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Exploring the Physics of Semiconductor Quantum Dots using Circuit Quantum Electrodynamics ANNA STOCKKLAUSER, VILLE MAISI, THOMAS IHN, KLAUS ENSSLIN, ANDREAS WALLRAFF, ETH Zurich — Semiconductor quantum dots and superconducting qubits both possess excitations in the microwave domain for which a wide range of novel approaches to create, store, manipulate and detect individual photons have been developed. A key ingredient are coplanar waveguide resonators in which the field energy of an excitation is distributed over a small mode volume. This feature creates sizable electromagnetic fields at the level of individual microwave photons mediating strong electromagnetic interactions with a variety of quantum systems. In an approach known as circuit quantum electrodynamics (QED) we both probe fundamental quantum optical effects and demonstrate basic features of quantum information processing. In this presentation, I will discuss experiments exploring the physics of semiconductor quantum dots in the context of circuit QED. We investigate the coherent dipole coupling of double dots to microwave photons [1,2] and detect radiation emitted from the dots in inelastic electron tunneling processes. This approach may allow us to explore quantum coherent interfaces between semiconducting and superconducting qubits.

[1] T. Frey et al., Phys. Rev. Lett. 108, 046807 (2012)
[2] A. Wallraff et al., Phys. Rev. Lett. 111, 249701 (2013)

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