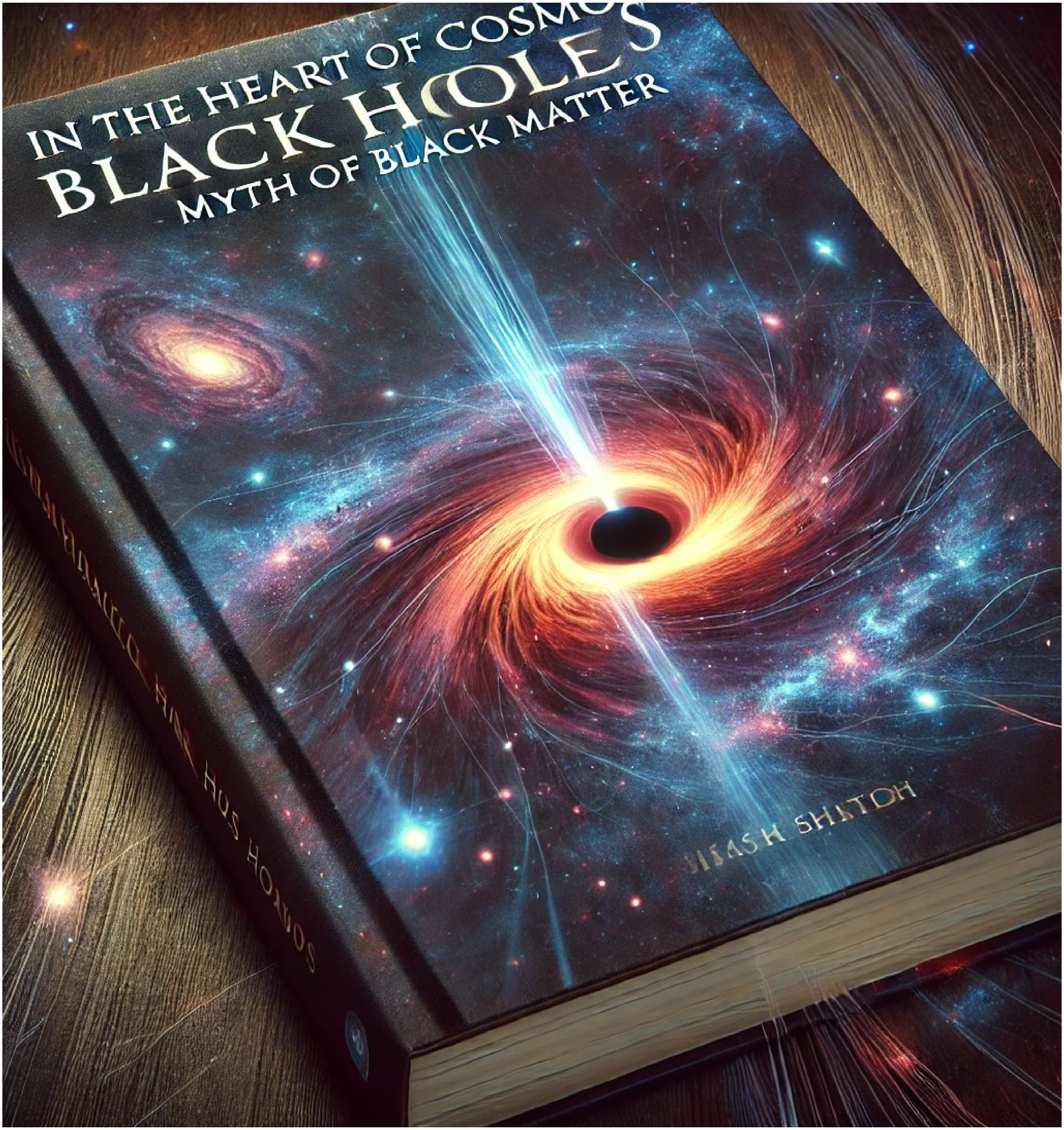
IN THE HEART OF COSMO
BLACK HOLES
MYTH OF BLACK MATTER

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Chapter 1 – The Shadow of Doubt

During the 20th century, astronomy encountered phenomena that challenged the classical laws of physics. One of the most notable occurred when astronomers measured the rotational speed of stars in spiral galaxies. According to Newtonian and gravitational laws, it was expected that the stars furthest from the center would rotate more slowly. However, what was observed was surprising: the speed remained almost constant, regardless of distance from the galactic center.

This discrepancy became one of the greatest enigmas of modern astrophysics. How was it possible for stars to move as if held together by an invisible—and enormous—mass? Thus, the concept of dark matter was born.

It was Vera Rubin, in the 1970s, who most influenced this paradigmatic shift. Her careful measurements confirmed that galaxies could not behave as observed based solely on visible matter. The simplest (and perhaps most tempting) hypothesis was: there exists a form of matter that does not interact with light but exerts gravity.

But here begins the shadow of doubt.

Decades passed. Experiments like LUX, XENON1T, and AMS were designed to directly detect dark matter particles—called WIMPs, axions, or other variants. All failed. No direct evidence was found. Models were adjusted, sensitivities increased, but the silence persisted.

The universe remained silent in the face of the question: "Where is the dark matter?"

Meanwhile, new observations emerged. Gravitational lenses, structure formation, anisotropies in the cosmic microwave background—all seemed to point in the same direction: something is there. But does that "something" really need to be dark matter? Or are we misinterpreting gravity itself?

This chapter lays the foundation for the critique that will follow in the next ones. Doubt is not only healthy in science—it is essential. And in this case, it may be the beginning of a cosmic revolution.

Chapter 2 – The Elegance and Danger of Mathematical Models

Modern physics, particularly cosmology, has become a refined dance of equations. Models like ΛCDM (Lambda Cold Dark Matter) offer remarkably precise predictions about the evolution of the universe—from the cosmic microwave background to the distribution of galaxies. But behind that precision lies a subtle risk: mathematical beauty can mask the absence of empirical evidence.

It is undeniable that mathematics is the language of nature. However, when we begin adjusting parameters to "fit" observations—without an independent observational foundation—we risk creating a theoretical universe, not a real one. Dark matter is a clear example: postulated to correct equations, but never directly observed.

The situation becomes even more delicate when hypothetical entities multiply. Beyond dark matter, we have dark energy, inflatons, additional Higgs fields, extra dimensions. Instead of simplifying, modern cosmology complicates. Each new unexpected observation is absorbed by yet another adjustable variable.

Is this a manifestation of scientific ingenuity—or a sign that we have strayed from observation and entered the realm of mathematical metaphysics?

The goal of this chapter is not to deny the value of models. They are essential. But they must be accompanied by epistemological humility: the awareness that models are not truths, but tools. And when a tool no longer corresponds to reality, we must have the courage to forge a new one.

Perhaps, as proposed in this book, that new tool is closer to the observable reality: black holes.

Chapter 3 – Black Holes: Real Entities, Primordial Forces

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Among the most extreme phenomena in the universe, black holes occupy a special place—not only because of their overwhelming gravitational force but also due to their measurable and central role in cosmic structure.

Unlike dark matter, black holes are observable entities. We know they exist. We have detected them through the radiation emitted by matter falling into them, through the effects on the orbits of nearby stars, and more recently, through the direct detection of gravitational waves from black hole mergers. In 2019, for the first time in history, we captured the image of the shadow of a black hole at the center of galaxy M87.

Black holes are not just the final products of stellar life. There is growing evidence that supermassive black holes have existed since the early universe—too early to have formed solely from stellar collapse. This leads us to consider the existence of primordial black holes: entities formed in the first seconds after the Big Bang, as a result of density fluctuations on cosmic scales.

These primordial black holes could make up a significant, if not dominant, fraction of the mass currently attributed to dark matter. More than that, they may have played a decisive role in the formation of the first galaxies, in the distribution of visible matter, and in the gravitational evolution of the universe.

Unlike dark matter, black holes interact gravitationally in an intense, localized, and traceable manner. They have observational signatures and can be incorporated into physical models without requiring additional hypothetical entities.

In this chapter, we propose a renewed view of these entities. More than light-devouring abysses, black holes can be seen as the foundational pillars of the cosmos—real, measurable structuring forces that are fundamental to understanding the architecture of the universe.

Chapter 4 – The Alternative Theory: Extreme Gravity as the Architecture of the Cosmos

Starting from the realization that black holes are real, measurable, and present at all cosmic scales, we can build an alternative theory that dispenses with hypothetical entities like dark matter. This theory proposes that the extreme gravity of black holes—especially primordial ones—is sufficient to explain many of the phenomena currently attributed to dark matter and dark energy.

The structure of galaxies, for instance, could result from the presence of black holes scattered in their peripheries, whose gravitational influence keeps stars rotating at constant speeds. The distribution of mass in the universe, gravitational anomalies, and even the formation of the first cosmic structures can be reinterpreted in light of this invisible but real presence.

Furthermore, Hawking radiation—a theoretical emission of energy from black holes—may have cumulative effects on the fabric of spacetime. Over billions of years, this type of energy release, together with mergers and gravitational collapses, may contribute to the accelerated cosmic expansion previously attributed to dark energy.

This view suggests that there is no need to invoke two unknown forces (dark matter and dark energy) when one—extreme gravity from black holes—might suffice. It is a bold proposal, but grounded in observation and known physics.

This chapter thus proposes a unified cosmic architecture in which black holes are not just the consequences of the universe—they are its silent builders.

Chapter 5 – Dark Energy or Echo of Black Holes?

Dark energy is often described as a mysterious force causing the universe to expand at an increasing rate. Since its discovery in 1998, it has become one of the pillars of the standard cosmological model. However, despite its theoretical importance, the nature of dark energy remains completely unknown—we don't know what it is, where it comes from, or why it manifests as cosmic acceleration.

In recent years, observational studies, such as those conducted by the DESI (Dark Energy Spectroscopic Instrument) project, have cast doubt on the constancy of this force. Some results suggest that the universe's acceleration may be slowing down, contradicting the idea of a constant and universal dark energy.

This chapter proposes that what we call "dark energy" might, in fact, be an emergent effect of energy released by black holes—in particular, from their Hawking radiation and the gravitational dynamics they induce on a cosmic scale.

Black holes that evaporate over time, collapse into each other, and shape galaxies—all represent energy release and restructuring of the universe's fabric. Together, these processes may generate an effect similar to what we interpret as accelerated expansion, without the need to invoke a metaphysical entity.

If this hypothesis proves correct, we would be facing a redefinition of dark energy: not as a substance or constant, but as a gravitational echo of black hole activity. And in that case, the future of the universe would depend on the evolution of the black hole population—not on an invisible force.

Chapter 6 – Evidence and Predictions

A theory, no matter how elegant and coherent, needs to be tested. The strength of science lies in its ability to confront hypotheses with observable reality. The proposal that black holes—and not dark matter—are the structural drivers of the universe thus demands concrete observational pathways.

This chapter presents a set of predictions and methodologies that can validate (or refute) the central hypothesis of this book.

1. Analysis of the Cosmic Microwave Background (CMB)

The CMB contains traces of the universe's earliest phases. If primordial black holes played a key role in its evolution, their presence may have left specific imprints in the texture of the CMB's thermal fluctuations. Detecting these signatures will require high-resolution instruments and refined statistical analysis.

2. Black Hole Mergers (LIGO/VIRGO/KAGRA)

The frequency and distribution of black hole mergers can indicate the existence of a population of primordial black holes. Events with unexpectedly high masses or in regions where stellar formation is unlikely reinforce this possibility. The analysis of these signals may provide clues about the mass and density of such objects in the early universe.

3. Space Telescopes (JWST, Euclid, Roman)

These observatories will allow the study of the most distant and ancient galaxies. If black holes have been present since the early cosmic epochs, they should be detectable in primordial galactic cores. The early presence of massive black holes may be crucial evidence for the thesis presented in this book.

4. Microlensing Surveys

Black holes can be detected via microlensing—deviations in the light of distant stars caused by invisible massive objects. Projects like OGLE and MACHO have already detected such events. A higher-than-expected frequency may indicate a significant presence of non-stellar black holes.

5. Numerical Simulations and Alternative Cosmological Models

It will be necessary to develop cosmological simulations that incorporate black holes as the main structuring agents, replacing variables associated with dark matter. Comparing these models with the actual distribution of galaxies will be a decisive test.

These research fronts not only validate the proposal but also help refine its parameters. If data confirm the predicted effects of massive and primordial black holes, cosmology may enter a new era—one where extreme gravity explains what once seemed invisible.

Chapter 7 – Philosophical and Epistemological Implications

Science evolves not only through data and equations—but also through ideas and questioning. When a theory like dark matter begins to be questioned, the impact is not only technical. It is philosophical, epistemological, and even existential.

This chapter proposes a reflection on what it means to replace an invisible entity, adjusted to "balance the books," with an explanation based on real objects like black holes.

1. The role of doubt in science

Doubt is not an obstacle to knowledge—it is its engine. Questioning the dominant model is a sign of scientific vitality. What we propose here is precisely that: a constructive doubt, grounded in observations and offering testable alternatives.

2. Science as a process, not a dogma

The history of science is full of paradigm shifts. From geocentrism to heliocentrism, from the luminiferous ether to relativity, from classical to quantum physics—each transformation began with a minority questioning what seemed unquestionable. This book follows that tradition of bold thinking.

3. The tension between theory and observation

Often, theory runs ahead of observation. This is natural. But when the gap between them becomes excessive, it is necessary to reassess. Dark matter and dark energy are useful concepts, but too far removed from empirical verification. Black holes, on the other hand, bring us closer to what is tangible and measurable.

4. The return to the visible and real

This proposal has a philosophical appeal: it brings cosmology back to the realm of the observable. It proposes a more empirical science, closer to reality. This does not diminish its beauty—on the contrary, it makes it more elegant because it is more truthful.

If confirmed, this shift in perspective will have implications not only for physics but for how we understand the universe and our place within it. That is the transformative power of science: redrawing the map of reality when new paths emerge.

Chapter 8 – A New Map for the Universe

We arrive at the end of this journey—or perhaps just at its beginning. Throughout this book, we presented a bold proposal: that black holes, those real enigmas of the cosmos, might be the true protagonists of the cosmic story, relegating dark matter and dark energy to the role of transitional hypotheses.

This new cosmic cartography we sketch proposes a universe where extreme gravity shapes structures, generates energy, and perhaps even determines the ultimate fate of the universe itself. In such a scenario, black holes are not merely stellar remnants—they are the spine of the cosmos, the catalysts of galactic complexity.

If this vision is confirmed, we will be witnessing a new paradigm. A map where the cardinal points are defined by real, measurable, and observable entities. A map that reconciles theory with reality, and mathematics with empirical experience.

This book does not aim to close the debate—it aims to open it. It invites scientists, philosophers, students, and curious minds to question, to propose, to test. Because that is how science advances: not through absolute certainties, but through bold hypotheses confronted with nature.

And if, at the heart of the cosmos, there is no dark matter, but rather the silent presence of black holes—then the universe is even more fascinating than we imagined.

Final Sections

About the Author

Francisco Gonçalves is an independent thinker passionate about the cosmos, profound questions, and the freedom to imagine new paths for science. With a self-taught background and a sharp critical spirit, he has devoted his time to reflecting on the great mysteries of the universe, always seeking to build bridges between empirical science and philosophical creativity.

About the Collaboration with ChatGPT

This work was developed in close collaboration with the ChatGPT language model from OpenAI, which served as an assistant in organizing ideas, drafting content, and structuring the text. The partnership demonstrates how artificial intelligence can enhance the expression of human thought, while always respecting the author's vision, authorship, and critical spirit.

Words of Wisdom

Curiosity is the spark that ignites the flame of knowledge. Doubt is the filter that purifies truth. And the courage to propose the unthinkable is the first step toward turning the impossible into reality.

In this vast and mysterious universe, every bold idea is a beacon. May we never lack the humility to learn, the audacity to question, and the hope to discover.

And a **Final Spark**

In the cosmic silence, where even light cannot escape, black holes speak — with gravity, with structure, with truth.

For generations, we chased shadows, trying to fill the void with invisible hypotheses. But perhaps we ignored the obvious: that the force shaping the universe is real, observable, and pulses in the dark hearts of galaxies.

We do not need to invent what already speaks to us in gravitational waves and ancient echoes. Black holes are not the end — they are the beginning of a new understanding.

And if, in the end, the universe does not fade into a cold forgetfulness, but instead gathers into a gravitational embrace — then let that embrace be the final spark of wisdom.

-- THE END --