Abstract Submitted
for the DAMOP17 Meeting of
The American Physical Society

Implementation of a Single-Shot Displacement Receiver for Quaternary Phase-Shift-Keyed Coherent States MATTHEW DIMARIO, FRANCISCO BECERRA, RICHARD JACKSON, ZEKE CARRASCO, CQuIC - University of New Mexico — Non-Gaussian receivers that achieve discrimination errors below the Quantum Noise Limit (QNL) are an important tool in communication and quantum information. Discrimination of coherent states of light with zero probability of error is fundamentally impossible due to their intrinsic overlap. Therefore, the goal is to design and demonstrate strategies that minimize the probability of error and outperform a perfect heterodyne measurement working at the QNL, while being compatible with current communication technologies. We experimentally implement a strategy proposed in PRA 86, 042328 (2012) to discriminate between quaternary phase-shift keyed (QPSK) coherent states below the QNL that is based on simultaneously testing multiple hypotheses within a single-shot measurement. The receiver uses displacement operations and single photon counting without the need for any feedback operations and thus it is compatible with current high-bandwidth communications. In our demonstration we use optimized displacement operations to minimize the probability of error in a polarization based set-up. Our investigations allow us to identify how the critical parameters, such as visibility of the displacements and detection efficiency, influence the error probability as well as what is required to out-perform a heterodyne measurement under realistic noise and loss.

Matthew DiMario
CQuIC - University of New Mexico

Date submitted: 27 Jan 2017 Electronic form version 1.4