Integrated Optical Devices for Applications in Quantum Information Processing

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Photonic quantum systems have become an established standard for quantum communication and information processing applications. Linear optical networks, which comprise multiple optical modes as well as highly non-classical states of light, have been investigated intensively over the last two decades in various theoretical proposals. Still, the implementation of more advanced setups, exhibiting an increased complexity in terms of number of channels or quantum input states, remains challenging. These can serve as an ideal test-bed for different application in quantum optics and quantum information science.

Integrated optic devices – such as optical fibers, waveguides or linear optical circuits – in combination with pulsed quantum light and time-multiplexing configurations offer distinct advantages to realize quantum optical experiments. The experimental setups get miniaturized, the spatial properties of generated quantum states are defined by the guiding geometries and networks are intrinsically stable. We present a toolbox for integrated quantum optical devices.