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Peer Review

Review of: "A Hollow Black Hole"

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This paper proposes a novel structure for massive black holes (MBHs), envisioning them not as singularities but as hollow shells composed of smaller black holes, enclosing a void capable of supporting standard physical dynamics. The authors present this "outside-in" perspective as a complement to the "inside-out" view of black hole cosmology, which postulates the observable universe as the interior of a black hole. The introduction touches upon the observed anomaly in galaxy rotation directions and briefly discusses alternative cosmological models.

The central idea of a hollow black hole is intriguing and offers a fresh perspective on the enigmatic nature of these celestial objects. By suggesting an internal structure beyond the event horizon, the paper attempts to address philosophical issues such as the information paradox, hinting at a mechanism for information transfer to potential "universes within" these hollow structures. The analogy drawn between the abstract/geometric and epistemic/ontic views in physics is a valuable framing, highlighting the interplay between mathematical formalisms and our understanding of reality. Furthermore, the attempt to connect this model with the information-theoretic e-dimensionality cosmology, known for explaining the accelerating expansion of the universe and the Hubble tension, suggests a potential for broader theoretical integration.

However, the paper in its current form presents several limitations and areas requiring further development. The description of the hollow black hole structure, while conceptually clear, lacks rigorous mathematical formalism. The approximation used to calculate the number of smaller black holes within the shell relies on a simplified geometric argument involving cubes, which may not accurately represent the packing efficiency or gravitational interactions within such a configuration. The relationship between the radius of the event horizon of the MBH and the parameters of the smaller black holes and the void is stated but not derived in detail.

doi.org/10.32388/8NHLK7

Furthermore, the connection between the proposed hollow black hole structure and the observed galaxy rotation anomaly remains speculative. While the introduction mentions this anomaly as a motivation, the paper does not elaborate on how a hollow black hole model could specifically explain the preferential clockwise rotation of galaxies observed in the JADES survey. A more explicit link or a proposed mechanism would strengthen this aspect of the argument.

The discussion regarding the resolution of the information paradox is also brief and relies on the assertion of information transfer to another universe. While this is a common idea in some theoretical frameworks, the paper does not provide a detailed mechanism within its hollow black hole model for how this transfer would occur or what the properties of these internal universes might be.

Finally, the paper mentions figures (Figure 1 and Figure 2) that are crucial for visualizing the proposed structure and the number of constituent black holes. The absence of these figures makes it challenging for the reader to fully grasp the spatial arrangement and the quantitative aspects of the model.

In conclusion, the paper "A Hollow Black Hole" presents a stimulating and novel concept that warrants further investigation. The idea of a structured black hole interior and its potential implications for cosmology and the information paradox are thought-provoking. However, the current presentation lacks the mathematical rigor and detailed elaboration required for a robust academic contribution. Future research should focus on developing a more formal mathematical framework for the hollow black hole model, exploring its dynamical stability, and providing a more concrete connection to observational data, such as the galaxy rotation anomaly. The inclusion of the mentioned figures and a more in-depth discussion of the information paradox and its resolution within this framework would significantly enhance the paper's impact and credibility. This initial exploration offers a promising avenue for future research into the fundamental nature of black holes and their role in the universe.

Declarations

Potential competing interests: No potential competing interests to declare.