Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Beyond strong coupling in a massively multimode cavity NEEREJA SUNDARESAN, YANBING LIU, DARIUS SADRI, LASZLO SZOCS, DEVIN UNDERWOOD, MOEIN MALEKAKHLAGH, HAKAN TURECI, ANDREW HOUCK, Princeton University — We present experiments in a new regime of cavity quantum electrodynamics (cQED), the multimode strong coupling regime, in which the qubit-cavity coupling is comparable to the free spectral range, thus requiring the collective treatment of all modes along with the qubit. Here we show that this regime is accessible in circuit QED by coupling a 90MHz microwave cavity with a transmon qubit, resonant with the 75th harmonic with a coupling strength exceeding 30MHz. When driving this system, we observe multimode fluorescence consistent with cavity-enhanced sideband emission, with unexpected multi-photon processes and the emergence of ultra-narrow linewidths. This multimode coupling opens the door for a wide range of potential experiments, including studying the manifestation of complex many-body phenomena, the breakdown of the rotating wave approximation, and the bridge between discrete and continuous Hilbert spaces.

Neereja Sundaresan
Princeton University

Date submitted: 14 Nov 2014 Electronic form version 1.4