Quantum piezoacoustics: From Low-dimensional electrons to qubits

Our research group is working on creating and discovering electronic quantum states of matter in low-dimensional electron systems and controlling tailor-made quantum circuits.

I will discuss our work developing hybrid piezoacoustic devices for coupling high frequency microwaves to two-dimensional electron systems. In particular I will highlight our recent results demonstrating *in situ* gate-tunable acoustoelectric transport in exfoliated monolayer graphene by measuring the voltage created as high-frequency surface acoustic waves dynamically drive charge carriers in the graphene. We employ a flip-chip device configuration to conduct these acoustoelectric measurements while simultaneously controlling the graphene carrier density with a metal-oxide back-gate.

I will also describe our efforts to couple this hybrid piezoacoustic devices to superconducting circuit based quantum bits and to a unique low-dimensional electron system formed by trapping an ensemble of electrons in vacuum above the free surface of superfluid helium.