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Robust, single-shot measurements for binary phase-shift keyed coherent state discrimination[1] MATT DIMARIO, F. ELOHIM BECERRA, University of New Mexico Center for Quantum Information and Control — The discrimination of binary phase-shift keyed (BPSK) coherent states is an integral part of many classical and quantum communication schemes. While complex measurement strategies employing feedback can far surpass the Quantum Noise Limit (QNL) set by a Homodyne measurement, there is also a need for non-adaptive strategies that can be scaled to high bandwidths and incorporated into current and future communication methods. Moreover, all measurement strategies are subject to non-ideal conditions and must be able to overcome realistic noise and imperfections in real-world communication channels while keeping their sensitivity performance. We investigate and experimentally demonstrate a robust, high-sensitivity discrimination strategy for BPSK coherent states that is based on a single, optimized displacement operation in phase space followed by photon counting. Robustness of the discrimination strategy comes from the information gained through a photon number resolving (PNR(m)) measurement, corresponding to projections onto Fock states up to a threshold of "m" photons, which characterizes the finite number resolution of realistic detectors. Optimal single shot measurements are compatible with high-bandwidth communication while being able to achieve sensitivities below the QNL under realistic conditions. Our experimental demonstration with a realistic detector and finite photon number resolution, allows the measurement to continually outperform the QNL, adjusted for our detection efficiency.

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