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One- and two-photon spectroscopy of a flux qubit coupled to a microscopic defect ADRIAN LUPASCU[1], PATRICE BERTET[2], EDUARD DRIESSEN[3], KEES HARMANS, HANS MOOIJ, Delft University of Technology, The Netherlands, QUANTUM TRANSPORT GROUP TEAM — We observed the dynamics of a superconducting flux qubit coupled to a microscopic defect. The presence of the defect is visible as an anticrossing in the spectroscopy of the flux qubit, as measured using one-photon excitation. We analyze the energy- level structure of the combined qubit-defect system using both one- and two- photon spectroscopy. The use of two-photon spectroscopy allows us to extract important additional information about the anharmonicity and coupling of the defect. We find that the system coupled to the qubit can be a two-level system, but not a harmonic oscillator. We consider two basic models, for a microscopic defect which is coupled to the qubit either magnetically or electrically respectively. We conclude that the large coupling constant, of approximately 200 MHz, can only be accounted for by electric coupling, and not by magnetic coupling. This shows that electrically coupled microscopic two-level systems are relevant to decoherence of superconducting flux qubits.

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