

量子ビット読み出しのためのトンネルダイオードを用いた極低温回路の改良
Improvement on the cryogenic circuit with tunnel-diode for qubit read-out

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One of the key features required to realize a fault-tolerant scalable quantum computer is the integration of integration of reliable and energy-efficient electronics for qubit control and readout. Recently, qubit control electronics have been successfully integrated using cryogenic CMOS technology [1,2,3] and superconducting Josephson junctions [4]. Compared to cryogenic CMOS devices and superconducting Josephson junction circuits, the tunnel-diode circuits have a relatively small device sizes ($\sim 4 \text{ cm}^2$) and lower power dissipation ($\sim 1 \mu\text{W}$).

We present recent development and experimental result of readout electronics using tunnel-diode cryogenic circuit. The operating temperature range between 4 K to 30 mK. The oscillating frequency reaches $>100 \text{ MHz}$. The phase noise was measured to be -20 dBc/Hz at offset frequency 10 Hz and -80 dBc/Hz at offset frequency 1 MHz.

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