NON-UNIVERSAL OPTICAL QUANTUM COMPUTING WITH ARRAY DETECTORS

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Non-universal quantum computing is a powerful technique for evaluation of specific computational tasks, which cannot be solved with classical computers. Contrary to universal quantum computers, such devices are designed for dealing with a special problem or with a class of special problems. Boson sampling [1, 2] is a typical example of such a method, which can be implemented with present-available technologies. The computational task, which is resolved with such devices, consists in evaluation of permanents for matrices—a polynomial of matrix entries, similar to determinant, but without minuses. Contrary to determinants, there exist no efficient classical algorithms for calculation of permanents. An optical device, implementing boson sampling, consists of single-photon sources, multi-port linear interferometer, and single-photon detectors. A challenging task in implementation of this scheme is detectors, which can discriminate adjacent photon numbers. The problem is that standard photon diods, nano-wire detectors, etc. may detect single photons without such a discrimination. A possible way to resolve this problem consists in splitting the incoming ray into multiple components and detecting each of them with such an on/off detector. The number of detected clicks is usually associated with the number of photons. However, this statement is not really true [3]. Hence such a device may give wrong values of permanents. We report about our theoretical result, which enables to reconstruct correct values of permanents with such array detectors. The consideration is based on the true photocounting equation for this detection scheme presented in Ref. [3]. We believe that our result will find its application for practical realizations of optical non-universal quantum computers.

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