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Reconciling cloning fidelities. (English) Zbl 1175.81043
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Summary: In most theoretical literature on Quantum Cloning fidelity is defined in terms of density matrices by assuming clones which are produced in distinguishable spatial modes. Recent optical implementations of cloning (Simon, Lamas-Linares), however, do not produce clones in distinct spatial modes, therefore another simpler expression for fidelity was proposed. However, no clear theoretical justification was provided for the equivalence of the two expressions. It is important to be able to compare experimental results with theoretical predictions, therefore the theoretical justification is given in this paper, along with the circumstances under which the two expressions for fidelity are equivalent. They are shown to be equivalent for all symmetric $N \rightarrow \text{MQC}$, with the symmetry requirement being lifted for ancilla-free cloners. The fidelity is verified explicitly for the $1 \rightarrow 2\text{UQC}$ based on stimulated emission proposed in (Simon), where the spatial indistinguishability of the output clones is also discussed.

MSC:

[81P50](#) Quantum state estimation, approximate cloning