LINEAR-OPTICAL QUANTUM ROUTER – EXPERIMENTAL IMPLEMENTATION

Černoch A.[1], Lemr K.[1], Bartkiewicz K.[1,2]

[1]RCPTM, Joint Laboratory of Optics of Palacký University and Institute of Physics of Academy of Sciences of the Czech Republic, 17. listopadu 12, 771 46 Olomouc, Czech Republic
[2]Faculty of Physics, Adam Mickiewicz University, PL-61-614 Poznań, Poland

A quantum router is one of the key components of future quantum networks. The device has two inputs – the signal and control qubits. Based on the state of the control qubit, the signal is coherently forwarded to two output ports (see conceptual scheme in Fig. 1).

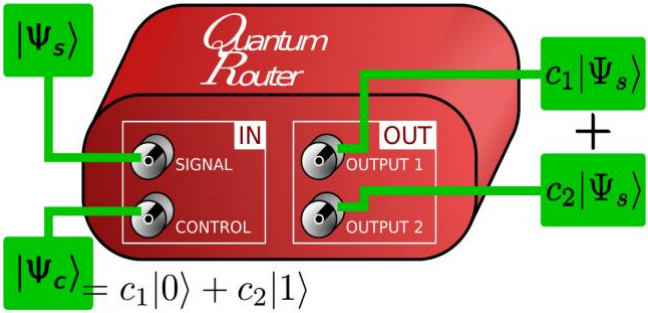

Figure 1: Conceptual scheme of a quantum router.

In this work, we report on an experimental implementation of a linear-optical quantum router based on our original theoretical proposal [1]. In contrast to the similar implementation [2], our device can reach success probability (routing efficiency) of up to 1/4. The only problem is that we have to program the router by two identical control qubits.

We perform three different tests to show that our device works properly. We verify the capability to route the signal correctly depending on the state of the control qubits. The typical contrast of the outputs with setting the control qubits to switch device to fully "ON" and "OFF" is 29:1. The quantum state of routed signal is not changed, it's fidelity with respect to the input state is (91±4$)%. The coherence between two output states was measured in terms of interference visibility which reached the value of 97%.

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[1] K. Lemr and A. Černoch, Opt. Comm. **300**, 282–285 (2013).
[2] C. Vitelli *et al.*, Nat. Photon. **7**, 521–526 (2013).