This talk is the second part of two back to back talks with M. Kounalakis.
The first talk was already submitted with ID number: MAR17-2016-005339.
Please schedule them back to back.

Abstract Submitted
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Experimentally simulating the dynamics of quantum light and matter at ultrastrong coupling using circuit QED (2) - light dynamics and light-matter entanglement -[1] R. SAGASTIZABAL, N. K. LANGFORD, M. KOUNALAKIS, C. DICKEL, A. BRUNO, F. LUTHI, QuTech and Kavli Institute of Nanoscience, Delft University of Technology, The Netherlands, D. J. THOEN, A. ENDO, Kavli Institute of Nanoscience, Delft University of Technology, The Netherlands, L. DICARLO, QuTech and Kavli Institute of Nanoscience, Delft University of Technology, The Netherlands — Light-matter interaction can lead to large photon build-up and hybrid atom-photon entanglement in the ultrastrong coupling (USC) regime, where the coupling strength becomes comparable to the eigenenergies of the system. Accessing the cavity degree of freedom, however, is an outstanding challenge in natural USC systems. In this talk, we directly probe light field dynamics in the USC regime using a digital simulation of the quantum Rabi model in a planar circuit QED chip with a transmon moderately coupled to a resonator. We produce high-accuracy USC light-matter dynamics, using second-order Trotterisation and up to 90 Trotter steps. We probe the average photon number, photon parity and perform Wigner tomography of the simulated field. Finally, we combine tomography of the resonator with qubit measurements to evidence the Schrödinger-cat-like atom-photon entanglement which is a key signature of light-matter dynamics in the USC regime.

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