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Coarse-graining makes it hard to see micro-macro entanglement[1]
SADEGH RAEISI, Institute for Quantum Computing, University of Waterloo, PAVEL SEKATSKI, Université de Genève, CHRISTOPH SIMON, IQIS, University of Calgary — Observing quantum effects such as superpositions and entanglement in macroscopic systems requires not only a system that is well protected against environmental decoherence, but also sufficient measurement precision. Motivated by recent experiments, we study the effects of coarse-graining in photon number measurements on the observability of micro-macro entanglement that is created by greatly amplifying one photon from an entangled pair. We compare the results obtained for a unitary quantum cloner, which generates micro-macro entanglement, and for a measure-and-prepare cloner, which produces a separable micro-macro state. We show that the distance between the probability distributions of results for the two cloners approaches zero for a fixed moderate amount of coarse-graining. Proving the presence of micro-macro entanglement therefore becomes progressively harder as the system size increases.

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