
Thesis Title : 3D Superconducting Transmon Qubit

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Abstract :

Superconducting Qubits are a promising candidate for quantum computing. The use of a Transmon qubit coupled with a high quality 3D superconducting cavity greatly increases its coherence time in comparison to some other implementations of superconducting qubits. A transmon qubit is realised by shunting the Josephson Junction with a large capacitance which decreases charge noise exponentially while maintaining the necessary anharmonicity to access only 2 levels of the system. In this thesis, spectroscopic measurement of the reflection coefficient of a rectangular aluminium cavity using a VNA is used to characterize its quality factor. The coupling quality factor is tuned at room temperature by trimming the length of the connector pin which probes the cavity. At superconducting temperatures of 20 mK, the quality factor is found to be ≈ 1 million. The transmon qubit and its interactions with the cavity are discussed. The dynamics of the transmon-cavity system and methods to characterize the coherence times are presented.
