

# Joint CQSE and CASTS Seminar

Weekly Seminar  
Dec. 23, 2016 (Friday)

TIME Dec. 23, 2016, 14:30 ~ 15:30  
TITLE Quantum optics with propagating microwaves in  
superconducting circuits  
SPEAKER Prof. IoChun Hoi  
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PLACE Rm716, CCMS & New Physics Building, NTU

## Abstract

In recent years, much effort has been invested to using superconducting artificial atoms to explore quantum optics in new parameter regimes. In this talk, I will address advances on quantum optics with propagating microwaves. 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]. By applying a second control tone, we observe the Autler-Townes splitting and a giant cross-Kerr effect [2]. Furthermore, we demonstrate fast operation of a single-photon router [3] using the Autler-Townes splitting. In the second sets of experiment, we embed a transmon at a distance from the end (mirror) of a transmission line [4]. By tuning the wavelength of the atom, we effectively change the normalized distance between atom and mirror, allowing us to effectively move the atom from a node to an antinode of the vacuum fluctuations. We probe the strength of vacuum fluctuations by measuring spontaneous emission rate of the atom.

[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] I.-C. Hoi et al. Nature Physics 11, 1045 (2015)

