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Suppressing systematic errors in weak measurements SHENGSHI PANG, University of Rochester, JOSE RAUL GONZALEZ ALONSO, TODD A. BRUN, University of Southern California, ANDREW N. JORDAN, University of Rochester — Noises are inevitable in real environments, and quantum systems are vulnerable to them, so it is vitally important to protect the quantum systems from noises in quantum information tasks and correct the errors in quantum systems caused by noises. In this talk, we focus on the systematic error of weak-measurement-based quantum metrology under decoherence. We obtain the systematic error of maximum likelihood estimation in general to the first-order approximation of a small deviation in the probability distribution, and investigate the robustness of both standard weak measurement and postselected weak measurement against systematic error. We find that, the systematic error of a weak measurement with the probe undergoing decoherence can be significantly reduced by postselecting the system with a large weak value. This indicates another advantage of weak value amplification in enhancing the performance of parameter estimation by weak measurements. The results are illustrated by an exact numerical simulation of decoherence arising from the coupling of the probe to a bosonic mode, and compared to the first-order analytical results we obtain.

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