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Qubit-Photon Entanglement and Hong-Ou-Mandel Interference with Propagating Microwaves CHRISTOPHER EICHLER, CHRISTIAN LANG, JOHANNES FINK, JOONAS GOVENIUS, LARS STEFFEN, STEFAN FILIPP, ANDREAS WALLRAFF, ETH Zurich, MATTHEW WOOLLEY, ALEXANDRE BLAIS, Universite de Sherbrooke — Itinerant microwave photons offer an attractive carrier of quantum information in superconducting circuits. However, until recently it remained challenging to measure photon statistics and coherence properties of microwave fields beyond the Gaussian level – mainly due to the absence of efficient detectors in this frequency range. Here, we present the on-demand generation and efficient characterization of microwave radiation and its entanglement with stationary qubits. Based on novel tomography techniques and low noise parametric amplification we are able to resolve all relevant quantum correlations between the propagating field and the superconducting qubit to demonstrate entanglement with high fidelity [1,2]. We have also created entangled microwave fields traveling in two spatially separated modes. Making use of the two-photon interference at a microwave beamsplitter we are able to prepare propagating NOON-type states, which we fully characterize by measuring the joint photon statistics of the two modes. The possibility to synthesize, guide and detect entanglement correlations between itinerant microwave photons and stationary qubits put microwave based quantum network experiments within reach. [1] arXiv:1209.0441v1 [2] C. Eichler et al., Phys. Rev. A 86, 032106 (2012)

Christopher Eichler
ETH Zurich

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