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Large Dispersive Shift of Cavity Resonance Induced by a Superconducting Flux Qubit in the Straddling Regime[1] KUNIHIRO INOMATA, RIKEN Advanced Science Institute, Japan, TSUYOSHI YAMAMOTO, NEC Smart Energy Research Laboratories and RIKEN, Japan, PIERRE-M. BILLANGEON, ZHIRONG LIN, RIKEN Advanced Science Institute, Japan, YASUNOBU NAKAMURA, The University of Tokyo and RIKEN, Japan, JAW-SHEN TSAI, NEC Smart Energy Research Laboratories and RIKEN, Japan, KAZUKI KOSHINO, Tokyo Medical and Dental University, Japan — We demonstrate enhancement of the dispersive frequency shift in a coplanar waveguide resonator induced by a capacitively coupled superconducting flux qubit in the straddling regime. The magnitude of the observed shift, 80 MHz for the qubit-resonator detuning of 5 GHz, is quantitatively explained by the generalized Rabi model which takes into account the contribution of the qubit higher energy levels. By applying the enhanced dispersive shift to the qubit readout, we achieved 90% contrast of the Rabi oscillations which is mainly limited by the energy relaxation of the qubit. We also discuss the qubit readout using a Josephson parametric amplifier.

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Kunihiro Inomata
RIKEN Advanced Science Institute, Japan

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