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Phase Tracking and Correction for Quantum Measurements of Coherent States MATTHEW DIMARIO, ELOHIM BECERRA, University of New Mexico — Non-Gaussian measurements for discriminating coherent states of light with different phases enable information transfer beyond what conventional technologies can achieve with an ideal Gaussian measurement, referred to as the standard quantum limit (SQL). However, random phase drifts in any real-world communication channel make the task of extracting the information encoded in coherent states very challenging. Current approaches for overcoming this problem in conventional optical communications based on heterodyne detection, which samples the full phase space, perform parameter estimation in the digital domain for phase estimation. While these techniques allow for tracking and correction of random phase drifts in conventional communications, they are incompatible with non-Gaussian (quantum) receivers. This puts in question the potential advantages of quantum receivers surpassing the conventional limits of detection in real channels with random phase drifts. We develop and demonstrate a method which performs real time parameter estimation using the data collected by the non-Gaussian optimized discrimination measurement itself. We can then adaptively correct for any phase changes that diminish the benefit over a heterodyne measurement. Our demonstration allows non-Gaussian receivers to overcome phase drifts in real channels while enabling discrimination below SQL. This demonstration makes non-Gaussian receivers more robust and a much more practical quantum technology for future applications in communication and information processing.

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