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Flux qubit ultrastrongly coupled to two resonators A. BAUST, E. HOFFMANN, M. HAEBERLEIN, M.J. SCHWARZ, P. EDER, J. GOETZ, F. WULSCHNER, E. XIE, L. ZHONG, K. FEDOROV, E.P. MENZEL, F. DEPPE, A. MARX, R. GROSS, TU Muenchen, Nanosystems Initiative Munich and Walther-Meissner-Institut, Germany — Circuit quantum electrodynamics has not only become a versatile toolbox for quantum information processing, but is also a powerful platform for the investigation of light-matter interaction. The coupling strength between microwave resonators and qubits acting as artificial atoms can be tuned over several orders of magnitude and can even reach the regime of ultrastrong coupling.We present spectroscopic data of a flux qubit coupled galvanically to the signal lines of two coplanar stripline resonators. We discuss the complex mode spectrum and show that the coupling strength between the qubit and one resonant mode reaches 15% of the respective mode frequency. Noticably, the high coupling strength is reached solely by the geometric layout of the qubit without utilizing additional coupling elements such as Josephson junctions. Our data exhibit a pronounced Bloch-Siegert shift and therefore represent an experimental evidence for the breakdown of the Jaynes-Cummings model. This work is supported by the DFG via SFB 631, and EU projects CCQED and PROMISCE.

Alexander Baust
TU Muenchen, Nanosystems Initiative Munich and
Walther-Meissner-Institut, Germany

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