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Quantum Superposition of Black Holes

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If relativistic gravitation has a quantum description, it must be meaningful to consider a spacetime metric in a genuine quantum superposition. But how might such a superposition be described, and how could observers detect it? I will present a new operational framework for studying "superpositions of spacetimes"via model particle detectors. After presenting the general approach, I show how it can be applied to describe a spacetime generated that is a superposition of two expanding spacetimes. I will then move on to show how black holes in two spatial dimensions can be placed in a superposition of masses and how such detectors would respond. The response exhibits signatures of quantum-gravitational effects reminiscent of Bekenstein's seminal conjecture concerning the quantized mass spectrum of black holes in quantum gravity. I will provide further remarks concerning the meaning of the spacetime metric, and on distinguishing spacetime superpositions that are genuinely quantum-gravitational, notably with reference to recent proposals to test gravitationally-induced entanglement.

Keyword-1

Black Holes

Keyword-2

Quantum Gravity

Keyword-3

Quantum Reference Frame

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