

Hybrid and optical implementation of the Deutsch-Jozsa algorithm

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A hybrid model of the Deutsch-Jozsa algorithm is presented, inspired by the proposals of hybrid computation by S. Lloyd and P. van Loock et. al. The model is based on two observations made about both the discrete and continuous algorithms already available. First, the Fourier transform is a single-step operation in a continuous-variable (CV) setting. Additionally, any implementation of the oracle is nontrivial in both schemes. The steps of the computation are very similar to those in the CV algorithm, with the main difference being the way in which the quantum or quantum units of analogic information, and the qubits interact in the oracle. Using both discrete and continuous states of light, linear devices, and photo-detection, an optical implementation of the oracle is proposed. For simplicity, infinitely squeezed states are used in the continuous register, whereas the optical qubit is encoded in the dual-rail logic of the KLM protocol. The initial assumption of ideal states as qunats will be dropped to study the effects of finite squeezing in the quality of the computation.

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