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Complex Multiphoton Processing Using Integrated Circuits

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Abstract:

Quantum information has attracted substantial interest in recent years for good reasons: the possibilities of information-theoretically secure encryption protocols and the computational power of quantum computers are starting to transform the landscape of modern computer science. Photons are among the most promising candidates for realizing these concepts and in recent years strong efforts have been made towards improving the integrated optics technology necessary for advanced photonic quantum systems. In this talk, I will present two integrated photonic experiments.

In the first experiment, two high fidelity and low loss polarizing beam splitters, implemented in a fused-silica chip, are used for performing heralded controlled-NOT operations; in principle, the only two-qubit gate necessary for building a quantum computer.

In the second experiment I performed a homomorphic encrypted quantum random walk using a borosilicate glass chip, which was designed to feature very low birefringence and polarization-independent unitaries.