Linear Optical Circuits Characterization with Thermal States of Light

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Currently, one of the promising directions for the construction of scalable quantum computing devices is a photonic platform, in which the computation process is reduced to the generation of Fock states of light, their linear optical transformation and measurement. The core of this platform is a linear-optical circuit that performs a specified conversion of photon modes. The accuracy of performing a given linear-optical conversion determines the accuracy of the entire computational scheme; therefore, the ability to precisely control the characteristics of such circuits is a necessary step towards the creation of full-scale computing systems. Linear-optical conversion is determined by some, in the general case, non-unitary, transfer matrix M connecting the light fields of the input and output modes. To restore it, coherent [1] or two-photon states of light are used [2]. Each of these methods has its own advantages and disadvantages. The use of powerful coherent states allows quick measurements, but it is sensitive to phase fluctuations at the system's input. The use of biphotons makes it possible to carry out measurements that are insensitive to phase fluctuations, but they require a more complex scheme for preparing input states and a longer registration time. We propose an original approach for characterizing linear optical circuits based on correlation measurements of the thermal states of light. It has the main advantages of both methods: a simple scheme for preparing input states, a fast accumulation time, and stability against phase fluctuations. The report will present the results of numerical [3] and physical experiments on the statistical reconstruction of matrices of linear-optical circuits based on correlation measurements of thermal fields.

References

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