A LOW GAIN OPTICAL AMPLIFIER AT THE QUANTUM LIMIT

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In a recent demonstration of quantum cloning with continuous variables, the essential ingredient was an optical amplifier working at the quantum limit even in the low gain regime. It has been used to demonstrate quantum cloning of coherent states [1]. This amplifier does not use any nonlinear optical process nor stimulated emission but just linear optical elements, detectors, modulators and electronic feed-forward circuits. Our amplifier set-up with its modular structure makes it easy to identify the various origins of the noise figure of the optical amplifier and to compare it with the general performance limitation. On the mathematical the foundations of the fundamental limitations of the field quadrature variances at the output of an optical amplifier is treated using the seemingly linear Bogoliubov transformations. We discuss the phenomenological description of various types of amplifiers, identifying the field operators used in the Bogoliubov transformation with field modes in the experimental set-up.

References

1. U.L. Andersen, V. Josse, and G. Leuchs, *Phys. Rev. Lett*., 2005, **94**, 240503