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Qubit Quantum Metrology in the Regime of Limited Resources

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— It has been demonstrated that quantum effects, such as entanglement and squeezing, can decrease the uncertainty of parameter estimation. A tight lower bound for this uncertainty exists for the regime of asymptotic measurement resources. Several bounds have been proposed for the more realistic non-asymptotic regime, but none are tight. We numerically investigate the non-asymptotic regime for a specific system: using ν qubit probes to estimate a rotation angle externally induced on the probes. We introduce a Bayesian modeling framework for qubit quantum metrology. We investigate the effect of entanglement on parameter estimation uncertainty as a function of ν in the non-asymptotic regime.

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