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Observation of σ_x coupling signal in a gap-tunable flux qubit XIAOBO ZHU, NTT Basic Research Laboratories, ALEXANDER KEMP, SHIRO SAITO, HAYATO NAKANO, KOUICHI SEMBA — We experimentally demonstrate the *in situ* tunability of the gap of a superconducting flux qubit, which was achieved by replacing the smallest Josephson junction of the qubit with a dc-SQUID. We observe different gaps as a function of the external magnetic pre-biasing field and the local magnetic field through the dc-SQUID controlled by high-bandwidth on chip control lines. The persistent current and gap behavior agree well with the numerical simulation results. We set the sensitivity of the gap on the control lines during the sample design stage. With a tuning range of several gigahertz on a qubit dynamics timescale, we observe coherent system dynamics at the degeneracy point [1]. We measured the microwave amplitude dependence of Rabi frequency at the same resonant frequency but at different flux bias of the gap-tunable flux qubit. It showed a systematical deviation between these two set of data, which indicated we observed σ_x coupling signal between the flux qubit and the microwave-line. Different from conventional σ_z coupling, this σ_x coupling has a remarkable merit toward realization of idea QND measurement.

[1] Xiaobo Zhu, Alexander Kemp, Shiro Saito, and Kouichi Semba, APPLIED PHYSICS LETTERS 97, 102503 (2010).

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