THE CHINESE UNIVERSITY OF HONG KONG

**Department of Physics**

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# Towards Quantum Network with Superconducting Circuits

*by*

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*Time: 11:00 a.m. - 12:00 n.n.*
*Join ZOOM Meeting: https://bit.ly/3uHlzIa*

ALL INTERESTED ARE WELCOME
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## Abstract

In recent years, quantum information science has advanced rapidly. The combination of quantum channels and quantum nodes would create a quantum network. Such a quantum network enables quantum computing and quantum communication, which is much more advantages than its classical counterpart in terms of computational ability and communication security.

In this talk, I will focus on implementation of quantum nodes using superconducting circuits. In the first sets of experiments, we embed a transmon artificial atom in an open transmission line. When a weak coherent state is on resonance with the atom, we observe extinction of up to 99% in the forward propagating field. We also study the statistics of the reflected radiation, and we demonstrate photon antibunching in the reflected signal by measuring the second-order correlation function [1]. The non-classical fields can be used as quantum information. By applying a second control tone, we observe the Autler-Townes splitting and a giant cross-Kerr effect [2]. The interaction between two fields via the artificial atoms can be used as phase gate. Furthermore, we demonstrate fast operation of a single-photon router [3] using the Autler-Townes splitting. In the second sets of experiments, we demonstrate that coherent-state microwave photons, with an optimal temporal waveform, can be efficiently loaded onto a single superconducting artificial atom in a semi-infinite 1D transmission-line waveguide [4]. At the end, I will propose promising experiments to implement quantum memory and readout state without cavity.

[1] I.-C. Hoi et al. Physical Review Letters 108, 263601 (2012)
[2] I.-C. Hoi et al. Physical Review Letters 111, 053601 (2013)
[3] I.-C. Hoi et al. Physical Review Letters 107, 073601 (2011)
[4] W. J. Lin et al. arXiv:2012.15084 (2021)

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