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**Efficient benchmarking of quantum optical devices via entanglement measures** NATHAN KILLORAN, NORBERT LUTKENHAUS, University of Waterloo — To carry out quantum communication protocols with light, we need quantum-enabled devices which can safely store and transmit quantum information, including quantum channels, repeaters, and memories. These devices must provide an inherent quantum advantage, outperforming all classical devices, even in the presence of imperfections. To be in the quantum domain, a device must preserve the correlations present in entangled states. Many benchmarks have been designed based on this idea. We have developed qualitative benchmarks requiring very limited experimental resources. In fact, we need as little as two test states and two homodyne measurements to find the quantum domain. Here, we extend these benchmarks, for free, to give quantitative statements about how much entanglement a device preserves. Our extension is based on truncating states to a finite energy level and using known measurement results to rigorously bound the induced error. A semidefinite program is employed to find the minimal entanglement compatible with the known information. Our results are faithful to the known benchmarks, providing quantitative statements for devices throughout the quantum domain.

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