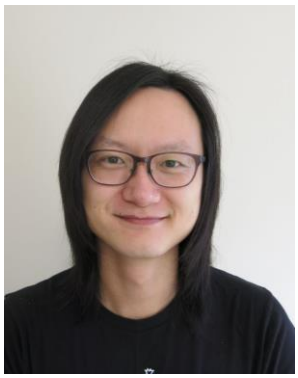
Revised

Phonon engineering of TLS defects in superconducting circuits (onsite and online)

Joint Seminar organized by the Department of Mechanical Engineering and Department of Physics

Date: 20 July, 2023 (Thursday)
Time: 11:00 a.m. (Hong Kong Time)
Venue: Room 7-34, Haking Wong Building HKU



Speaker: Dr Mo Chen
Department of Applied Physics and the Institute for Quantum Information and Matter, California Institute of Technology

Zoom Online Lecture:
https://tinyurl.com/4388jkv4

Meeting ID: 999 1728 1377
Password: 302040

Abstract:

Material defects are ubiquitous. Seven decades ago, defects challenged the new-born semiconductor industry, and today they are one of the major roadblocks for quantum technologies. Solid-state quantum devices, in particular, superconducting qubits, stand out as one of the leading platforms for fault-tolerant quantum computing. However, the performance of superconducting qubits is limited by the presence of various microscopic forms of two-level state (TLS) defects in the amorphous surfaces of the materials that make up the qubits. Previous attempts to address this issue mostly focused on circuit designs that reduced the negative impact of TLS.

In this seminar, I will introduce an orthogonal approach that engineers the primary phonon bath of the TLS, and in doing so, turns the TLS into a coherent, useful quantum resource in the toolbox of superconducting quantum circuits. First, I will introduce a hybrid platform which embeds the superconducting circuits and TLS within an acoustic metamaterial design that features a GHz-wide acoustic bandgap at microwave frequencies. This bandgap structures the acoustic bath of TLS, suppresses direct phonon emission from TLS, and extends their relaxation time by two to three orders of magnitude, with the longest T1 exceeding 5 ms. Next, I will discuss quantum sensing of individual low-frequency TLS fluctuators (MHz) in this hybrid platform, using the long-lived TLS as a probe to gain further insights into the defect physics.

Biography:

Mo Chen is a postdoctoral scholar in the Department of Applied Physics and the Institute for Quantum Information and Matter at the California Institute of Technology. He received his B.S. in Optics from Fudan University in 2012 and his S.M. and Ph.D. in Mechanical Engineering from the Massachusetts Institute of Technology in 2015 and 2020, respectively. His research interests are focused on gaining a fundamental understanding of device physics and applying that knowledge to engineer novel quantum devices, such as qubits, quantum sensors, and quantum memories.

ALL INTERESTED ARE WELCOME

For further information, please contact Prof. Nicholas Fang at 3917 2639.