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Investigating the level broadening of a semiconductor charge qubit in microwave emission measurements A. STOCKKLAUSER, N. HEDRICH, V. F. MAISI, J. BASSET, K. CUJIA, C. REICHL, W. WEGSCHEIDER, T. IHN, K. ENSSLIN, A. WALLRAFF, ETH Zurich — We investigate a hybrid circuit quantum electrodynamics architecture in which a double quantum dot charge qubit is coupled to a nearby microwave cavity. The discussed experiments explore the emission of microwave radiation from a voltage-biased GaAs double dot similar to Ref. [1]. A superconducting coplanar waveguide resonator serves as a tool to study aspects of the quantum dot level structure that are difficult to access in transport measurements. We explore resonances in microwave emission that arise from inelastic interdot transitions resonant with the cavity [2]. In particular, the line width of the emission resonances is investigated and linked to the level broadening of the double dot charge qubit. We study the dependence of the emission line width on the tunnel rates to the leads and identify this as the dominant contribution to the broadening of the qubit levels. For the explored bias conditions qubit decoherence is low in comparison. We extract the tunnel rates to the leads from the linewidth of the emission signal and compare it with the tunnel rates extracted from current measurements.

[1] Y.-Y. Liu *et al.*, Phys. Rev. Lett. **113**, 036801 (2014).
[2] A. Stockklauser *et al.*, Phys. Rev. Lett. **115**, 046802 (2015).

Anna Stockklauser
ETH Zurich

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