universität innsbruck

Innsbruck Physics Colloquium

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Hot photons and shaking inductors

In this talk, I will you about some of our recent research in quantum circuits and mechanics. Studying superconducting quantum circuits on their own, I describe our recent work studying quantum photonics at radio frequencies. By engineering an "out-of-box" circuit design in circuit QED, we implement an extreme ultra-strong coupling regime of cavity electrodynamics, which enables us to use a GHz superconducting qubit to observe the quantisation of a "hot" 170 MHz electromagnetic field, bridging an order of magnitude in frequency difference and bringing circuit QED into an unusual extreme dispersive coupling regime in a thermal limit. Using four-wave mixing sideband transitions of the qubit, we use the qubit as a cool resource to deplete the entropy of hot photonic mode, cooling it to its ground state and dynamically stabilising single photon states. In a second part of the talk, I will describe recent experiments using a superconducting loop to implement a "shaking inductor", couple radio-frequency photons to the vibrational phonons of a superconducting beam using quantum interference. Observing the high-Q mechanical mode using the flux-tunable cavity, we show flux-tunable couplings and mechanical frequencies, and the signature scaling of the coupling with the external magnetic field, promising for scaling up the coupling rates in optomechanics into the single-photon strong coupling regime where the intrinsic nonlinearity will enable us to create non-classical states of mechanical motion.

Tuesday, 3.12.2019, at 17:15 h in lecture hall C

Innsbruck Physics Colloquium, Organisation: M. Beyer, H.-C. Nägerl, A. Reimer