On chip squeezing generation and detection

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Squeezed light with reduced quantum noise properties is a good candidate for a wide variety of applications, encompassing quantum metrology, processing and communication [1]. The ongoing growth of these technologies implies a need for stable, compact and efficient setups, suitable for out-of-the-lab realization. In this context, the miniaturization of squeezing experiments thanks to integrated optics has been experiencing a growing interest. In this context, integrated optics on lithium niobate provides a valuable platform [2,3]. The high confinement of light in waveguides combined with non-linear properties allows obtaining compact and efficient generation of squeezing, even in a single pass (cavity-free) configuration [3]. On the other hand, spatial mode matching issues at homodyne interferometers are greatly simplified with single-spatial-mode splitters and combiners [4], whose splitting ratio can be controlled, whenever required thanks to electro-optical effect. In this contribution, we will address the miniaturization of squeezing experiment by discussing a home-made lithium niobate chip fully integrating single-mode squeezing generation and the detection (optical part) on the same component. The chip includes a periodically poled waveguide for the generation of squeezing by spontaneous parametric down conversion (SPDC) at telecommunication wavelengths (1540nm), followed by an integrated tunable beam-splitter for the homodyne detection. The SPDC occurs in one arm of the beam-splitter, while the other serves for the injection of the local oscillator (LO). The ratio of the beam-splitter can be electro-optically adjusted by applying the appropriate voltage on two electrodes deposed on the chip. Note that an additional beam splitter acting as an integrated optical switch, can be added at the output of the SPDC stage so as to rout the squeezed beam toward the homodyne detector, to collect it for any dedicated application or to manipulated it in a single photon subtraction experiment. In this contribution, I will present some details on the chip fabrication as well as preliminary results on the chip characterization. I will conclude by discussing new possible architectures and developments on the same substrate.

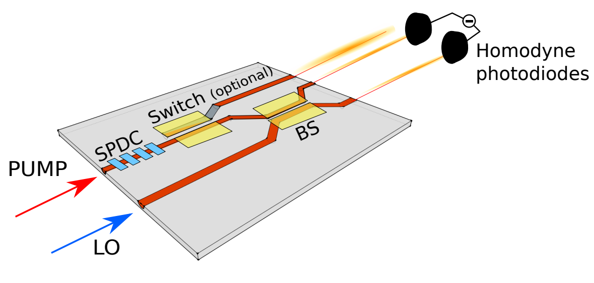

Figure 1: Schematic of the chip for single mode squeezing generation and detection

References

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