Integrated quantum optics using the Silicon on Insulator (SOI) plateform

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Abstract: Integrated quantum optics using silicon wire waveguides is presented. The Kerr nonlinearity of silicon allows the generation of photon pairs within straight waveguides, within micro-ring resonators, as well as the realisation of more complex circuits.

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1. Introduction and Results

The Silicon-on-Insulator (SOI) is an attractive platform for integrated optics. The high index of silicon enables large density integration of optical circuits which can be fabricated with CMOS- compatible technology. The strong light confinement allows non linear effects to be realized at low pump power. Photon pair generation in SOI waveguides have been reported by a number of groups.

Following [1], we report here the generation of photon pairs in SOI waveguides in continuous wave regime s well as the generation of photon pairs in SOI micro-ring resonators. In the later case the pump frequency is aligned with one resonance of the resonator, and the photon pairs are collected on neighbouring resonances, thereby realising a high brightness, narrowband, photon pair source. More recent results on the realisation of additional integrated quantum optics circuits will also be presented, as well as an analysis of the sources of noise which affect the SOI source of photon pairs.

[1] S. Clemmen, K. Phan Huy, W. Bogaerts, R. G. Baets, Ph. Emplit, S. Massar "Continuous wave photon pair generation in silicon-on-insulator waveguides and ring resonators," Optics Express **17,** 16558 (2009).