

Black Holes Decohere Quantum Superpositions

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We show that if a massive body is put in a quantum superposition of spatially separated states, the mere presence of a black hole in the vicinity of the body will eventually destroy the coherence of the superposition. This occurs because, in effect, the gravitational field of the body radiates soft gravitons into the black hole, allowing the black hole to harvest “which path” information about the superposition. A similar effect occurs for quantum superpositions of electrically charged bodies. The effect is very closely related to the memory effect and infrared divergences at null infinity.

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