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Estimation of the projection error of a qubit readout by quantum Zeno effect KOSUKE KAKUYANAGI, YUICHIRO MATSUZAKI, HAYATO NAKANO, NTT Basic Research Laboratories, KOUICHI SEMBA, National Institute of Information and Communications Technology, SHIRO SAITO, NTT Basic Research Laboratories — In a quantum system, frequent projection operations can suppress a specific kind of time evolutions that show quadratic behavior in a time domain. This phenomenon is known as quantum Zeno effect (QZE). Normally, projection operations freeze the qubit state so that the qubit remains in the initially prepared state such as a ground state or an excited state. However, if a projection error occurs, qubit state is flipped. In this case, frequent projection operations do not keep qubit state. This means that, by investigating the efficiency of the QZE, we can in principle estimate the projection error rate of the qubit readout system. A Josephson bifurcation amplifier (JBA) readout method provides us a way to perform fast and low back-action superconducting qubit readout. We fabricate a sample that has a JBA resonator coupled to the superconducting flux qubit. By using this sample, we demonstrated QZE by applying multiple readout pulses during Rabi oscillations. Because of the multiple readout pulses, Rabi oscillation was suppressed and the qubit was kept in its initial state. From the holding time of the state via the QZE, we concluded that the projection error of the JBA readout is less than 2%.

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