EXPERIMENTAL TESTS OF COHERENCE AND ENTANGLEMENT CONSERVATION UNDER UNITARY EVOLUTIONS

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In the year 2015, Svozilík *et al*. published a theoretical paper [1] discussing coherence migration in a studied system during time evolution. The authors proposed several experiments to test this effects. In our recent paper [2] we experimentally demonstrate the migration of coherence between composite quantum systems and their subsystems. The quantum bits are implemented using polarization states of single photons. We experimentally tested the coherence conservation in two different schemes. The first setup is based on a linear optical controlled-phase quantum gate. The second scheme utilizes the process of spontaneous parametric down-conversion for generation of correlated photon pairs. In the first experiment, a linear-optical process is selected and in the second experiment a typical nonlinear-optical process is used.

Our experiments allow one to verify the relation between correlations of the subsystems and the coherence of the composite system. We observe that the maximal accessible coherence is conserved for the implemented class of global evolutions of the composite system. The derived conservation law can be used to predict time evolution of quantum correlations in any studied system.

[1] J. Svozilík et al., Phys. Rev. Lett. **115**, 220501 (2015).
[2] A. Černoch et al., Phys. Rev. A **97**, 042305 (2018).