Tsinghua University
Department of Physics

Physics Seminar 2012 Fall

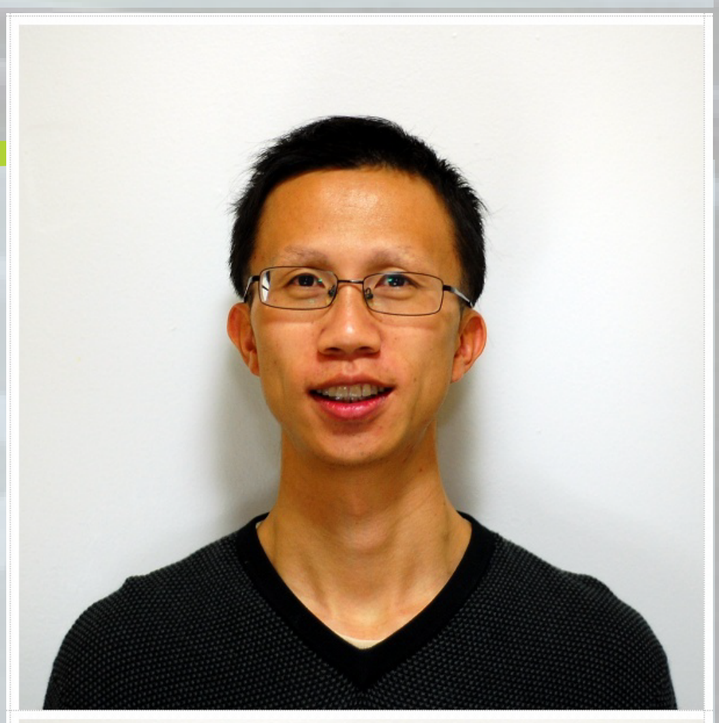
Emulating a mesoscopic system using superconducting quantum circuits

Abstract

Achieving the ultimate computation power relies on the development of a large-scale quantum computer. Towards the large-scale quantum computer, a great challenge is to build a high-efficient readout system to detect large numbers of qubits. Here, we introduce a frequency-multiplexed readout scheme for superconducting phase qubits, which is capable to readout multiple qubits with a single excitation and readout line. The new scheme dramatically simplifies the circuit design and allows us to scale up to a 9-element quantum processor with only 5 control lines.Taking advantage of this ReZQu-architectured quantum processor, we controllably split a microwave photon and manipulated the splitted photons before they recombined for detection. In this way, we were able to simulate the weak localization effect in mesoscopic systems - a coherent backscattering process due to quantum interference. The influence of the phase coherence was investigated by tuning the coherence time of the quantum circuit, which in turn mimics the temperature effect on the weak localization process. At the end, we demonstrated an effect resembling universal conductance fluctuations, which arise from the frequency beating between different coherent backscattering processes. The universality of the observed fluctuation was shown as the independence of the fluctuation amplitude on the detailed experimental conditions.

Speaker

Yu Chen received his B.S. from University of Science and Technology of China in 2003 and Ph.D. in University of Minnesota, Twin Cities in 2009. He works in University of California, Santa Barbara as Postdoctoral Researcher in Physics since 2010. He is a meber of the American Physical Society. He was awarded “Outstanding Student Fellowship” of USTC during 1998-2003 and “Doctoral Dissertation Fellowship” of UMN during 2008-2009.



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Conference room on 3rd floor in the New Science building

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