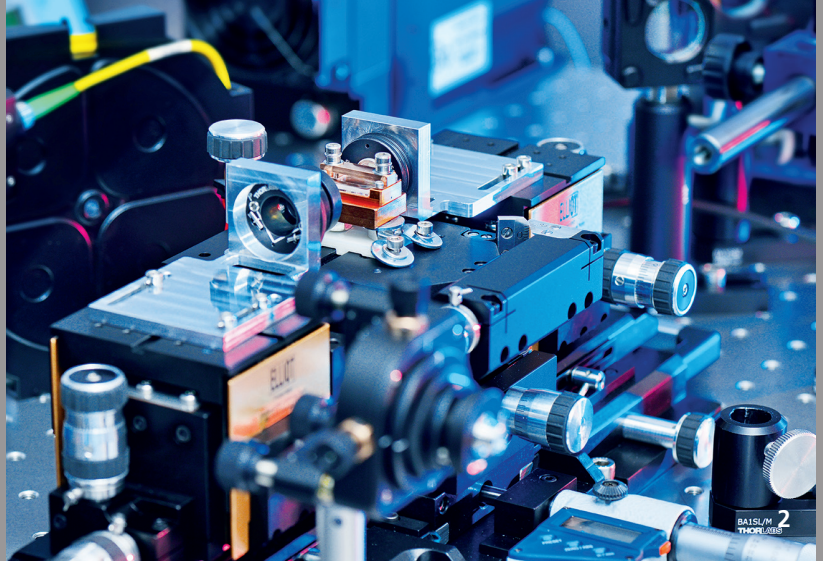

CHARACTERIZATION STATION FOR WAVEGUIDE-BASED PHOTON PAIR SOURCES

Task

Sources of single photons and entangled photon pairs may play an important role in quantum communication and imaging in the future. Parametric fluorescence (spontaneous parametric down conversion SPDC) can be used to generate them. Due to their small dimensions, sources based on waveguide structures are particularly interesting for application integration, but optimizing such structures requires the precise characterization of the components in the development process.

Method

As part of the Fraunhofer project NESSiE, Fraunhofer ILT is developing and building a measuring station for correlation measurements of the generated photon pairs of highly integrated SPDC sources. The institute is testing and optimizing its functionality on the basis of initial measurements. The laboratory setup is designed in such a way that the incoupling unit, the driving laser beam, the crystal holder and the photon detector can be exchanged in a modular way. Thus, the setup can be used flexibly to investigate different photon pair sources.

Results

To measure waveguide structures with lateral dimensions of 10 µm and below, the optical and mechanical design of the measurement station makes it possible to image the laser radiation in a diffraction-limited manner and to position the waveguide in the submicrometer and microrad range both precisely and stably for the long-term. The characterization station can detect emission rates in the kHz range and filter out the ambient light and the driving laser field, both of which are typically many orders of magnitude stronger than the generated photon pairs. To characterize the sources, the generated photon rate, the coincidence-to-noise ratio, and the second-order correlation function are measured automatically.

Applications

As part of the NESSiE project, laser-structured waveguides in periodically poled lithium niobate were developed at Fraunhofer CAP in Glasgow and characterized at Fraunhofer ILT. For further measurements, AlGaAs waveguides will be provided by Fraunhofer IAF in Freiburg.

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2 Characterization setup.