Discrimination of binary coherent states using a homodyne detector and a photon number resolving detector

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We investigate quantum measurement strategies capable of discriminating two coherent states probabilistically with significantly smaller error probabilities than can be obtained using non-probabilistic state discrimination. We apply a postselection strategy to the measurement data of a homodyne detector as well as a photon number resolving detector in order to lower the erro probability. We compare the two different receivers with an optimal intermediate measurement scheme where the error rate is minimized for a fixed rate of inconclusive results. The photon number resolving (PNR) receiver is experimentally demonstrated and compared to an experimental realization of a homodyne receiver with postselection. In the comparison it becomes clear, that the perfromance of the new PNR receiver surpasses the performance of the homodyne receiver, which we proof to be optimal within any Gaussian operations and conditional dynamics.

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