Quantum integrated photonics

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Integrated photonic circuits have a strong potential to perform quantum information processing [1, 2]. Indeed, the ability to manipulate quantum states of light by integrated devices may open new perspectives both for fundamental tests of quantum mechanics and for novel technological applications. By exploiting waveguides fabricated by femtosecond laser waveguide, integrated circuits with three dimensional geometry can be designed to carry out several quantum information processing tasks. Our aim has been to develop and implement quantum simulation by exploiting 3-dimensional integrated photonic circuits. As first we implemented an integrated beam splitter able to support polarization-encoded qubits. As following step we addressed the implementation of discrete quantum walk: we investigated how the particle statistics, either bosonic or fermionic, influences a two-particle discrete quantum walk both in ordered and disordered systems [3]. We will discuss the perspectives of optical quantum simulation: the implementation of the *boson sampling* to demonstrate the computational capability of quantum systems [4,5,6] and the development of integrated architecture with three-dimensional geometries [7].

References

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