Seminar/Talk

Quantum dynamics of a high impedance cavity coupled to a Josephson junction

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In this talk I will discuss the dynamics of a high impedance microwave cavity galvanically coupled to a DC biased Josephson junction, focusing in particular on how the occupation and the properties of the cavity modes are affected by the charge tunneling processes occurring in the junction. At low voltages compared to the superconducting gap of the junction, the dominant process is the inelastic tunneling of Cooper pairs, which populates the different cavity modes [1, 2]. We directly measure the photon emission in one mode at 6 GHz and observe more than 70 emission peaks as a function of bias voltage. At larger voltages close to the gap, quasiparticle tunneling dominates. This dissipative process modifies both the resonance frequency and the linewidth of the modes. A quantum treatment of this process in terms of Lamb shift and quantum jumps is required to quantitatively explain our measurements [3]. We show that the Lamb shift gives rise to a nonlinear spectrum of the resonator and that the loss rate induced by the junction can be exploited for the realization of quantum Zeno dynamics.References[1] M. Hofheinz et al. “Bright side of the coulomb blockade”. In: Physical Review Letters 106.21(2011). DOI: 10.1103/PhysRevLett.106.217005.[2] C. Rolland et al. “Antibunched Photons Emitted by a dc-Biased Josephson Junction”. In:Physical Review Letters 122.18 (2019). DOI: 10.1103/PhysRevLett.122.186804.[3] J. Esteve, M. Aprili, and J. Gabelli. “Quantum dynamics of a microwave resonator stronglycoupled to a tunnel junction”. In: (2018). arXiv: 1807.02364.

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ONLINE via Zoom

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