MAR14-2013-020446

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

Driven superconducting quantum circuits[1]

YASUNOBU NAKAMURA, The University of Tokyo

Driven nonlinear quantum systems show rich phenomena in various fields of physics. Among them, superconducting quantum circuits have very attractive features such as well-controlled quantum states with design flexibility, strong nonlinearity of Josephson junctions, strong coupling to electromagnetic driving fields, little internal dissipation, and tailored coupling to the electromagnetic environment. We have investigated properties and functionalities of driven superconducting quantum circuits. A transmon qubit coupled to a transmission line shows nearly perfect spatial mode matching between the incident and scattered microwave field in the 1D mode [1]. Dressed states under a driving field are studied there and also in a semi-infinite 1D mode terminated by a resonator containing a flux qubit [2]. An effective Λ-type three-level system is realized under an appropriate driving condition. It allows "impedance-matched" perfect absorption of incident probe photons and down conversion into another frequency mode [3]. Finally, the weak signal from the qubit is read out using a Josephson parametric amplifier/oscillator which is another nonlinear circuit driven by a strong pump field [4].

[1] K. Koshino *et al.*, PRL **110**, 263601 (2013).
[2] K. Inomata *et al.*, PRB **86**, 140508(R) (2012).
[3] K. Koshino *et al.*, PRL **111**, 153601 (2013).
[4] Z. R. Lin *et al.*, APL **103**, 132602 (2013).

[1]This work was partly supported by the Funding Program for World-Leading Innovative R&D on Science and Technology (FIRST), Project for Developing Innovation Systems of MEXT, MEXT KAKENHI "Quantum Cybernetics," and the NICT Commissioned Research.