Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Circuit QED Photonics DAVID ZUECO, EDUARDO SÁNCHEZ-BURILLO, Universidad de Zaragoza-CSIC, JUANJO GARCÍA-RIPOLL, CSIC, LUIS MARTÍN-MORENO, Universidad de Zaragoza-CSIC — In this talk we report our theoretical results for the scattering of few photons against few two level systems. The photons travel through an open superconducting coplanar waveguide transmission line and the two level systems can be flux qubits or transmons. Several phenomena will be discussed: the linear and nonlinear behavior as a function of the ratio between the number of photons and number of qubits. For the case of flux qubits we discuss the cases of strong and ultrastrong line-qubits coupling. Different phenomena are found and described: Fano profiles, Raman scattering, photon generation and novel and non-perturbative qubit-qubit interecations through the line. Finally, we consider the case of transmon qubits. We theoretically demonstrate that driven transmons can be used as a minimal setup for doing up and downcoversion. By minimal, we mean that sending just one photon two photons are generated through the qubit. In our calculations, the parameters are taken from the chip reported in a recent Science paper by the Wallraff group [van Loo et al, Science 342, 1494 (2013)] .

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Date submitted: 14 Nov 2014 Electronic form version 1.4