THE CHINESE UNIVERSITY OF HONG KONG

Department of Physics

COLLOQUIUM

Quantum Optics with Superconducting Artificial Atoms in One Dimensional Space

by

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Date: June 21, 2021 (Monday)
Time: 1:30 - 2:30 p.m.
Join ZOOM Meeting: https://bit.ly/3wHuPgK

ALL INTERESTED ARE WELCOME
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Abstract

Artificial atoms made from superconducting circuits can be strongly coupled to propagating microwave photons. In this talk, I will address advances on quantum optics with superconducting artificial atoms in one dimensional (1D) space. In the first sets of experiments, we embed a transmon in a transmission line. When driving the qubit strongly on resonance such that a Mollow triplet appears, we observe a few percent amplitude gain for a weak probe at frequencies in-between the triplet. This amplification is not due to population inversion, but instead results from a four-photon process that converts energy from the strong drive to the weak probe [1]. In the second sets of experiment, we embed a transmon at a distance from the end (mirror) of a transmission line. 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 [2]. In the third sets of experiment, we place two superconducting qubits in a transmission line terminated by a mirror, which suppresses decay. We measure a collective Lamb shift reaching 0.8% of the qubit transition frequency and exceeding the transition linewidth [3].

[1] P. Y. Wen et al. Physical Review Letters 120, 063603 (2018)
[2] I.-C. Hoi et al. Nature Physics 11, 1045 (2015)
[3] P. Y. Wen et al. Physical Review Letters 123, 233602 (2019)

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