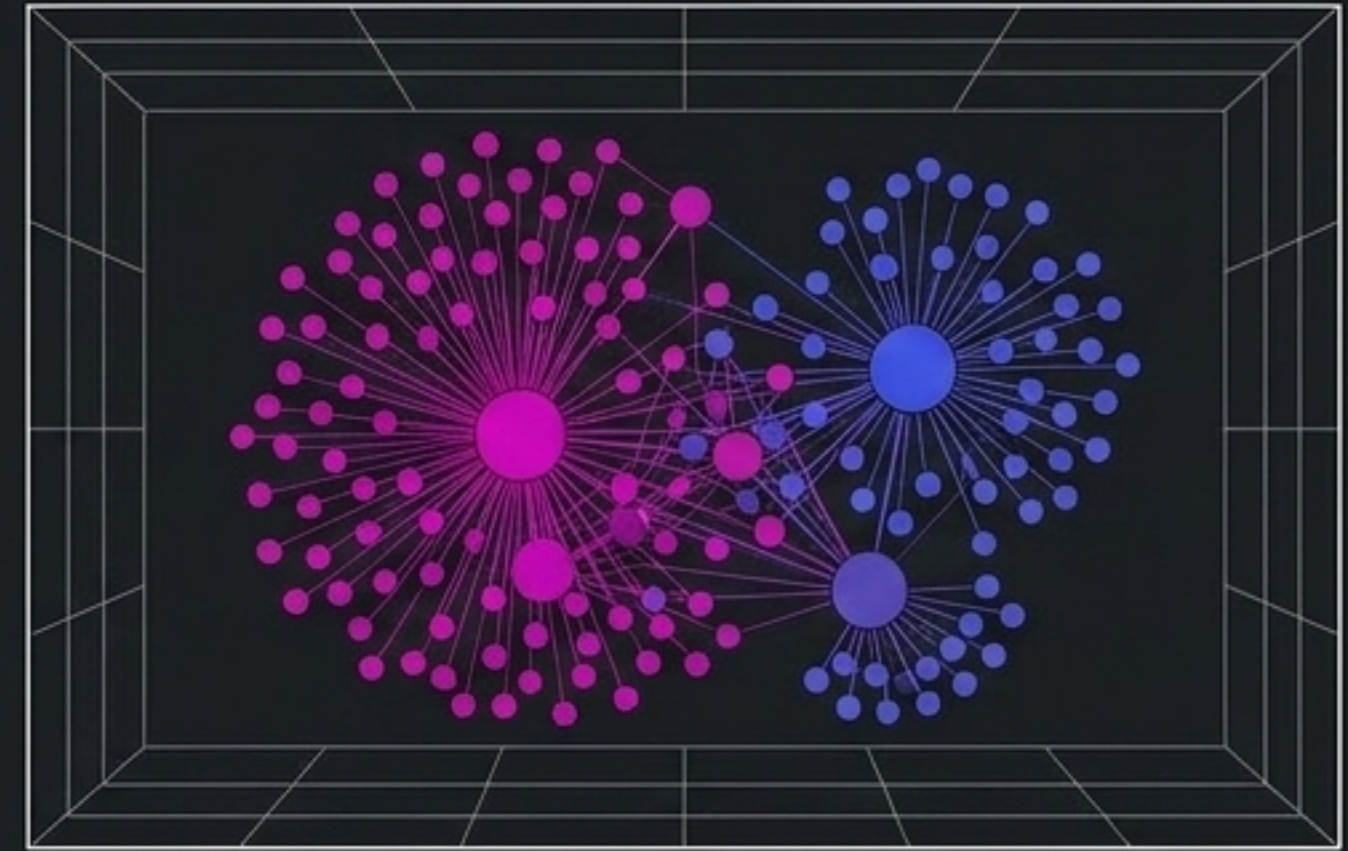


Are all natural systems mathematically similar? No. Common complex systems like clouds, trees, and turbulence are fractals—meaning they are perfectly self-similar at every scale, creating steep, straight spectral graphs. The brain and the cosmic web are different: they rely on scale-dependent, self-organized structures (broken power laws). Their matching complexity is exceptionally rare.

Network Topology and Centrality



Erdős-Rényi Random Network
Low Clustering Coefficient



Biological & Cosmic Networks
High Clustering Coefficient & Degree Centrality

Average Connections per Node (Cerebellum): 1.9 to 3.7
Average Connections per Node (Cosmic Web): 3.8 to 4.1

When mapped as mathematical graphs, neither system is a random scatter of points. Both possess exceptionally high clustering coefficients and degree centrality. They form highly interconnected local neighborhoods centered around massive structural hubs.

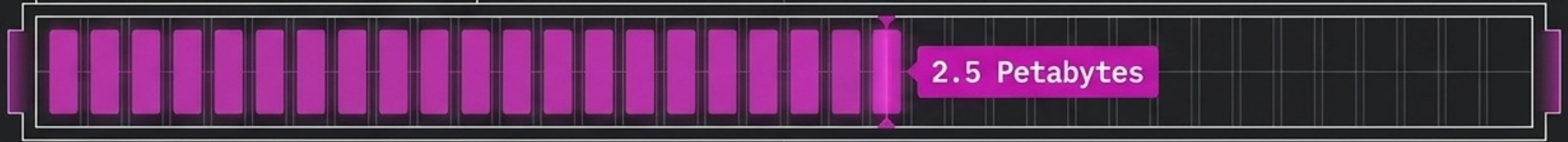
The Cosmic-Brain Diagnostic Matrix

Metric	Human Brain (Micro)	Observable Universe (Macro)
Fundamental Nodes	~86 Billion (Neurons)	~100 Billion (Galaxies)
Active Network Mass	~30% (Cellular structures)	~30% (Dark + Baryonic Matter)
Passive Medium	~70% (Water)	~70% (Dark Energy)
Network Topology	High Clustering / Broken Power Law	High Clustering / Broken Power Law
Average Connections (per node)	~1.9 – 5.4	~3.8 – 4.1

A quantitative side-by-side summary reveals that across physical composition, structural morphology, and graph theory, the architectural constraints of both systems are nearly identical.

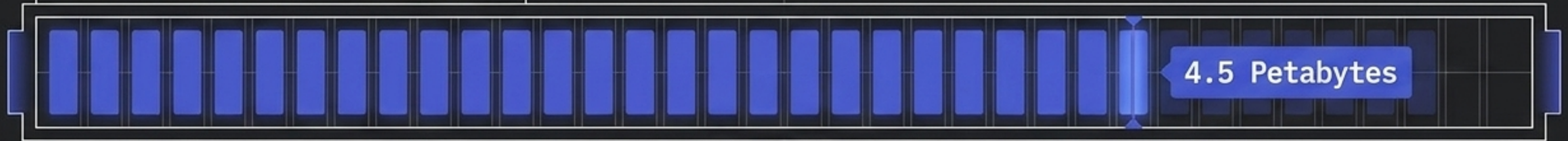
Limits of Information Capacity

Human Connectome Capacity



(Calculated at ~4.7 bits of information per neuron)

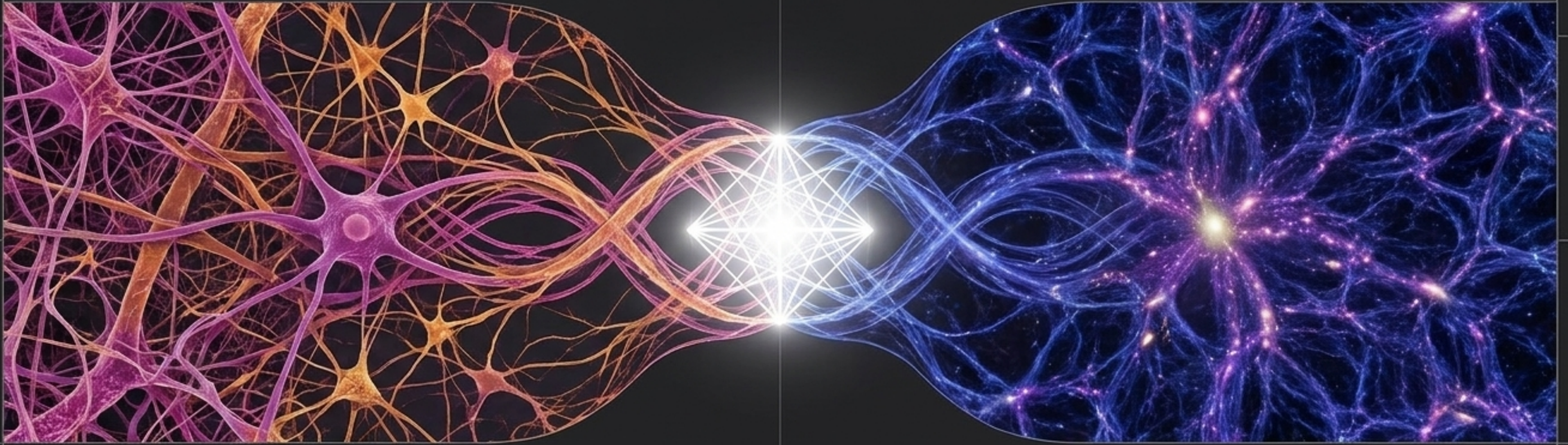
Observable Universe Capacity



(Total information entropy required to describe the evolution of cosmic clustering)

Complexity can be measured by how many bits of information are required to predict a system's behavior. The total memory capacity of the adult human brain is strikingly close to the total amount of information needed to describe the structural evolution of the entire visible universe.

Scale-Agnostic Self-Organization



Why do these systems mirror each other? Because completely different physical forces—electromagnetism and biology in the brain, versus gravity and dark energy in the cosmos—are bound by similar universal constraints. When balancing energy, expansion, and mass, nature finds the exact same optimal network architecture to manage complexity, regardless of whether the system spans micrometers or Megaparsecs.

“Roughly speaking, this similarity in memory capacity means that the entire body of information stored in a human brain—the entire life experience of a person—can, in principle, be encoded into the distribution of galaxies in our universe.”

— Franco Vazza & Alberto Feletti