Cosmos as an Echo of Rebound: A Fractal Model of Nested Universes (Revised Version)

This is a revised version of the preprint originally posted on 23 June 2026. The mathematical model remains unchanged; the revision corrects factual inaccuracies regarding external data and clarifies the status of observational interpretations.

Abstract:
We present a mathematical model in which dark matter is interpreted as an interference pattern arising from adjacent topological phases generated by a hierarchy of universes born inside black holes ("fractal rebounds"). The model introduces a scalar field $\Phi(x,t)$ — the topological phase field — whose action includes non-minimal coupling to gravity and discrete sources encoding memory from past rebounds via conserved gravitational helicity. The framework yields specific, testable predictions: an oscillatory dark matter density profile around supermassive black holes, correlation of mass excess with spin orientation, and a discrete spectrum of stochastic gravitational waves in the millihertz range. Currently, the model lacks robust observational confirmation, but it remains internally consistent and offers a novel theoretical perspective on the nature of dark matter, dark energy, and the multiverse structure.

1. Introduction

The standard cosmological model assumes that dark matter consists of weakly interacting massive particles. However, direct searches for such particles have not yet succeeded. This opens room for alternative hypotheses. In this work, we propose a model in which dark matter is not a substance but an interference pattern arising from interactions between our Universe and adjacent topological phases. These phases are born inside black holes during "rebounds" — quantum events analogous to the Big Bang, but occurring on scales inaccessible to direct observation.

The model is speculative but internally consistent and yields specific quantitative predictions. Its value lies not in definitive truth but in its ability to connect disparate areas of physics (quantum gravity, cosmology, black hole astrophysics) into a unified formalism.

2. Mathematical Framework

We introduce a scalar field $\Phi(x,t)$ — the topological phase field — describing the contribution of adjacent topological layers to the effective metric of our Universe. The action is:

$$S = \int d^4x \sqrt{-g} \left[\tfrac{1}{2} g^{\mu\nu} \partial_\mu \Phi \, \partial_\nu \Phi - V(\Phi) - \tfrac{\xi}{2} R \Phi^2 + L_{int} + L_{source} \right] + S_{EH} + S_{matter},$$

where:
- $V(\Phi) = \lambda/4 \, (\Phi^2 - v^2)^2 + m^2/2 \, \Phi^2$ — a potential allowing multiple vacua,
- $L_{source} = \Phi(x) \sum_n q_n \, \delta_\varepsilon^{(4)}(x - x_n)$ — discrete sources encoding memory of past rebounds,
- $q_n \propto M_{PBH} / M_{Pl}$ — topological charge linked to conservation of gravitational helicity,
- L_{int} — interaction with fermionic dark matter generated from gravitational waves.

The equation of motion for Φ:

$$\Box \Phi - \xi R \Phi - V'(\Phi) + \delta L_{int}/\delta\Phi = \Sigma_n q_n \delta_\varepsilon^{(4)}(x - x_n).$$

The modified Einstein equations include the contribution of Φ to the effective energy-momentum tensor.

3. Testable Predictions

From the model, three main predictions follow:

1. Oscillatory dark matter density profile around supermassive black holes:
$\Delta M_{DM}(r) = A \cdot \sin(2\pi r/\lambda) / (2\pi r/\lambda) \cdot \exp(-r/r_{core})$,
with $\lambda \sim \alpha R_g$, where $R_g = GM_{BH}/c^2$, $\alpha \sim 0.1–0.3$.

2. Correlation of mass excess with spin orientation of the SMBH:
$\Delta M \propto \cos^2\theta$,
where θ is the angle between the spin axis and the line of sight.

3. Discrete spectrum of stochastic gravitational waves in the millihertz range:
$\Omega_{GW}(f) = \Sigma_{k=1}^{N_{mem}} A_k \exp(-(f - k f_0)^2 / 2\sigma^2)$,
where f_0 is determined by the mass of the mother black hole.

4. Discussion

The model was originally proposed on theoretical grounds and then compared with available observational data. During this comparison, errors were made in interpreting the chronology and data structure of the work by Sharma et al. (2026). The author acknowledges these errors and reframes this work as theoretical, without claiming observational confirmation at this stage. The mathematical model remains unchanged and offers testable predictions for future observations.

Currently, the most promising avenues for testing the model are:
- LISA data (launch in the 2030s), which could verify the predicted discrete GW spectrum.
- Multi-epoch reverberation mapping with a larger number of spectral lines to test the oscillatory profile and spin correlation.
- X-ray spectroscopy to search for asymmetries in line profiles.

5. Conclusion

A fractal model "Cosmos as an Echo of Rebound" is presented, in which dark matter is interpreted as an interference pattern from adjacent topological phases. The model is mathematically rigorous, internally consistent, and yields specific testable predictions. At present, it lacks robust observational confirmation, but remains an interesting hypothesis that can be tested in future experiments. The author leaves the model open to criticism and further development.

Acknowledgments

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References

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