MAR14-2014-021046

Abstract for an Invited Paper
for the MAR14 Meeting of
the American Physical Society

Single photon Kerr effect in circuit QED

G. KIRCHMAIR[1], Departments of Physics and Applied Physics, Yale University

The recent development of a 3D architecture for superconducting circuits has dramatically increased the coherence time of qubits and cavities. This allows us to reach the single-photon Kerr regime in circuit QED, where the interaction strength between individual photons in a waveguide cavity exceeds the loss rate. Here, using a two-cavity/single-qubit system, we engineer an artificial Kerr medium that enters this regime and allows the observation of new quantum effects. We realize a Gedankenexperiment [1] proposed by Yurke and Stoler, in which the collapse and revival of a coherent state can be observed. During this evolution non-classical superpositions of coherent states, i.e. multi-component Schrödinger cat states, are formed. We visualize this evolution by measuring the Husimi Q-function and confirm the non-classical properties of these transient states by Wigner tomography.

In collaboration with B. Vlastakis, Departments of Physics and Applied Physics, Yale University; Z. Leghtas, Departments of Physics and Applied Physics, Yale University and INRIA Paris-Rocquencourt, Domaine de Voluceau; S. E. Nigg and H. Paik, Departments of Physics and Applied Physics, Yale University; E. Ginossar, Department of Physics and Advanced Technology Institute, University of Surrey; M. Mirrahimi, INRIA Paris-Rocquencourt, Domaine de Voluceau; L. Frunzio, S. M. Girvin, and R. J. Schoelkopf, Departments of Physics and Applied Physics, Yale University.

[1] "Observation of quantum state collapse and revival due to the single-photon Kerr effect," G. Kirchmair, B. Vlastakis), Z. Leghtas, S. E. Nigg, H. Paik, E. Ginossar, M. Mirrahimi, L.Frunzio, S. M. Girvin & R. J. Schoelkopf, Nature, 495, 205 (2013)

[1]Current Address: Institute for Quantum Optics and Quantum Information, Austrian Academy of Science and University of Innsbruck, Institute for Experimental Physics