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Selection rules for multiphoton excitations in a qubit-resonator system F. DEPPE, T. NIEMCZYK, M. MARIANTONI, E. P. MENZEL, E. HOFFMANN, M. J. SCHWARZ, E. SCHUBERTH, A. MARX, R. GROSS, Walther-Meissner-Institut and TU Muenchen, Garching, Germany, E. SOLANO, Universidad del Pais Vasco and Ikerbasque Foundation, Bilbao, Spain — The theoretical analysis of a qubit-resonator system reveals selection rules at certain symmetry points of the qubit. In the case of a superconducting flux qubit, this symmetry of the double-well potential can be broken in a controlled way by changing the external magnetic field. Only then, odd and even multiphoton processes can coexist at the same flux bias. We illustrate this phenomenon with spectroscopy measurements of a superconducting flux qubit strongly coupled to an on-chip coplanar waveguide resonator. Our studies extend up to three-photon driving and clearly show the transition from strict selection rules to a regime of coexistent multiphoton excitations. We acknowledge support from SFB631, NIM, UPV/EHU Grant GIU07/40, and European project EuroSQIP.

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