

Quantum Superpositions of Massive Bodies and Gravitationally Mediated Entanglement

Friday, 9 December 2022 09:00 (1 hour)

In order to avoid contradictions with complementarity and causality in a gedankenexperiment involving a quantum superposition of a massive body, it was previously shown (in arXiv:1807.07015) that it is necessary for there to be both quantized gravitational radiation and local vacuum fluctuations of the spacetime metric. We review this gedankenexperiment and the previously given “back of the envelope” arguments that resolve it. We then improve upon this analysis by providing a precise and rigorous description of the entanglement and decoherence effects (given in arXiv:2112.10798). As a by-product of our analysis, we show that under the protocols of the gedankenexperiment, there is no clear distinction between entanglement mediated by the Newtonian gravitational field of a body and entanglement mediated by on-shell gravitons emitted by the body. This suggests that Newtonian entanglement implies the existence of graviton entanglement and supports the view that the experimental discovery of Newtonian entanglement—as envisioned in proposed experiments—may be viewed as evidence for the existence of the graviton

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