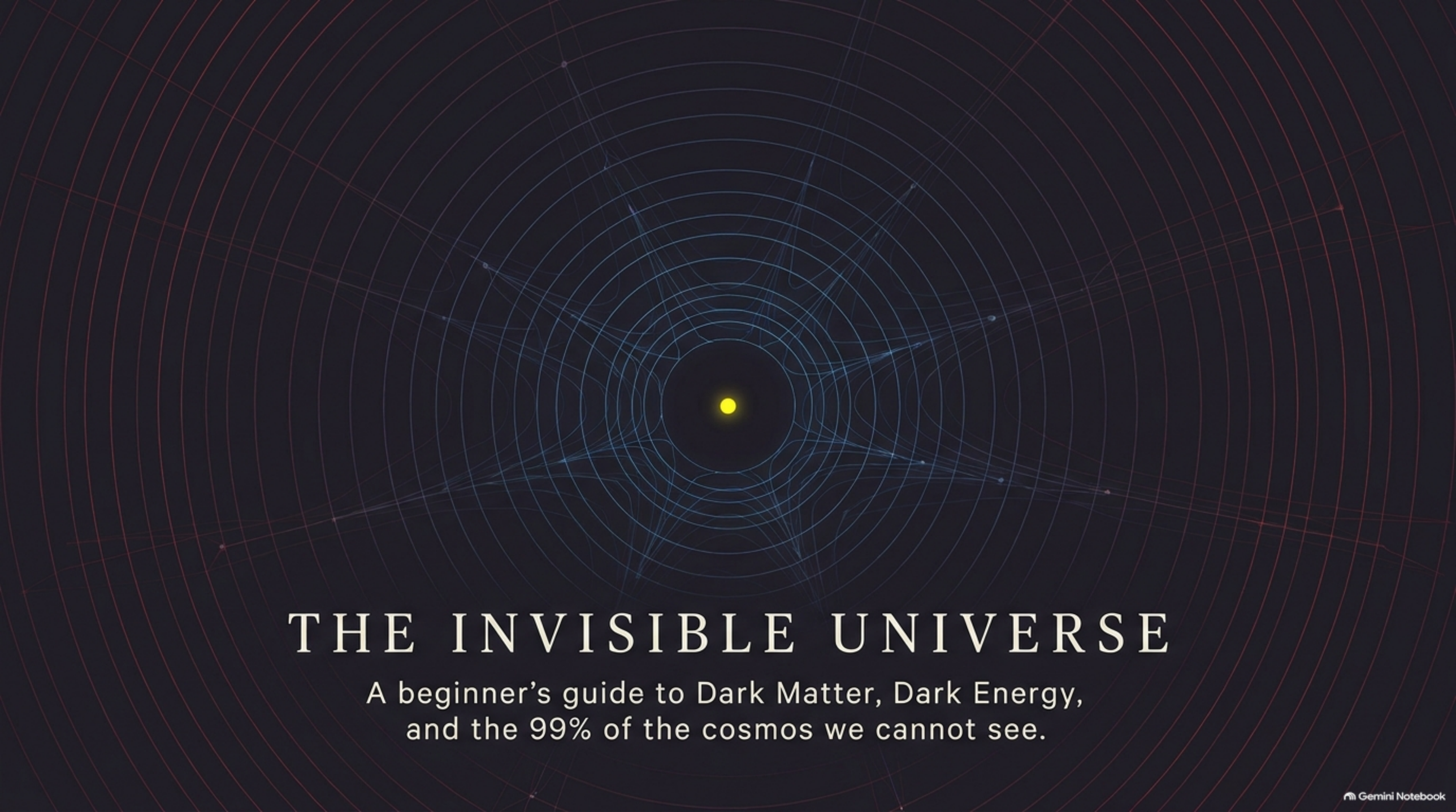


THE INVISIBLE UNIVERSE

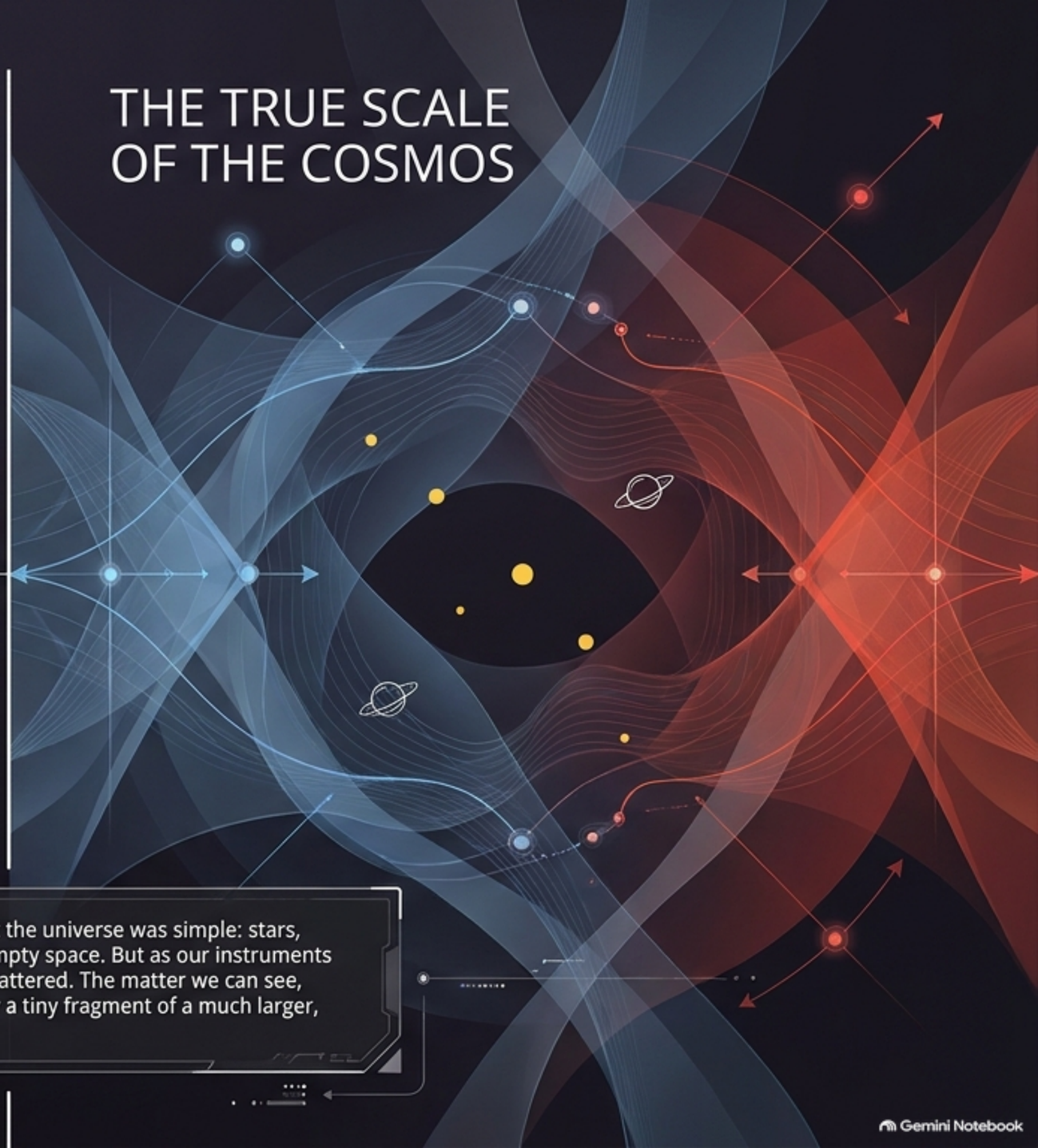
A beginner’s guide to Dark Matter, Dark Energy,
and the 99% of the cosmos we cannot see.

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THE HISTORICAL ILLUSION



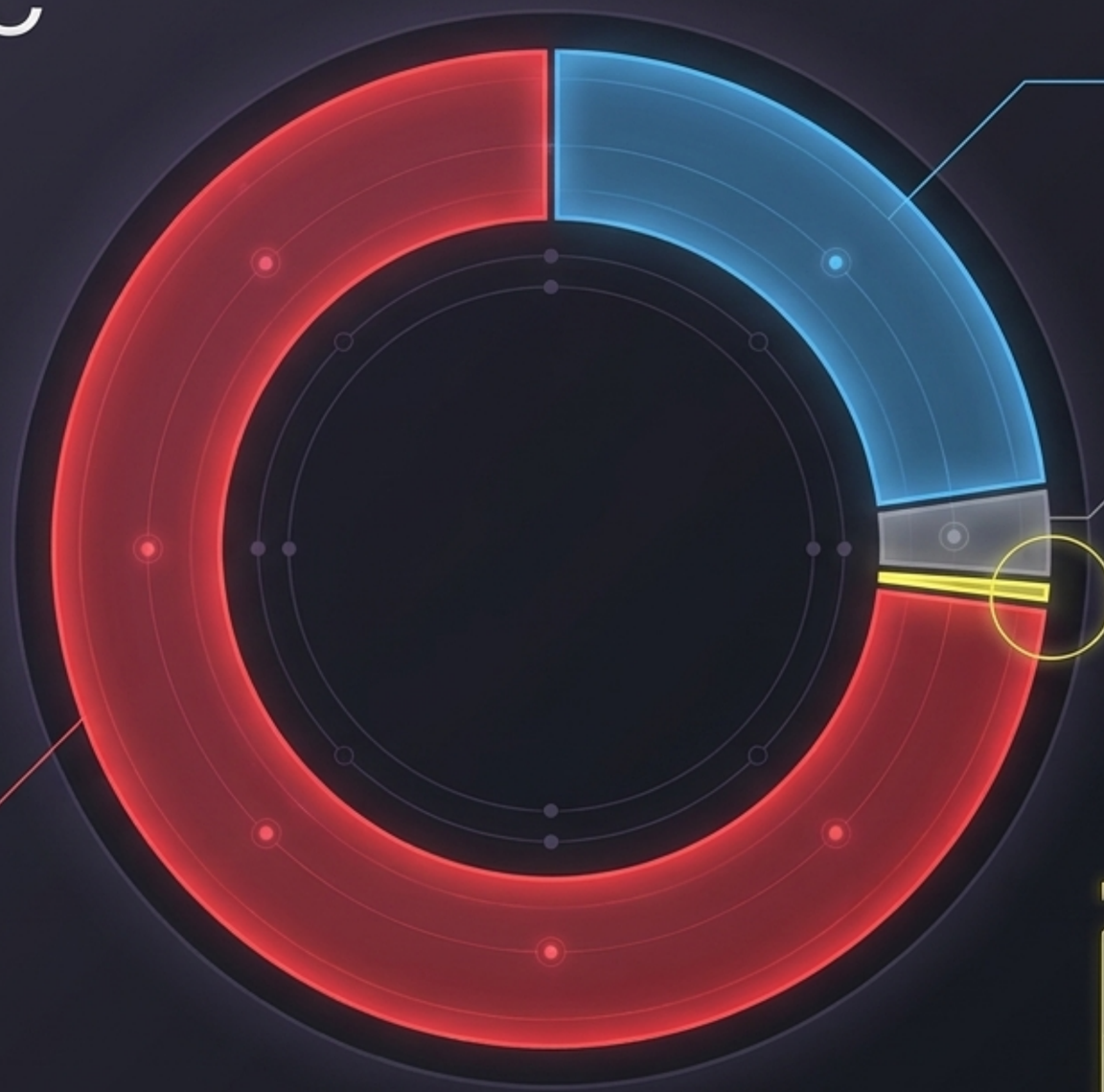
THE TRUE SCALE OF THE COSMOS



For millennia, humanity thought the universe was simple: stars, planets, and vast stretches of empty space. But as our instruments evolved, this intuitive illusion shattered. The matter we can see, touch, and understand is merely a tiny fragment of a much larger, invisible reality.

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THE COSMIC BUDGET



24.4%
Dark Matter
(The invisible glue)

3.2%
Interstellar gas and dust
(Baryonic)

0.4%
Visible matter
(Stars, planets, us)

72%
Dark Energy
(The unseen expander)

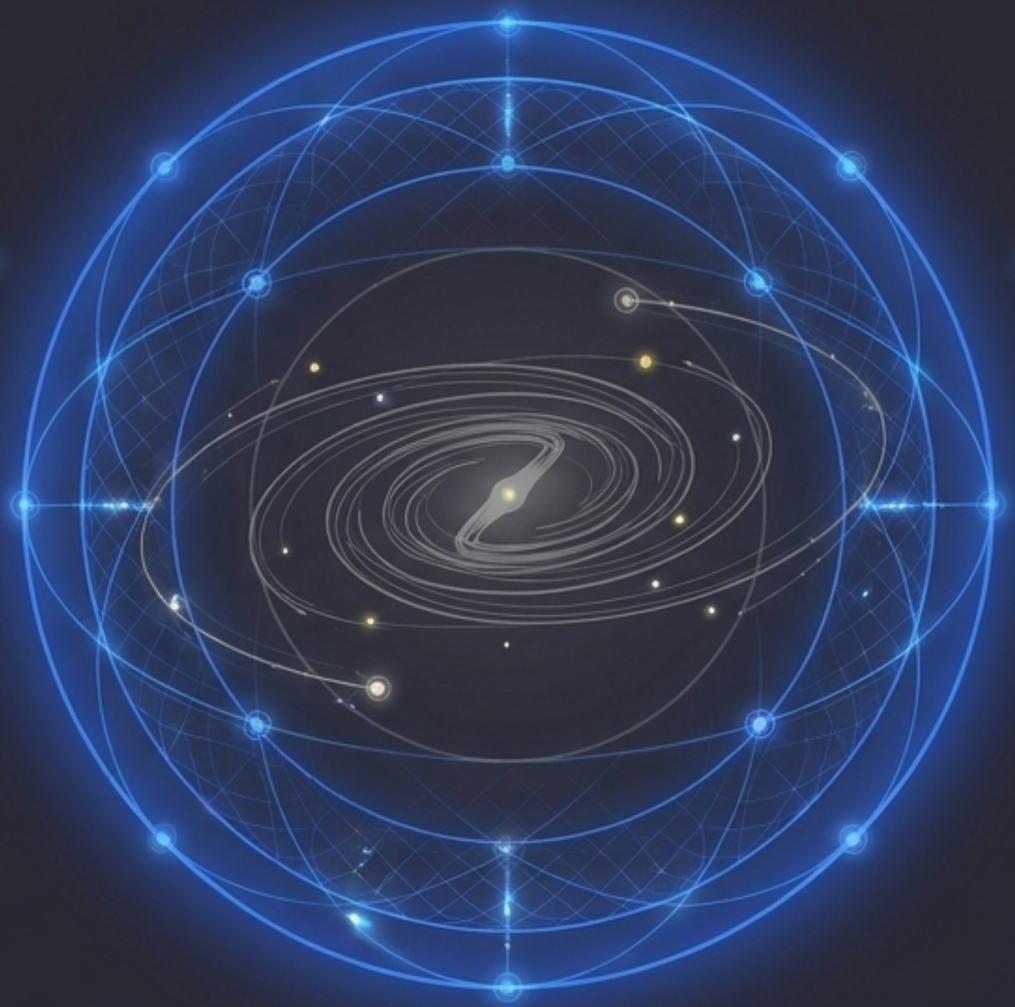
Everything humanity has ever observed—every star, planet, and galaxy—accounts for less than 1% of the universe's total energy budget.

The rest is entirely invisible.

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Mystery 1: The Dark Matter Scaffolding

In 1933, astrophysicist Fritz Zwicky observed that galaxies in the Coma Cluster were moving incredibly fast—so fast they should have escaped the cluster's gravity and flown apart.



He realized an immense, unseen mass must be anchoring them. We cannot see it, but we can feel its gravity holding the universe together.

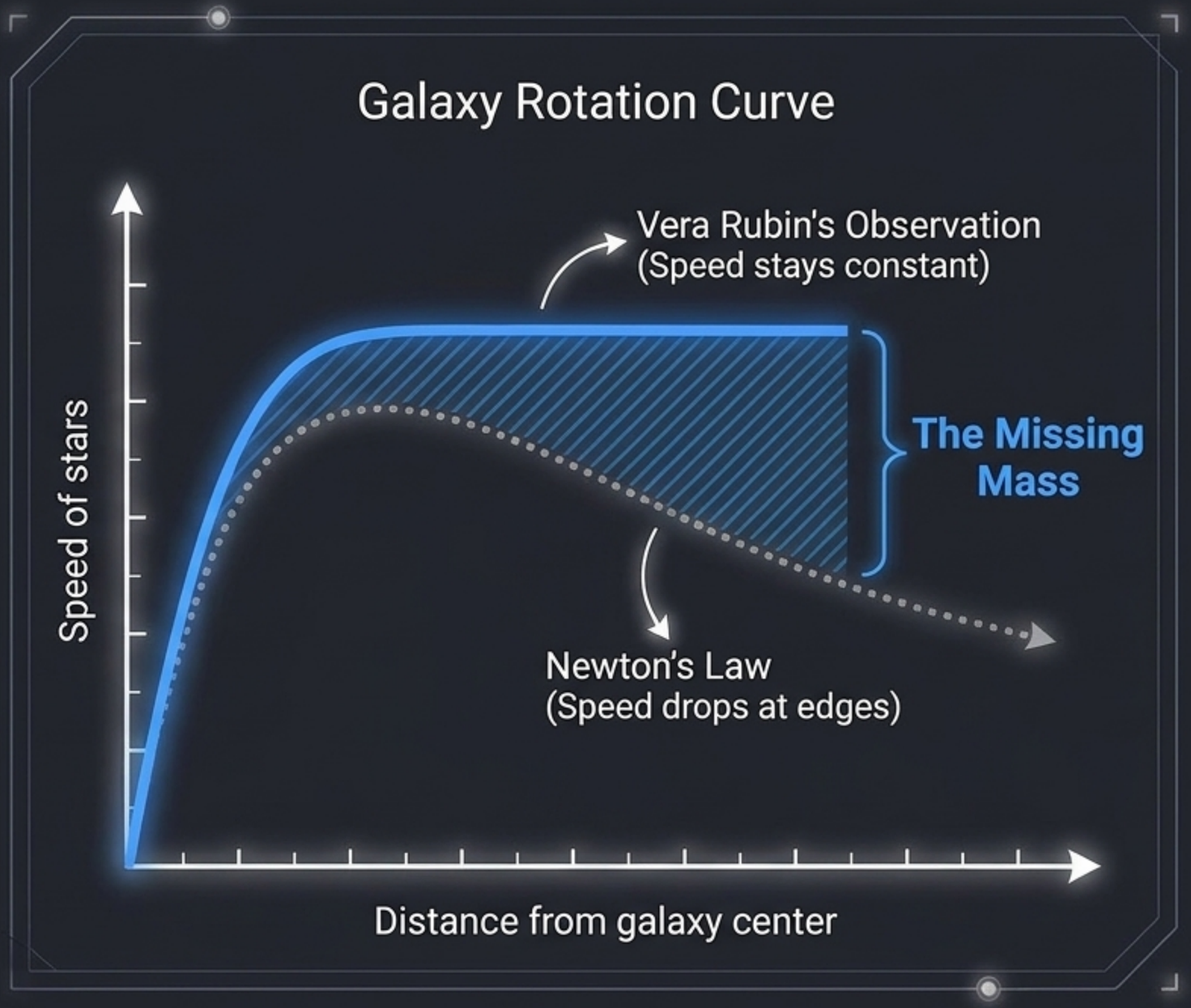
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Mystery 2: The Andromeda Anomaly

In the 1970s, Vera Rubin measured the spin of the Andromeda galaxy.

Based on visible mass, stars at the outer edges should orbit slowly. Instead, they moved fast enough to be thrown into deep space.

The gap between expectation and reality proved that galaxies are embedded in massive invisible “halos” providing extra gravitational pull.



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The Prime Suspect

For decades, scientists hunted for “ordinary” dark matter like hidden planets. Today, physics points to something entirely new: **Exotic Matter**. These theoretical particles pass right through our physical world without interacting with it.

Ordinary (Baryonic) Matter



Dead stars



Cold gas

Ruled out by the EROS experiment—not enough exist.

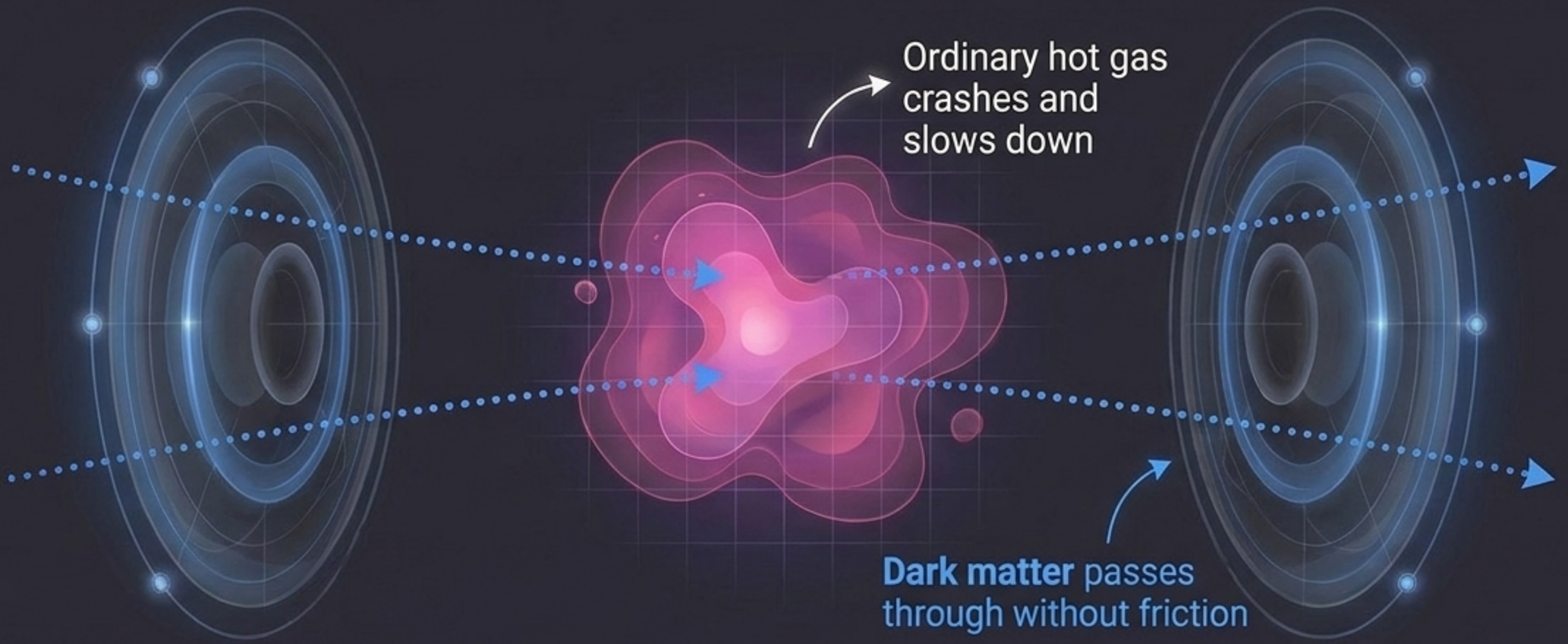
Exotic Matter



WIMPs
(Weakly Interacting Massive Particles)

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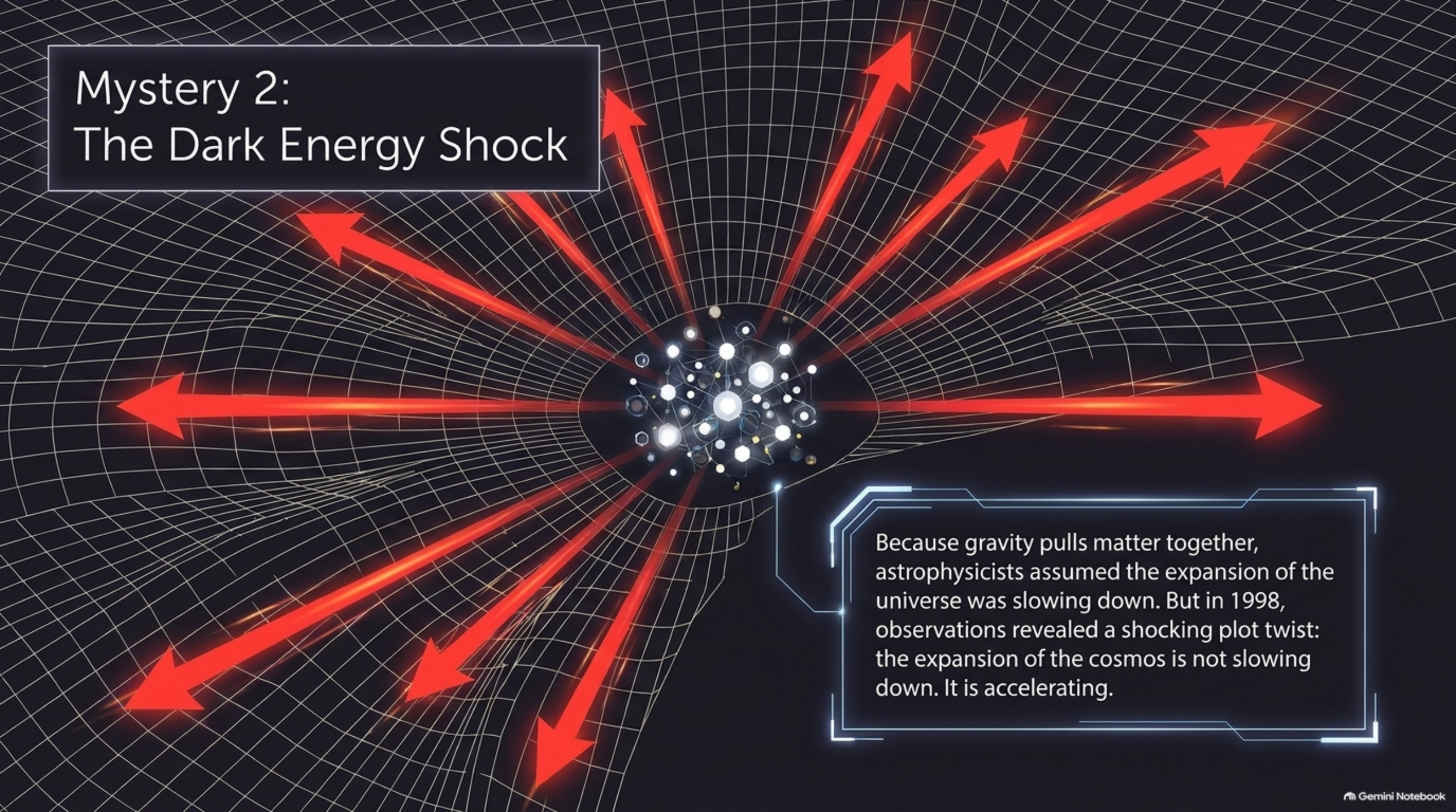
The Smoking Gun: The Bullet Cluster



When two massive galaxy clusters collided, the ordinary hot gas crashed and slowed down in the center. But the vast majority of the gravity kept moving right through the collision without slowing down. We visually mapped dark matter separating entirely from ordinary matter.

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Mystery 2: The Dark Energy Shock

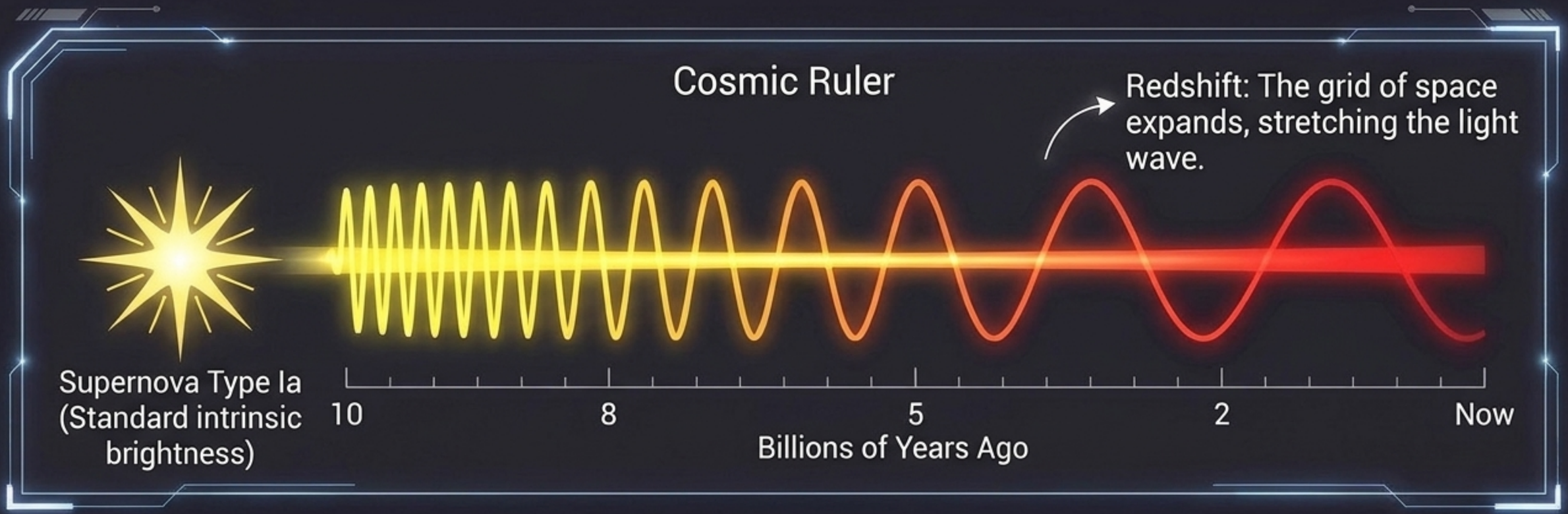


Because gravity pulls matter together, astrophysicists assumed the expansion of the universe was slowing down. But in 1998, observations revealed a shocking plot twist: the expansion of the cosmos is not slowing down. It is accelerating.

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Measuring the Invisible: Standard Candles

To trace this expansion, projects like the Supernova Legacy Survey at Hawaii observe exploding stars (Supernovae) that always shine with the exact same intrinsic brightness. By measuring how faint they look (distance) and how much their light stretches (redshift), we can precisely map the acceleration of the universe.



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The Ultimate Cosmic Battle

Dark Matter tries to pull the universe together. Dark Energy is actively ripping it apart.
Right now, Dark Energy is winning, diluting the cosmos into the void.

	Dark Matter	Dark Energy
Direction		
Force	Gravity (Positive Pressure)	Repulsion (Negative Pressure)
Role	The Builder	The Expander
Action	Pulls galaxies together and anchors structure.	Pushes the fabric of space apart.

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Hunting the Invisible

Astronomers and particle physicists are attacking these mysteries from every angle. It requires the most sensitive instruments ever built, spanning deep underground caverns, massive particle accelerators, and orbital space telescopes.



1. Underground

Deep detectors waiting for a single Dark Matter particle collision.



2. Accelerators

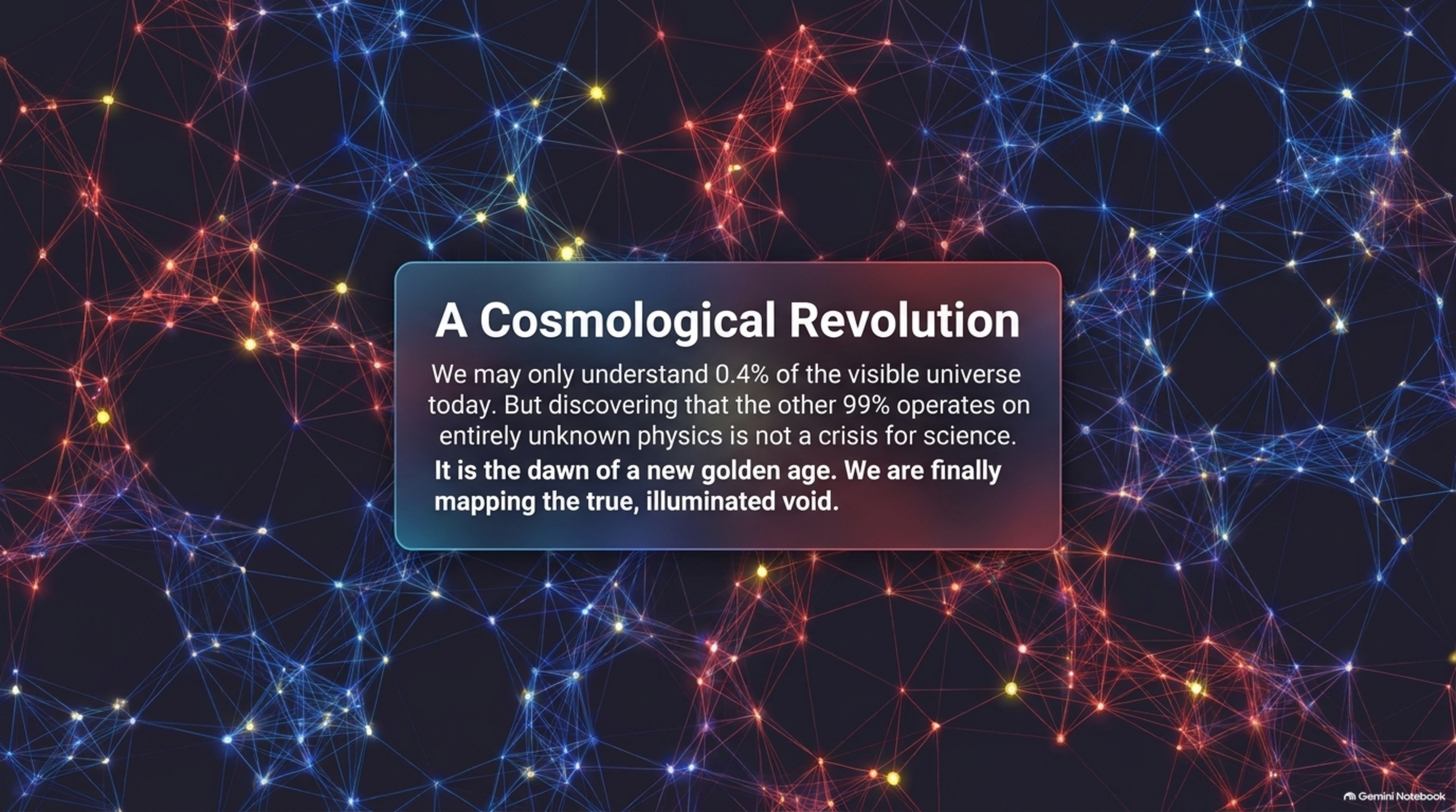
The LHC in Geneva attempting to create dark matter by smashing particles.



3. Space

Probes mapping the cosmic microwave background to measure Dark Energy.

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A Cosmological Revolution
We may only understand 0.4% of the visible universe today. But discovering that the other 99% operates on entirely unknown physics is not a crisis for science.
It is the dawn of a new golden age. We are finally mapping the true, illuminated void.
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