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Dispersive coupling between a surface-acoustic-wave resonator and a superconducting qubit. ATSUSHI NOGUCHI, REKISHU YAMAZAKI, Research Center for Advanced Science and Technology, University of Tokyo, JST, PRESTO, YUTAKA TABUCHI, KOJI USAMI, Research Center for Advanced Science and Technology, University of Tokyo, YASUNOBU NAKAMURA, Research Center for Advanced Science and Technology, The University of Tokyo, Center for Emergent Matter Science, RIKEN — Hybrid quantum systems involving superconducting qubits are widely investigated in quantum information science. Surface-acoustic-wave (SAW) devices can be another low-loss physical system and a candidate for the component. The strain caused by a SAW can couple to varieties of physical systems, such as microwaves, optical electromagnetic fields and NV centers through piezo and other elastic effects. Here we propose a dispersively-coupled quantum system consisting of a high-Q SAW resonator (resonant frequency: 300 MHz) and a superconducting transmon qubit (3.5 GHz) on a quartz substrate. The qubit is also coupled to a microwave coplanar waveguide resonator (5.5 GHz) for the measurement. The coupling strength χ between the SAW resonator and the qubit is expected to be around 10 kHz, which is larger than the decay rate of the SAW resonator, about 300 Hz, already achieved in our experiment at a dilution-fridge temperature.

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