Abstract of the final qualifying paper of D. Frolovtsev

Impact of the Migdall effect on the states of entangled photons produced by a double-crystal scheme

Academic supervisor:
Assoc. Prof. S. Magnitsky

The thesis is dedicated to theoretical and experimental investigation of the Migdall effect (dependency of the spontaneous parametric down-converted (SPDC) light polarization on the scattering direction) and its impact on the states generated via double-crystal scheme for the polarization-entangled photon pairs generation.

Within the theoretical study it were first constructed and analyzed models describing the effects of joint action of the Migdall effect and the main factors causing decoherence. The quantity allowing one to identify the strength of impact of the Migdall effect on the states produced by the double-crystal scheme was introduced. The dependence of the quantity on the pump wavelength and the scattered light propagation angle shows the Migdall effect should be taken into account when tailoring the up-to-date optimized sources. The conducted research allowed the author to deduce methods for the full elimination of the Migdall effect induced entanglement suppression.

Within the experimental study two different methods for the polarization deviation (the Migdall effect) measurement were developed and experimentally implemented. Two polarization-entangled photon sources were created. One source operated in the range of strong impact of the Migdall effect, and another is a source with minimized polarization deviation having entanglement of formation 0.94±0.04. To characterize the sources a quantum tomography system for the two-photon polarization states was implemented.