Characterization of linear optical integrated circuits through correlation measurements

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Currently, there is an actual problem of characterizing linear-optical integrated circuits for problems of quantum optics and quantum informatics. Indeed, linear optical computing is one of the most popular platforms for implementing quantum simulators, for example, the so-called boson sampling. Many scientific groups are trying to create chips performing given quantum operations. But one need methods for characterizing the chip matrix, capable of efficiently and accurately reconstruct these processes.

Today, there are two main methods for their characterization: due to interferometry [1] and due to correlations of biphotons [2]. The advantage of the first method is that it uses powerful classical states of light and does not require a long acquisition time. The advantage of the second one is that it is not sensitive to phase fluctuations and does not require phase modulators. In article [3], a more general approach was proposed for tomography of non-unitary multimode linear-optical chips using coherent states of light and the maximum likelihood method.

We propose a technique that combines the advantages of all known methods: we use the classic powerful thermal state of light, and correlation measurements that are insensitive to phase fluctuations. The reconstruction of the chip matrix can be performed by solving an analytical linear equation system, and next, it can be clarified by means of maximum likelihood method. The results of both numerical and physical experiments will be presented.

References

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