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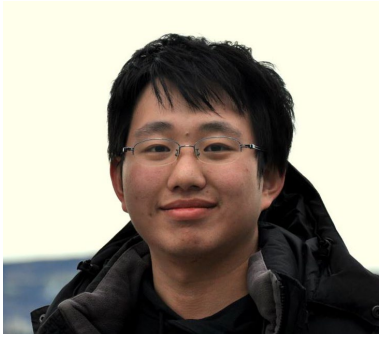
Integrated Quantum Acoustics: From Phoonic Atoms to Quantum interfaces

Linbo Shao
Virginia Tech



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Zoom: https://purdue-edu.zoom.us/j/99252077596

Abstract
Future heterogeneous quantum architectures require connecting diverse physical systems--superconducting qubits for computation, solid-state spins for memory, and optical photons for networking. Microwave-frequency acoustic waves (phonons) offer a universal platform to bridge these domains due to their compact wavelength, long coherence times, and versatile coupling. In this talk, I present an integrated quantum acoustics platform harnessing these advantages. First, we realize on-chip "phononic atoms" using phononic crystal resonators on lithium niobate. Leveraging the electro-acoustic effect, we demonstrate cavity quantum acoustodynamics (cQAD), including Autler-Townes splitting, AC Stark shifts, Rabi oscillations, and non-reciprocal frequency conversion. Second, I discuss how integrated phonons act as essential quantum interfaces. I will detail the acoustic driving of diamond silicon-vacancy (SiV) centers and the acoustic-wave-mediated microwave-to-optical converter, highlighting how phonons link atomic systems, microwaves, and light.

Bio
Linbo Shao is an Assistant Professor in the Bradley Department of Electrical and Computer Engineering at Virginia Tech since 2022. He is also affiliated with Department of Physics and Virginia Tech Center for Quantum Information Science and Engineering (VTQ). He received his Ph.D. in Engineering Science in 2019 and M.S. in Applied Physics in 2016 from Harvard University, and B.S. in microelectronics in 2014 from Peking University. He served as lead-PI for DARPA OpTIm and SynQuaNon DO programs, as well as research contracts from industry including Toyota and Raytheon. His broad research interests include lithium niobate integrated acoustic-wave, optical, and acousto-optic devices for sensing, computing, and quantum applications; diamond color centers and emerging solid-state emitters; and cryogenic electronics for quantum infrastructure.

Host
Associate Professor Joseph M. Lukens, jlukens@purdue.edu