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Realization of an Impedance-Matched Λ System Using an Artificial Atom[1] KUNIHIRO INOMATA, RIKEN Center for Emergent Matter Science, Japan, KAZUKI KOSHINO, College of Liberal Arts and Sciences, Tokyo Medical and Dental University, Japan, YASUNOBU NAKAMURA, RIKEN and Research Center for Advanced Science and Technology, The University of Tokyo, Japan, ZHIRONG LIN, RIKEN Center for Emergent Matter Science, Japan, WILLIAM D. OLIVER, MIT Lincoln Laboratory, USA, JAW-SHEN TSAI, TSUYOSHI YAMAMOTO, RIKEN and NEC Smart Energy Research Laboratories, Japan — We realize an impedance-matched Λ-type three-level system using dressed states in a circuit QED system, where a superconducting flux qubit and a coplanar waveguide resonator are coupled capacitively. Under an appropriate choice of microwave frequency and intensity for the qubit drive, two radiative decay rates from the upper level to the lower two levels in the Λ system become identical, and the impedance-matched Λ system is realized. Perfect absorption and nearly deterministic down-conversion of the incident microwave photons are theoretically expected in this system. We experimentally observe that the incident microwave is perfectly absorbed and is down-converted by 64 MHz corresponding to detuning between the qubit transition and the qubit drive. The down-converted signal is amplified by a Josephson parametric amplifier, and the power spectrum is directly detected. The conversion efficiency of $\sim 75\%$ has been obtained.

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Kunihiro Inomata
RIKEN Center for Emergent Matter Science, Japan

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