Photon number states via iterated photon addition in a loop

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The preparation of n-photon states, that is, the implementation of sources emitting a specific number of photons, is an important problem in many quantum optics and quantum information applications. In this work, we analyse the possibility of using an arrangement consisting solely of a periodic single-photon source [1], a beam splitter, mirrors, and a realistic photon detector. The setup consists of a loop in which we employ Hong—Ou-–Mandel interference to achieve iterative photon addition. Its purpose is to generate an arbitrary n-photon Fock state probabilistically, conditioned by measurement results. These states exhibit strong non-classical behaviour. The literature typically proposes more complex schemes for their generation. In this work, we demonstrate that our arrangement [2] composed only of passive linear optical elements, can generate up to four-photon states with reasonable fidelity and probability even with imperfect detectors. Our work also contributes to the better understanding of photonic interferometric loops which are important in photonic quantum computing.

References

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