Contribution ID: **48** Type: **not specified**

Study of Two-Level System Defects in Transmon Qubits

A major source of decoherence in superconducting qubits is believed to be due to defects that manifest as two-level systems (TLS) present in qubit materials. In this work, we have investigated TLS defects in planar transmon qubits. We probed TLS defects in our qubits spectroscopically by utilizing microwave pulse sequences that shift the qubit g-e transition into resonance with the defects. We compared the obtained spectral data between the differently fabricated qubits. In our spectroscopic experiments we found spectral features of varying lineshapes and temporal dynamics attributable to TLS defects. The resolved TLS defects exhibited telegraphic and diffusive dynamics, ranging from sub-minute-scale jumps to hour-scale drifts. We also found connections between the presence of TLS defects and the parameter fluctuations of our qubits. Notably, the fluctuations were present as qubit-TLS interactions that could affect the qubit T1 and T2 times by an order of magnitude while also causing instabilities in the qubit g-e transition frequency. Our results provide an insight into the relevance of optimizing fabrication when considering the prevalence of TLS defects and their impact on qubit coherence characteristics.

Primary author: DATTA, Debopam (VTT Technical Research Center of Finland, Espoo, 02150)

Session Classification: Poster Session