Reclassifying Universal Cosmology: The Observational Refutation of Dark Matter and Dark Energy after Almost a Century of Uncertainties

Fabiano Rosolem

IAmOctopus Research and Development

2025

Abstract

This paper presents a unified interpretation of cosmic structure based exclusively on classical gravitation, General Relativity, and observational astrophysics, in which the so-called dark sector is entirely reinterpreted as real baryonic matter. The central point is the introduction of two formal concepts, *Baryonic Obscurus* and *Cosmos Tenebris*, and a simple, dynamic mathematical formalism that reclassifies all inferred gravitational mass as the sum of visible and obscured baryonic components. The text begins with a historical overview, from Aristotle and Ptolemy to the heliocentrism of Copernicus, Kepler, and Galileo, through Newton and Einstein, establishing the conceptual basis for a vectorial reading of the universe after the Big Bang. Next, we describe the early emergence of supermassive black holes, quasars, high-rate supernovae, and large-scale structures such as Laniakea, the Great Attractor, and Shapley, emphasizing that all known cosmic development is governed by real mass, momentum, vectors, and gravitational hierarchies.

Keywords: Cosmology, Dark Matter, Dark Energy, Spectroscopy, Baryonic Obscurus, Cosmos Tenebris, Gravitational Dynamics.

1 Historical basis for cosmic dynamics

1.1 Geocentrism and its conceptual limitations

For about two millennia, the dominant cosmological model in the West was the geocentric system. Around 330 BC, Aristotle formulated a cosmology in which Earth occupied the immovable center of the universe, surrounded by crystalline spheres to which the stars were fixed. In the 2nd century, Ptolemy refined this view in his work *Almagest*, introducing epicycles and deferents to adjust the mathematics to observations. Despite the geometric ingenuity, this model did not offer a physical mechanism to explain: the origin of orbital speed; the stability of orbits; the unification between celestial and terrestrial motions. Earth was treated as an ontological exception, and the stars as qualitatively distinct entities. In short, geocentrism was a descriptive model, yet sterile in dynamic terms.

1.2 The heliocentric revolution and the idea of planets as satellites

In 1543, Nicolaus Copernicus published *De revolutionibus orbium coelestium*, proposing that the Sun occupies the center of the planetary system and that Earth is merely a planet in orbit. This ostensibly simple change corrects a fundamental asymmetry: Earth ceases to be an absolute point to become a body in motion alongside the other planets. Between 1609 and 1619, Johannes Kepler formulated his three laws of planetary motion: orbits are elliptical, with the Sun at one focus; planets sweep equal areas in equal times; and the harmonic relation, where the square of the orbital period T is proportional to the cube of the semi-major axis a:

$$T^2 \propto a^3 \tag{1}$$

In 1610, Galileo Galilei observed the moons of Jupiter with his telescope. By detecting satellites orbiting another body besides Earth, he empirically demonstrated that Earth is not the only center of orbital motion. The distinction between "planet" and "satellite" then became merely a difference of scale and gravitational hierarchy, not of intrinsic nature.

1.3 Newton and the unification of heaven and Earth

In 1687, Isaac Newton published *Philosophiæ Naturalis Principia Mathematica*. In it, the law of universal gravitation formally unified the fall of an apple with the motion of the Moon, abolishing the conceptual boundary between heaven and Earth. The famous equation,

$$F = G\frac{m_1 m_2}{r^2} \tag{2}$$

establishes that the same invisible force that makes apples fall governs celestial orbits. For the first time, a universal dynamics was created, applicable to both terrestrial bodies and celestial objects. The circular orbital speed results from the equality between the centripetal force required by the orbit and the available gravitational force. From the classical circular orbit condition in Newtonian gravitation, we immediately derive:

$$v = \sqrt{\frac{GM}{r}} \tag{3}$$

That is, for an object in a circular orbit of radius r around a mass M, the tangential component v balances the gravitational attraction. From the same structure, we obtain the escape velocity, corresponding to the kinetic energy needed for a body to free itself from the gravitational field of M:

$$v_{esc} = \sqrt{\frac{2GM}{r}} \tag{4}$$

These two expressions — circular orbital velocity and escape velocity — form the mechanical core of all orbital dynamics discussed in this work. They define the boundary between capture and escape, between satellite and projectile, between gravitational binding and vectorial independence of an object.

1.4 Einstein and the curvature of spacetime

In 1915, Albert Einstein presented the Theory of General Relativity. Gravitation ceased to be conceived as a force acting at a distance to become the curvature of spacetime itself induced by energy-mass. This theory successfully explained several phenomena that challenge Newtonian gravitation: the anomalous precession of Mercury's perihelion; the deflection of light passing through intense gravitational fields (observed in 1919); and the gravitational redshift of light frequencies. However, for the regime of weak fields and non-relativistic speeds, Newton's equations remain an excellent approximation. It is exactly this regime — weak gravitation and classical orbital dynamics — that dominates most of the discussion in this article.

1.4.1 Statement of physical compatibility

All subsequent analysis explicitly assumes: Newtonian gravitation in weak-field regimes; relativistic corrections only where necessary; classical mechanics for orbital dynamics; and no new forces and no hypothetical new particles. The proposal does not alter established physical laws; it merely reorganizes the inventory of baryonic mass into a new conceptual taxonomy. That is, all accepted fundamental physics (gravitation, known particle physics, classical astrophysics) remains valid and in use — what changes is only the interpretation of what constitutes the "missing mass" in the universe.

2 Big Bang, initial vector fields and formation of colossal structures

2.1 Post-Big Bang dynamics

Shortly after the Big Bang, on time scales of less than a few hundred million years, the universe went through stages of evolution marked by: extremely high density; accelerated cooling of radiation and matter; recombination and decoupling of radiation (emergence of the first neutral atoms); and growth of small density perturbations, seeds of structure.

The initial expansion of space generated a kinematic field of recession, moving portions of the universe apart, while gravitation acted trying to reverse part of that motion. From the primordial instants, no region was truly neutral: every particle, cloud, filament, or protogalaxy was simultaneously subjected to vectors inherited from expansion, vectors induced by density gradients, and vectors linked to local instabilities. Thus, very early on, the universe presented itself as a competitive vector field, not a static scenario. Each region of the early cosmos suffered varied directional influences — matter flows receding with expansion or collapsing into aggregates — a dynamic tapestry that would shape the formation of the first structures.

2.2 Supermassive black holes and the time problem

Modern astronomical observations show quasars containing central black holes of billions of solar masses at extremely remote cosmic epochs only a few hundred million years after the Big Bang. Notable examples include quasars like TON 618 and UHZ1, among other extreme cases. TON 618, for example, hosts a black hole of about 40 billion solar masses, detected at a redshift $z \approx 2.2$, when the universe was only ~ 3 billion years old. Even more impressive, the quasar UHZ1 was recently observed (with help from JWST and the Chandra X-ray Observatory) at $z \sim 10$, meaning when the cosmos was only about 450 million years old.

Even if the central black hole of UHZ1 is significantly smaller than that of TON 618 (on the order of tens of millions of solar masses), its mere presence so early imposes enormous challenges to traditional linear growth models by accretion. These objects require, to form quickly: extremely efficient gravitational collapse of massive amounts of matter; continuous feeding by dense gas and surrounding stars; effective transport of angular momentum (so that matter falls into the core); and emission of collimated relativistic jets, which remove energy and angular momentum from the system.

Each supermassive black hole acts as a center of intense gravitational and kinematic vectors. Around it there is: matter falling (*infall*) at high speed toward the nucleus; jets of relativistic plasma and radiation being ejected from the poles, sweeping the surrounding medium; and shock waves propagating through the interstellar and intergalactic medium, heating and compressing distant gas clouds. There is no known phenomenon in this picture that requires postulating dark matter or any non-baryonic component. The entire scenario — the early formation of these gigantic gravitational "wells" — can be explained with gravitation, magnetohydrodynamics, radiation, and baryonic matter. In other words, the emergence of supermassive black holes in the early universe, although challenging, does not demand any new form of exotic matter; it only demands extreme astrophysical conditions and fast baryonic processes, the feasibility of which is beginning to be corroborated by observations like that of quasar UHZ1.

2.3 Supernovae as vector injections

The supernova rate in the young universe was much higher than today. Each individual supernova: ejects material at thousands of kilometers per second, injecting a radial pulse of matter and energy into the surrounding medium; compresses and heats neighboring clouds as it expands, potentially triggering shock and subsequent collapse in other regions; alters local magnetic fields as the ejected plasma carries field lines away; and injects heavy elements into the surrounding medium, chemically enriching the next generations of stars.

These explosions are true vectorial "kicks" into the interstellar medium: they generate shock fronts that push gas outward while larger gravitational fields (like that of the galaxy or cluster) pull that gas inward. The result is an asymmetric redistribution of mass and angular momentum. With each supernova, the local vector architecture is reprogrammed: speeds, flow directions, and densities change abruptly. In short, supernovae are not just luminous events to catalog — they are violent operations of vector editing in the great dynamic database of the cosmos. They spread matter and gravitationally stir the surroundings, without any need to invoke non-baryonic agents to explain their effects.

2.4 Large-scale architecture: Laniakea, Great Attractor, and Shapley

On larger scales, galaxies and clusters do not move randomly through the universe — there is a clear hierarchy of gravitational attraction on large scales. Observations of redshifts and peculiar flows reveal a fabric of coherent motions. Our Milky Way is attracted toward the Virgo Cluster (the nearest dominant galaxy group). The Virgo cluster itself participates in an even larger flow called the Laniakea supercluster, which gathers several clusters in joint infall. Laniakea, in turn, converges toward the region known as the Great Attractor, a huge center of mass relatively nearby (in cosmological scale) influencing hundreds of galaxy groups. The Great Attractor is itself influenced by even more massive structures, such as the Shapley supercluster, one of the largest known concentrations of galaxies in the local universe.

Each level of this hierarchy gravitationally "pulls" the level below. The average direction of the Milky Way's peculiar motion relative to the microwave background, for example, is a consequence of this cascade of gravitational vectors: our galaxy is accelerated toward the Shapley concentration through intermediaries (Virgo, Laniakea, Great Attractor). Again, there is no need to invoke "hypothetical entities" or some extra force: the vector hierarchy emerges from the distribution of real (baryonic) mass on progressively larger scales. The coherent velocities of galaxies and clusters are fully consistent with normal gravitation produced by the mapped structures (even if part of that mass is obscured and distributed in non-luminous gas and matter). Thus, the universe on the largest scales organizes itself as an interconnected web of gravitational vectors that channel matter along filaments toward concentrated masses. All of this can be understood as a consequence of baryonic mass (visible or not) spread throughout the cosmos — there is no observational evidence that it is necessary to introduce some kind of dark matter with a distribution discrepant from baryonic matter to explain galaxy streams on large scales.

2.5 Spectroscopy and the hidden baryonic budget

Astronomical spectroscopy, covering multiple wavelengths (radio, infrared, optical, ultraviolet, X-rays), directly reveals various forms of baryonic matter in the universe: neutral hydrogen (detected by its 21 cm line in radio, for example); ionized hydrogen (visible in emission lines like Hα or through diffuse X-ray emission from hot plasma); helium in different ionization states; "metals" (heavier elements) identified in absorption and emission lines in the interstellar and intergalactic medium; cold dust (glowing in far-infrared), hot dust (near-infrared), and complex grains detected by thermal emission; and molecules in specific bands (for example, carbon monoxide in radio/mm, indicating dense molecular clouds).

Spectral maps in radio, infrared, optical, and UV have shown some important facts: a large portion of the universe's baryons are in diffuse phases (low-density gas in the intergalactic medium or galaxy halos); a significant fraction is in very hot gas (temperatures of millions of degrees) that does not emit visibly in optical, but only in X-rays or via indirect effects (like the Sunyaev-Zel'dovich effect); another part is so cold and rarefied that only extremely sensitive instruments can infer its presence (for example, via weak absorptions in distant quasars or dispersion of radio pulses from magnetars and FRBs).

The balance of this search is clear: the baryonic inventory of the universe is not fully known. Even after decades of surveys, a relevant portion of baryons remains "missing" or poorly mapped, possibly in the so-called warm-hot intergalactic medium (WHIM) and other hidden reservoirs. What is already known is sufficiently complex to justify the hypothesis that a substantial fraction of the inferred "dark" mass is actually unmapped obscure baryonic matter — that is, *Baryonic Obscurus*. Indeed, precision cosmological measurements like those from the Planck satellite indicate that baryonic matter should compose about 4.8-5% of the energy content of the universe, but direct censuses of baryons in the local universe detect less than half of that directly. This discrepancy, known as the missing baryons problem, suggests that there are many unidentified baryons distributed in diffuse structures. In other words, before concluding that $\sim 25\%$ of the universe is made of non-baryonic dark matter, it is prudent to question whether we have already found all the $\sim 5\%$ of ordinary baryonic matter predicted — the evidence is that we have not. Thus, we still need to complete the real baryonic budget of the cosmos.

3 Universal vector dynamics, orbital hierarchies, and the problem of the observed shell

3.1 Orbital motion as an expression of vector dominance

All orbital motion can be understood as a vector competition between initial inertia (the inherited velocity that "pushes" the object to continue in a straight line in space) and the gravitational attraction of some central body (which "pulls" the object to deviate its trajectory). Mathematically, as we have already reviewed, the circular orbit condition is given by:

$$v = \sqrt{\frac{GM}{r}} \tag{5}$$

Any orbiting body is effectively in permanent free fall; it tries to fall toward the gravitational center, but has enough tangential component to avoid collision — in other words, it "misses the ground" indefinitely. If the tangential velocity v falls below the above value, the trajectory ceases to compensate for the fall and tends toward collision; on the other hand, if the velocity exceeds the escape velocity:

$$v_{esc} = \sqrt{\frac{2GM}{r}} \tag{6}$$

the body cannot be captured: it escapes into space, because the kinetic energy exceeds the gravitational binding barrier. This relationship is universal and scale-independent. In all cases (artificial satellites, Moon, Earth, stars, galaxies), the dispute is between an inherited vector (initial momentum or historical motion of the object) and a gravitational pull vector (toward the center of the system). This vector perspective allows us to analyze systems as disparate as low satellites and entire galaxies under the same light: either the escape vector wins (and the object is not retained) or the gravitational vector dominates (and the object is bound to the system).

3.2 Concrete escape velocities: Earth, Mercury, and the edge of the Solar System

To fix ideas, it is worth citing concrete values of escape velocities in some scenarios. On Earth's surface, the escape velocity is on the order of $v_{\text{esc, Earth}} \approx 11.2$ km/s (about $40,300$ km/h). This is the speed a rocket must reach to completely escape Earth's gravity without ever falling back. On Mercury, the planet closest to the Sun and much less massive than Earth, the surface escape velocity is about $v_{\text{esc, Mercury}} \approx 4.3$ km/s (approximately $15,500$ km/h). Mercury has a much smaller gravitational potential, facilitating local escapes. Now consider the escape velocity from the Sun's field in the outer Solar System, around Neptune's orbit (~ 30 AU from the Sun). We estimate something on the order of $v_{\text{esc, Sun@Neptune}} \sim 6.5$ km/s, which corresponds to about $23,000 - 25,000$ km/h. Note that, although Neptune is 30 times farther from the Sun than Earth, the Sun's enormous mass still requires tens of thousands of km/h for something to escape its gravitational influence at that distance.

Now, consider a hypervelocity interstellar object like 3I/ATLAS (one of the recently discovered interstellar objects passing through the Solar System). It has a velocity on the order of $v_{\text{ATLAS}} \approx 250,000$ km/h (i.e., ~ 69.4 km/s), almost ten times greater than the solar escape velocity in the Neptune region. The mechanical conclusion is inevitable. There is no Newtonian scenario in which the Sun captures this object. 3I/ATLAS's speed is so high compared to the local escape velocity that solar gravity can barely deflect its trajectory, much less capture it. There is no need to invoke unknown forces or extraordinary effects to explain its passage. 3I/ATLAS's hyperbolic trajectory is simply a clear case of an object in escape regime: its motion vector exceeds the solar attraction vector at that distance. The numerical value itself proves that it is in escape regime; if the local escape velocity is on the order of 2×10^4 km/h and the object travels at 2.5×10^5 km/h, the chance of capture is essentially zero. This is a concrete example of the vectorial supremacy of inertia over gravity: the object's impulse vastly prevails over the Sun's "will" to retain it.

3.3 Ellipses as natural geometry of systems under external influence

Perfectly circular orbits would only be possible in an ideal environment: they require an exact and isolated balance between the central gravitational force and the object's tangential velocity. In the real universe, however: no system is completely isolated (there are always perturbations from neighboring stars, tides from other bodies, etc.); there are always external pulls competing; and there are always potential gradients in multiple directions (the gravitational field is rarely a perfect monopole - neighbors distort the field).

As a result, orbits tend to be elliptical. The eccentricity of an orbit is, in fact, the observable signature that the system is not perfectly isolated. A nearly circular orbit indicates a relatively stable and symmetric environment; a very eccentric orbit reveals strong external influence or a history of significant perturbations. The shape of the trajectory is not a mere geometric detail — it is an index of the object's vector context. In other words, when we see a planet or comet with an elongated orbit, we can infer that it was pulled unevenly at some point (or is undergoing continuous perturbations). The ellipse emerges naturally as a consequence of initial conditions and interactions: it is the mathematical "signature" of a dynamic equilibrium under inverse-square forces affected by non-perfectly symmetric boundary conditions. Thus, in real multi-body systems, ellipses (and non-closed orbits, like hyperbolic or parabolic trajectories) are the norm. This reinforces that gravitational hierarchies are interconnected — no orbit exists in a vacuum of influences.

3.4 Hill spheres: quantitative gravitational authority

To quantitatively define how far the "local gravitational authority" of a body orbiting a larger body extends, the concept of Hill sphere is introduced. The Hill sphere of an orbiting body defines the region around it within which it gravitationally dominates relative to the central body. Mathematically, the Hill radius R_H can be approximated by:

$$R_H = a\left(\frac{m}{3M}\right)^{1/3} \tag{7}$$

where m is the mass of the smaller body, M is the mass of the central body, and a is the semi-major axis of the smaller body's orbit around the central one. In simple terms, R_H increases if mass m is larger, and increases if distance a is larger. The constant $1/3$ and the factor 3 in the denominator derive from an analysis of force balance and gravitational tides.

Some examples help: Earth retains the Moon in a stable orbit because the Moon orbits well within Earth's Hill sphere. Earth's R_H around the Sun is about 1.5 million km, while the Moon is only ~ 0.38 million km from Earth. Jupiter, being much more massive and farther from the Sun, has a huge Hill sphere (almost 50 million km radius), allowing Jupiter to host dozens of moons and even co-orbit Trojan asteroids. Mercury and Venus, on the other hand, have small Hill spheres and effectively cannot host stable natural moons.

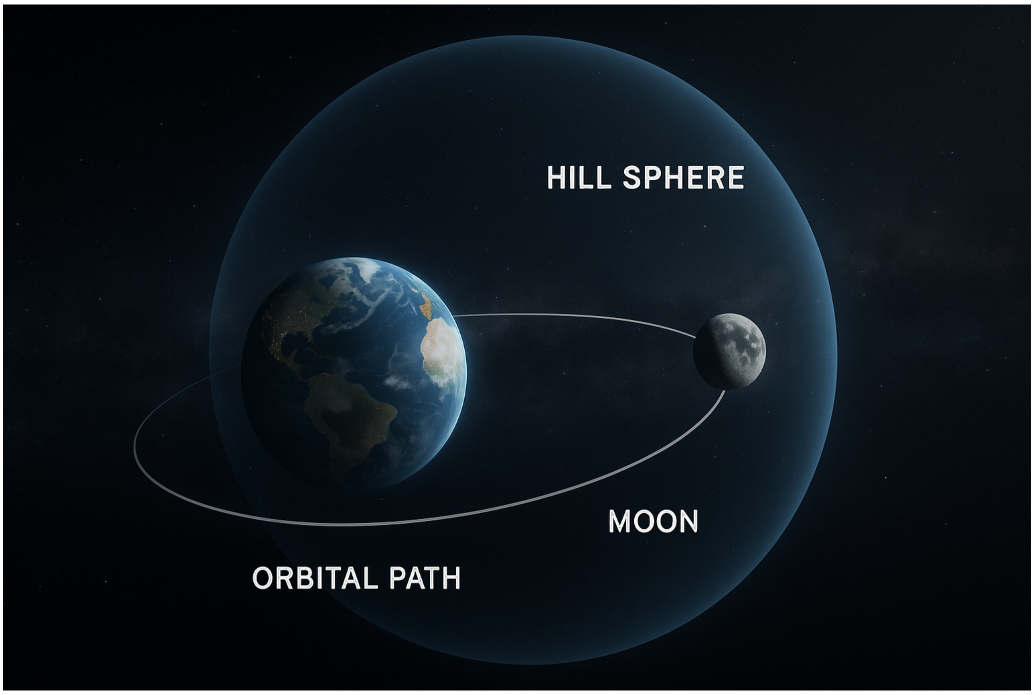

Figure 1: Photorealistic diagram of Earth's Hill Sphere. The transparent blue bubble illustrates the region of Earth's gravitational dominance, where the Moon orbits stably. The external red lines show the Sun's gravitational field, which dominates beyond this boundary.

3.5 Hierarchical architecture of the Solar System

Within the Sun's Hill sphere orbit all planets, main belt asteroids, myriads of comets, and a huge population of debris. From a mechanical and hierarchical point of view: Earth is nothing more than a satellite of the Sun; the Moon, in turn, is a satellite of Earth; and artificial satellites, like the International Space Station, are hierarchical sub-satellites. In other words, they inherit Earth's orbital motion while having their own motion around it.

The Solar System, therefore, presents a fractal structure of satellites of satellites, organized only by mass, distance, and inherited motion vector. The traditional label "planet" is largely a historical convention; physically, a planet is nothing more than a star satellite that does not have significant own emissions and locally dominates its orbit. From the perspective of mechanics, Earth behaves as a solar satellite and itself exhibits a small sphere of influence (Hill) within which it acts as a center for its moons and satellites. The entire system is hierarchical. This cascade architecture results purely from classical gravitational laws applied iteratively on decreasing scales.

3.6 Vector inheritance in layers

An intuitive way to visualize this hierarchy is to think of motion vectors being added in layers. For example, consider: Earth orbiting the Sun at about $107,000$ km/h; the Moon orbiting Earth at approximately $3,680$ km/h; and the International Space Station orbiting Earth at about $28,000$ km/h. Each object adds the local orbital vector to the global orbital vector. The ISS does not "choose" to escape the Solar System by traveling at $28,000$ km/h, because this motion is embedded in Earth's much larger motion around the Sun. Similarly, the Moon does not decide to approach the Sun separately; it accompanies Earth on its journey. The entire structure acts as a vector transmission system on multiple scales. This illustrates that orbital vectors are largely inherited from the upper levels of the hierarchy.

3.7 Observed shell versus volume of the observable universe

Modern observation of the universe is fundamentally based on mapping the sky in an angular sphere around us. Telescopes scan in angular coordinates, and spectrographs collect light from points on this sphere. We thus build "slices" of the universe in 3D, but it is crucial to distinguish two concepts: the angular shell of the sky, which is the 360-degree celestial sphere; and the three-dimensional volume of the observable universe, which is the entire spatial extent up to ~ 46 billion light-years away.

State-of-the-art instruments like the Euclid space telescope, JWST, the Very Large Telescope (VLT), the ALMA interferometer, CHARA (optical array), VLTI etc., operating with various spectroscopic instruments, have already covered a significant fraction of the deep sky "shell". This angular coverage accumulated by missions and observatories from multiple agencies approaches tens of percent. However, this impressive percentage refers to the surface (2D), not the 3D volume. When we consider the effective three-dimensional volume probed in spectral depth, the fraction mapped drops drastically. The observable universe has a radius of 46 billion light-years; most detected galaxies and quasars reside in thin redshift shells where surveys have looked. In volumetric terms, it is estimated that less than 1% of the volume of the observable universe has been sampled in detail.

This reality imposes a serious epistemological consequence: we make theoretical decisions based on a very limited sample. In particular, maintaining strong hypotheses like dark matter and dark energy — elevating them to near dogmas — from the analysis of an incomplete shell of the universe is an epistemologically rash decision. The scientific method requires caution proportional to uncertainty, and here the volumetric uncertainty is enormous ($>$ 99% of the cosmos not observed in detail). This does not invalidate the real observations we have made, but it invalidates excessive confidence in interpretations that extrapolate far beyond the available observational domain. The warning that remains is: we need to map much more of the universe and with diverse methods before conclusively affirming that the missing matter cannot be baryonic or that cosmic acceleration can only be explained by a cosmological constant or dark energy.

3.8 The Euclid image: shell versus cosmos

A metaphor coined in the context of the Euclid mission well summarizes the discrepancy between data and universe: Euclid's contribution to our knowledge is like a shell compared to the entire cosmos. Euclid will build a three-dimensional database through mosaics that can be zoomed multiple times. However, even the largest of these mosaics is comparable, in terms of fraction of the universe, to a tiny shell on the surface of an almost infinite sphere. The ability to zoom and see internal details does not change the fact that the rest of the sphere remains practically unknown.

In other words, Euclid and similar projects offer us a spectacular but minuscule sample of cosmic reality. This shell metaphor underlines the importance of not overinterpreting current data as if it were a complete view. In the last century, it has been tempting to take models fitted to this bit of data (this "data shell") and extrapolate universal laws and invisible entities. However, in light of the modesty imposed by coverage numbers, it is necessary to recognize that the confidence placed in undetected components rests on a very narrow observational base. We must face the cosmos as a largely open enigma.

3.9 Epistemological consequence: a shell of data, a century of hypotheses

The situation described above configures a paradox in the contemporary scientific method. On one hand, we have an extraordinarily rich volume of data, yet limited to a superficial shell of the universe; on the other hand, we have increasingly complex and "certain" hypotheses about the entire universe. In particular, cosmology has adopted the stance that: if something is being gravitationally pulled, there is a vector and therefore there is mass; if there is a force acting and bending trajectory, then there is mass somewhere to generate that force; therefore, if we see deflected galaxies, accelerated clusters, or dragged filaments, there must be real mass involved in these effects.

The question becomes: have we correctly cataloged this mass? If we do not see the matter directly with current instrumentation, we are faced with two options — either it is a completely new type of non-interactive matter (the traditional idea of "non-baryonic dark matter"), or it is common baryonic matter not yet detected (*Baryonic Obscurus*). At this point, spectroscopy and related observational methods become the final judge between these alternatives. We can define a clear empirical criterion: if something produces a spectral line, then there is baryonic matter present; if there is no spectral line at all in a given region and there is no measurable gravitational curvature there, then it is reasonable to conclude that there is a vacuum (*absence* of matter/energy in that region); there does not exist, to date, any third category of "entity" whose effect is empirically proven but which does not fit into matter (with spectrum) or vacuum (without mass or energy).

Thus, whenever we infer missing mass, the burden of proof is to detect it in some way. If deeper spectra reveal previously invisible gas or plasma, then B_{vis} increases and B_{obsc} decreases, solving the discrepancy without new physics. But so far, the pattern has been to discover new reservoirs of ordinary matter as we improve our instruments, indicating that we are still filling gaps in the baryonic inventory of the universe.

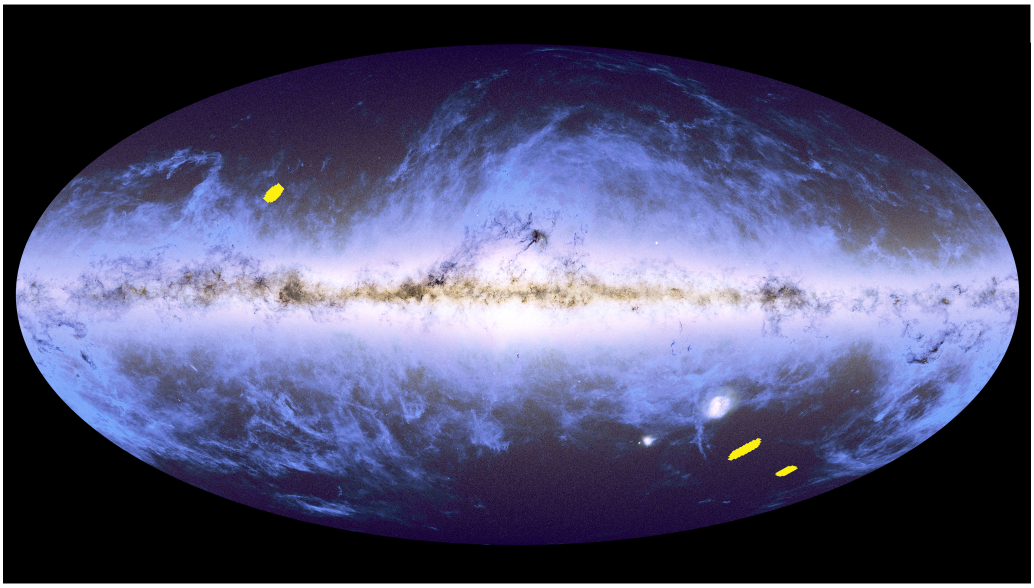

Figure 2: Sky map with Euclid Deep Fields marked in yellow. These regions represent the "Observed Shell" described in this work: high-depth windows that, although detailed, reveal only a two-dimensional surface compared to the total volume of the universe. Credit: ESA/Euclid/Euclid Consortium/NASA; ESA/Gaia/DPAC; ESA/Planck Collaboration. License: CC BY-SA 3.0 IGO.

4 Baryonic Obscurus and Cosmos Tenebris: dynamic baryonic formalism

4.1 Formal definitions in Latin

For greater conceptual clarity, the following fundamental definitions are established:

- **Baryonic Obscurus:** Dark baryonic matter. Refers to real but non-illuminated mass, detectable only by gravitational effect. Encompasses gas, dust, plasma, compact or diffuse objects that contribute to gravity.
- **Cosmos Tenebris:** Absolutely empty regions. The term denotes real physical vacuum, without mass and without energy. These are volumes where there are no particles, nor significant radiation, nor measurable curvature of spacetime. It is genuine vacuum.

4.2 Main formula: total gravitational mass

We mathematically formalize the central hypothesis through the equation:

$$M_{grav} = B_{vis} + B_{obsc} \tag{8}$$

where: M_{grav} is the total inferred gravitational mass; B_{vis} is the visible baryonic mass; and B_{obsc} is the obscure baryonic mass.

Table 1: Structural Comparison: Standard Model vs. Dynamic Baryonic Model

Parameter / Concept	**Standard Model (ΛCDM)**	**Proposed Model (B.O. + C.T.)**
Dark Matter	Unknown non-baryonic physical entity (27%).	*Baryonic Obscurus*: Common baryonic matter not detected.
Dark Energy	Intrinsic property of vacuum or scalar field (68%).	Non-existent as an entity; interpreted as vectorial dynamics of expansion.
Vacuum	Contains fluctuating energy and cosmological constant.	*Cosmos Tenebris*: Absolute absence of matter and vectors ($\Phi = 0$).
Nature of Gravity	Generated by visible mass + dark matter halo.	Generated exclusively by $B_{vis} + B_{obsc}$.
Epistemological Approach	Introduction of new entities to fit data.	Recalibration of existing mass inventory.
Solution for Discrepancies	Adjustment of free parameters ($\Omega_{dm}, \Omega_{\Lambda}$).	Improvement of spectroscopic detection (increase of B_{vis}).

4.3 Formulas isolating each component

From the main equation, the fundamental identities follow:

$$B_{obsc} = M_{grav} - B_{vis} \tag{9}$$

$$B_{vis} = M_{grav} - B_{obsc} \tag{10}$$

These expressions reaffirm that B_{obsc} functions as the complement of B_{vis} relative to the inferred gravitational total.

4.4 Dynamic proportionality

We can also write the normalized proportions of each component in the total:

$$\frac{B_{obsc}}{M_{grav}} = 1 - \frac{B_{vis}}{M_{grav}} \tag{11}$$

This relation makes explicit that the two terms are complementary: increasing one implies decreasing the other, keeping the total fixed.

4.5 Vector version of the gravitational law

Incorporating this reclassified inventory into the law of universal gravitation, the vector force becomes:

$$\vec{F}_{grav} = G\frac{(B_{vis} + B_{obsc})m}{r^2} \tag{12}$$

The gravitational force experienced by a test mass m depends only on the sum of visible and obscure baryonic mass. There is no additional "exotic" term.

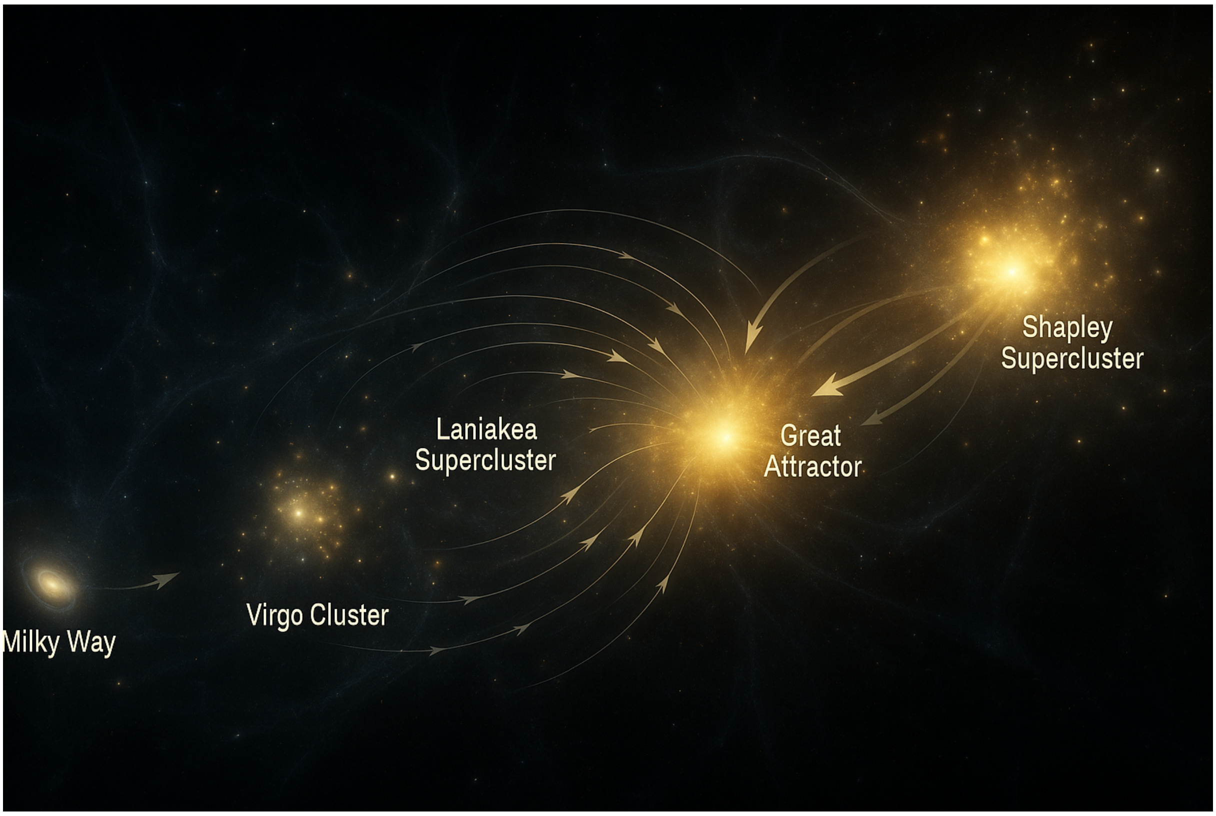

Figure 3: Hierarchy of gravitational flows in the local universe. The illustration demonstrates the "vector cascade" described in the text: the Milky Way and the Local Group are attracted by the Virgo Cluster, which in turn flows toward the Great Attractor at the heart of Laniakea, all being influenced by the massive pull of the Shapley Supercluster. The flow lines represent the vector sum of baryonic gravitational forces.

4.6 Densities and Cosmological Fractions

Equivalently, in terms of density parameters (Ω):

$$\Omega_{grav} = \Omega_{vis} + \Omega_{obsc} \tag{13}$$

In the standard ΛCDM model ($\Omega_m \approx 0.315$), the proposal is to read this value as the sum of visible baryons + obscure baryons (Ω_{obsc}).

4.7 Cosmos Tenebris: formalization of vacuum

We define the potential associated with real physical vacuum as null ($\Phi_{vac} = 0$). In these regions, there is no measurable curvature ($T_{\mu\nu} = 0$) and no resultant force vectors.

4.8 Dynamicity of the formula

The equation $M_{grav} = B_{vis} + B_{obsc}$ is structurally immutable, but its terms are historically dynamic. As detection technology advances, matter classified as B_{obsc} will be reclassified as B_{vis}.

5 Refutation of the dark paradigm and future implications

5.1 Scientific faith and epistemological contradiction

Cosmology has sustained for almost a hundred years the hypothesis of the existence of dark matter and dark energy to explain discrepancies between theory and observation. Neither of these entities, however, has been directly detected to date. This situation generates an epistemological contradiction: cosmology refused mystical-religious explanations, but ended up preserving a form of scientific faith in undetected entities. The baryonic proposal eliminates this epistemological asymmetry.

5.2 Six points of refutation

The refutation of the dark paradigm can be organized into six main points:

1. **Absence of direct detection:** No experiment has isolated a dark matter particle in the laboratory, nor identified a field associated with dark energy as an autonomous physical entity.
2. **Excessive dependence on mathematical adjustments:** Dark matter was introduced to "close" rotation curves and dark energy to adjust cosmic acceleration. Both emerged as

mathematical responses to discrepancies.

3. **Arbitrariness of cosmological inventory:** The proportion of dark matter and dark energy in the standard model ($\sim 27\%$ and 68%) is adjusted to reconcile different datasets, without a theoretical foundation that predicted these values.

4. **Remaining baryonic ignorance:** The real baryonic budget of the universe is still incomplete. It is premature to peremptorily declare that the "missing" mass is not baryonic.

5. **Negligible volumetric coverage:** Less than 1% of the volume of the observable universe has been probed in spectral depth. Building global entities (that would dominate 95% of the content) from this minimal fraction is risky.

6. **Existence of a simple alternative formalism:** The equation $M_{grav} = B_{vis} + B_{obsc}$ reinterprets the same observations consistently without appealing to new entities.

The burden of proof now falls on the exotic hypotheses.

5.3 Heavy spectroscopy as the final tribunal

Spectroscopy becomes the final judge of the baryonic hypothesis. Any detected signal is a signal of matter (baryonic). Over the coming decades, telescopes like the Nancy Grace Roman and the Extremely Large Telescope (ELT) will expand spectral surveying.

The criterion is simple: if there is a spectral line, there is baryonic matter; if there is no spectral line and no measurable curvature, then there is vacuum (*Cosmos Tenebris*). There is no third empirically verified category.

5.4 Future of instrumentation and vision at 200 years

The purely dynamic baryonic model predicts two future responses: **Response A** (They will find more baryonic matter in forms invisible today, confirming the B_{obsc} model) or **Response B** (Even with ideal instrumentation, mass is still missing, refuting the baryonic hypothesis). In both cases, the equation $M_{grav} = B_{vis} + B_{obsc}$ remains the base structure.

5.5 General conclusion

The known universe empirically offers us only two clear states: presence of matter (observed by any interaction) and absence of matter (vacuum). Everything that pulls, pushes, curves, refracts, absorbs, or emits is baryonic matter. The introduction of a third ontological entity is not necessary while the baryonic inventory remains open. The *Baryonic Obscurus* + *Cosmos Tenebris* model only demands that we accept that the inventory of real matter is incomplete and that the observed shell is too small to justify universal dogmas.

References

1. Planck Collaboration, Aghanim N et al. Planck 2018 results VI Cosmological parameters. *Astronomy and Astrophysics* 641 A6 2020.

2. Tully R B et al. The Laniakea supercluster of galaxies. *Nature* 513 71 to 73 2014.

3. Nicastro F et al. Observations of the warm hot intergalactic medium and the missing baryons. *Nature* 433 495 to 498 2005.

4. Mellier Y et al. Euclid I Overview of the Euclid mission. *Astronomy and Astrophysics* 697 A1 2024.

5. Natarajan P et al. A massive black hole in the early universe UHZ1. *Astrophysical Journal Letters* 960 L1 2024.

6. NASA IPAC. Nancy Grace Roman Space Telescope Mission Overview. NASA Technical Summary 2020 to 2024.

7. NASA Solar System Exploration. 3I ATLAS Object Overview. NASA Data Release 2025.