清华大学高等研究院
Institute for Advanced Study, Tsinghua University

物理学术报告
Physics Seminars (biweekly)

Title: Experimental quantum error correction with binomial bosonic codes

Speaker: Luyan Sun
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Time: 4:00pm, Tuesday, April 23, 2019

(3:30~4:00pm, Tea and Coffee)

Venue: Conference Hall 322, Science Building, Tsinghua University

Abstract

Quantum error correction (QEC) is necessary for a practical quantum computer because of the inevitable coupling of quantum systems with the uncontrolled environment. A measurement-based QEC requires rapid extraction of error syndromes without disturbing the stored information and fast real-time feedback control for error corrections. Encoding quantum information on photonic states in a microwave cavity for QEC has attracted a lot of interests because of its hardware efficiency. This scheme benefits from the infinite dimensional Hilbert space of a harmonic oscillator for redundant information encoding and only one error syndrome that needs to be monitored. In this talk, I will describe our experimental realization of both repetitive QEC with a binomial bosonic code in a circuit quantum electrodynamics architecture and full control on the logical qubit [1]. The demonstrated binomial bosonic codes promise the realization of QEC-enhanced precision measurements and could also be further explored for fault-tolerant quantum computation. The quantum feedback control technique developed for this work also provides new perspectives for control and measurement of open quantum systems.

[1] L. Hu, Y. Ma, W. Cai, X. Mu, Y. Xu, W. Wang, Y. Wu, H. Wang, Y. P. Song, C.-L. Zou, S. M. Girvin, L-M. Duan and L. Sun, Nature Physics s41567-018-0414-3 (2019).