

In the era of all-embracing digitization, transmission and data security is one of the key issues relevant to every human being. To ensure the privacy of used sophisticated methods of coding are used. Currently the most popular are classical methods, based on mathematical algorithms, however, quantum solutions have gained in importance. The idea of these solutions is often based on the use of single-photon sources.

This project focuses on study of triplets-photon source, which are produced through the *third order of spontaneous parametric down-conversion process (TO SPDC)*. In this process, a single photon is transformed into three with some probability. Thanks to this, between generated photons correlations are observed, both in their spectrum or polarization.

Under this proposal, construction and characterization of TO SPDC source is planned. Numerical simulations will be carried out, which will show what type of correlations between photons are expected. Next, measurements of spectrum and photon number statistics will be done.

The TO SPDC source will be a unique system that will enable its utilization in tests of fundamental principles of quantum theory, which helps to better understand the world around us. However it will have a number of attractive properties that will make it a very good choice for the use in a wide range of experiments in the field of quantum optics, TO SPDC source may be also used in a commercial way. Thanks to generation of higher-dimensional states, it will offer the possibility of coding a so-called qutrit (three-level object). In analogy to qubits, which currently are the base of quantum computer design, qutrits may improve this concept. By using new type of coding, the register of quantum computer will be increased, which results in its computing capabilities. This fact will translate directly to the security of sensitive data, which are used in banks, schools, offices, everywhere.