Black Hole Information Paradox

CUIP's Resolution through Dimensional Compression

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Abstract

The black hole information paradox remains one of the most persistent problems in reconciling quantum mechanics with general relativity. While dominant proposals such as the holographic principle suggest that information is preserved via boundary encoding, we propose a new resolution based on the CUIP (Charlotte Unified Information Principle) framework. In this approach, black holes are treated as dimensional compressors that preserve information through a structured projection sequence: from 3D infalling matter, to 2D event horizon encoding, to 1D radiation modes, potentially terminating in a 0D point representation. This view offers a novel mechanism for information conservation across dimensional transitions and suggests an underlying informational principle of projection, which may relate to the Minimal Dimensional Representation Principle (MDRP) to be developed in future work. The model preserves quantum consistency without modifying established physical laws.

1. Introduction

The black hole information paradox is widely recognized as one of the most significant conceptual challenges in theoretical physics. Stephen Hawking originally proposed that information falling into a black hole could be irretrievably lost, implying a violation of unitarity and conflicting with the fundamental principles of quantum mechanics. However, in 2004, influenced by developments such as the AdS/CFT correspondence, Hawking revised his view and suggested that information might be preserved and eventually released, potentially through quantum gravitational mechanisms.

Various theoretical frameworks have been proposed to resolve this paradox, including the holographic principle and AdS/CFT duality. While these models offer valuable insights, they often rely on additional assumptions—such as anomalous thermodynamics or non-causal behavior—that raise further questions about physical consistency and general applicability.

2. Black Holes as Dimensional Compressors

CUIP offers a fundamentally different approach by interpreting black holes as information-dimensional compressors. A three-dimensional object falling into a black hole may be encoded on the two-dimensional surface of the event horizon. Subsequently, Hawking radiation implies that the black hole emits particles, which, according to string theory, can be described as one-dimensional strings. This suggests a progression of dimensional reduction—from 3D to 2D to 1D—through which information is not destroyed, but instead preserved in lower-dimensional form.

3. Informational Projection and Dimensional Encoding

This dimensional transition can be interpreted as a form of informational re-representation, possibly related to the Minimal Dimensional Representation Principle (MDRP) proposed in CUIP.

Unlike string theory, which emphasizes the one-dimensional structure of particles, CUIP focuses on the dimensional encoding of information itself. In this framework, the structure and projection of information take precedence over the geometric interpretation of physical entities.

4. Conclusion

In summary, CUIP addresses the black hole information paradox without introducing modifications to established physical laws. Instead, it reframes the problem by proposing that information is intrinsically projectable across dimensions, thereby preserving quantum consistency through a new perspective.

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