

# Kolloquium

## Theoretische Physik



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### Mesoscopic Quantum electrodynamics: from atomic-like physics to quantum transport

Cavity QED techniques have turned out to be instrumental to probe or manipulate coherently two level systems such as superconducting quantum bits. The success of this field relies on the implementation of a strong coupling between the two level systems and cavity photons. Recently, experiments on hybrid mesoscopic circuits embedded in coplanar microwave cavities have appeared [1, 2]. This architecture is appealing since new degrees of freedom can be used in the context of cavity QED. In the first part of this talk, I will discuss how the strong coupling between a single charge [3, 4, 5] or spin [6, 7, 8, 9] degree of freedom in a double quantum dot and cavity photons can be obtained.

Mesoscopic circuits are a model system for quantum transport and condensed matter phenomena due to the presence of fermionic reservoirs. In the second part of this talk, I will show that microwave cavities are a powerful probe in that context. For a quantum dot coupled to a superconducting contact, a microwave cavity reveals photo-emission due to quasiparticle tunneling, although this effect is too weak to be detected in a transport measurement [10]. A microwave cavity could also provide a new way to test the peculiar properties of Majorana bound states induced inside a spin-orbit coupled quantum nanowire by a superconducting contact [11].

References:

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