SFB/TRR 21 - Seminar

25. Juli 2012, Ulm

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The Cavity-Embedded Cooper-Pair Transistor: a Strongly Coupled Light-Matter System

The quantum mechanical interaction of light with matter has long been a source of fascination for physicists. Recent developments in superconducting electronics have deepened this fascination by extending the techniques of quantum optics to condensed matter systems, and allowing new regimes of light-matter interaction to be accessed. As an example, in our recent work we use the ac Josephson effect of a Cooper pair transistor to pump microwave photons into a high-Q microwave cavity. These cavity photons in turn have a strong backaction on electrical transport through the transistor, so that the cavity-embedded Cooper-pair transistor (cCPT) can only be viewed as a single quantum system with both electrical and photonic components. A rich interplay between electrical transport and photon emission arises, exhibiting both highly nonlinear dynamics and strong self-oscillations. The cCPT therefore provides an excellent platform for studying the quantum dynamics of a nonlinear system. Furthermore, it offers the promise of inducing strong light-matter interactions between microwave photons and other structures as nanomechanical resonators, perhaps even at the level of single quanta.

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