Optical Squeezing from a Ti:LiNbO$_3$ Optical Waveguide Resonator

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Electronic integrated devices have completely transformed computation, communication, and the ways in which we interact with the world on a daily basis. Such systems offer, for example, scalability, integrability and mass producibility. It is therefore expected that the majority of new optical technologies must similarly shift towards integrated platforms. With this goal in mind, we present recent advancements in resonator devices in an integrated platform for single-mode squeezed light production.

We demonstrate that this platform is capable of prodcuing moderate levels of single-mode optical squeezing; the "building block" for continuous-variable quantum optics. Optical coatings are deposited in-house on the end faces of a Ti:LiNbO$_3$ waveguide sample, thereby producing the desired resonator. The losses in this sample are measured to be around 0.16 dB/cm and the nonlinear efficiency is consistent with the expected nonlinear-efficiency [1]. The device is pumped with up to 9 mW of 775nm light (generated in a similar waveguide resonator device [2]). The squeezed state produced is directly observed to be -2.9 $\pm$ 0.1 dB below the shot noise level, corresponding to -4.9 $\pm$ 0.1 dB of squeezing exiting the waveguide when detection losses are removed [1]. A representative measure of the squeezing is shown in Fig. 1.

The results presented here highlight, for the first time, the suitability of Ti:LiNbO$_3$ waveguide resonators for the production of high quality single-mode squeezing.

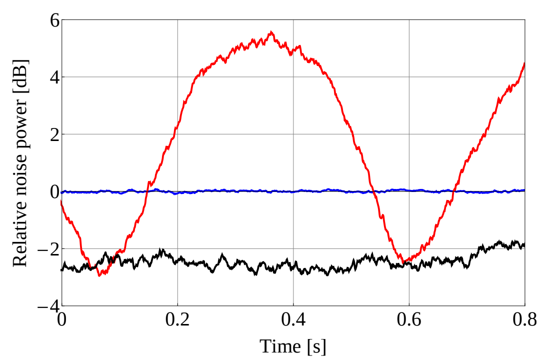

Figure 1: Homodyne measurements showing the variances of the shot noise (blue) and squeezing as the local oscillator phase is varied (red) or drifting (black).

References

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