Highlights

RESEARCH AREA 3 - **Quantum Science and technologies**- 2022

"Observation of Two-Mode Squeezing in a Traveling Wave Parametric Amplifier"

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PHYSICAL REVIEW LETTERS 128, 153603 (2022)

Traveling wave parametric amplifiers (TWPAs) have recently emerged as essential tools for broadband near quantum-limited amplification. However, their use to generate microwave quantum states still misses an experimental demonstration. In this Letter, we report operation of a TWPA as a source of two-mode squeezed microwave radiation. We demonstrate broadband entanglement generation between two modes separated by up to 400 MHz by measuring logarithmic negativity between 0.27 and 0.51 and collective quadrature squeezing below the vacuum limit between 1.5 and 2.1 dB. This work opens interesting perspectives for the exploration of novel microwave photonics experiments with possible applications in quantum sensing and continuous variable quantum computing.

This work is supported by the European Union's Horizon 2020 research and innovation program under Grant Agreement No. 899561. M.E. acknowledges the European Union's Horizon 2020 research and innovation program under the Marie Sklodowska Curie (Grant Agreement No. MSCA-IF-835791). A.R. acknowledges the European Union's Horizon 2020 research and innovation program under the Marie Sklodowska Curie Grant Agreement No. 754303 and the "Investissements d'avenir" (ANR-15-IDEX-02) programs of the French National Research Agency.

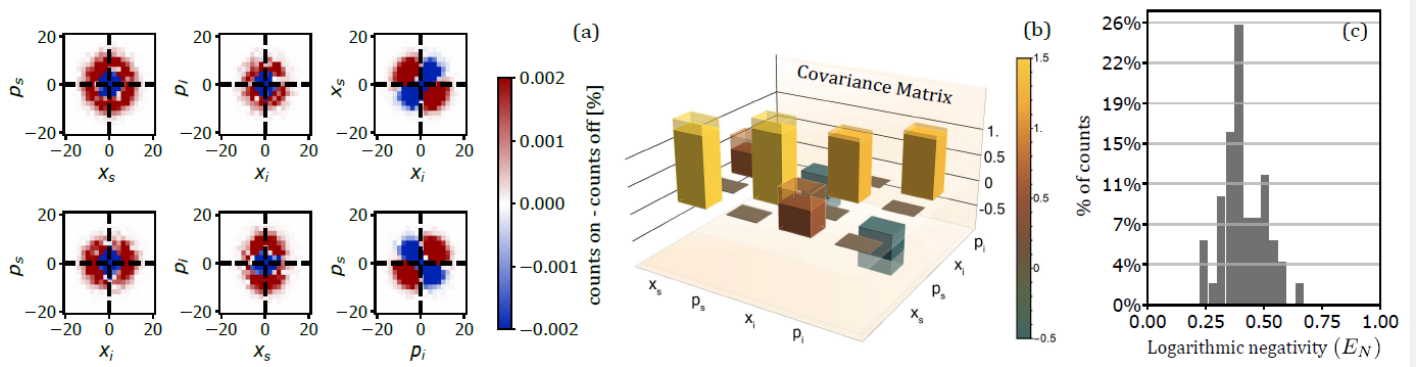

Fig. 1: (a) Measured quadrature phase space distribution (two-dimensional differential histogram plots: difference between pump on and pump off histograms) for 10^8 on-off acquisitions and detuning Δ = 200 MHz; the shape of the differential quadrature distributions in the phase spaces indicates the presence of two-mode correlations. (b) Reconstructed covariance matrix with uncertainty indicated by shaded regions. (c) Entanglement stability over time: histogram of 50 repeated entanglement measurements, each obtained from a set of 2 × 10^6 repeated on-off quadrature acquisitions. Pump frequency f_p = 4.415 GHz.