Contribution ID: **577** Type: **Oral**

Qubit tomography with limited resources of continuous weak measurement and qubit controls

Tuesday 22 May 2018 13:15 (15 minutes)

We investigate a new method for qubit state tomography [1] based on limited resources of continuous weak measurement [2] and qubit controls. As in many qubit experiments, such as in superconducting circuits, the qubit measurement could practically be done with only a few observables, e.g., continuously measuring σ_z observable of a superconducting qubit [3]. To determine a full density matrix of a qubit system, one needs to add unitary controls in order to transfer information about other parameters of the qubit's state to the measured observable. In this work, we use only a continuous σ_z measurement of a qubit with arbitrary (weak) strength and a fixed-axis Rabi oscillation control. We use the Bayesian mean estimation to construct the qubit states from measurement records. We also investigate the information transfer during the continuous measurement, and how the information of different qubit coordinates are transferred to the measured observable by considering the Fisher information. Our results show that we can get the state estimators with high fidelity using a small strength of measurement, along with qubit rotation about the Rabi axis making an $\pi/4$ with the x-axis, y-axis and z-axis. In addition, the variance of the estimators shows similar trend as those under fluctuation of many iterations.

References

[1] M. A. Nielsen and I. L. Chuang, "Quantum Computation and Quantum Information," (Cambridge University Press,Cambridge, England, 2000).

[2] H. M. Wiseman and G. J. Milburn, "Quantum Measurement and Control," (Cambridge University Press, Cambridge, UK, 2010).

[3] S. J. Weber, A. Chantasri, J. Dressel, A. N. Jordan, K. W. Murch, and I. Siddiqi, "Mapping the optimal route between two quantum states," Nature (London), 511, 570 (2014).

Author: Mr CHALERMPUSITARAK, Teerawat (Optical and Quantum Physics Laboratory, Department of Physics, Faculty of Science, Mahidol University)

Co-authors: Dr CHANTASRI, Areeya (Centre for Quantum Dynamics, Griffith University, Nathan, QLD 4111, Australia); Mr PANG, Shengshi (Department of Physics and Astronomy, University of Rochester, Rochester, New York 14627, USA); Prof. JORDAN, Andrew (Center for Coherence and Quantum Optics, University of Rochester, Rochester, New York 14627, USA)

Presenter: Mr CHALERMPUSITARAK, Teerawat (Optical and Quantum Physics Laboratory, Department of Physics, Faculty of Science, Mahidol University)

Session Classification: A15: Atomics

Track Classification: Atomic Physics, Quantum Physics, Molecular and Chemical Physics