Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Entanglement-assisted weak measurement[1] SHENGSHI PANG, University of Southern California, JUSTIN DRESSEL, University of California, Riverside, TODD A. BRUN, University of Southern California — Postselected weak measurement with a large measurement can amplify small coupling parameters. However, a major shortcoming is that the postselection probability is usually very low when the amplification is large, which means an enormous amount of resources is necessary. So, how to increase the postselection probability is an important problem in practical application of weak measurement. In this work, we study the optimization of weak measurement and propose an entanglement-assisted protocol for it. We start from maximizing the postselection probability with a given weak value. The result shows the maximum postselection probability is proportional to the variance of the observable under the initial state of the system. As is know that the variance has different scaling under entangled or uncorrelated states, it inspired us to show using entanglement in the initial state of the system can increase the postselection efficiency beyond that with sequential use of systems. With this result, we further find the Fisher information of weak measurement can approximately reach the Heisenberg limit with the assistance of entanglement. Finally, we give simple quantum circuits for the implementation of this protocol with qubits, including initialization, weak interaction and postselection.

[1]This research was partially supported by the ARO MURI Grant No. W911NF-11-1- 0268. S. P. and T. A. B. also acknowledge the support from NSF Grant No. CCF-0829870, while J. D. acknowledges support from IARPA/ARO Grant No. W91NF-10-1-0334.

Shengshi Pang
University of Southern California

Date submitted: 14 Nov 2014 Electronic form version 1.4