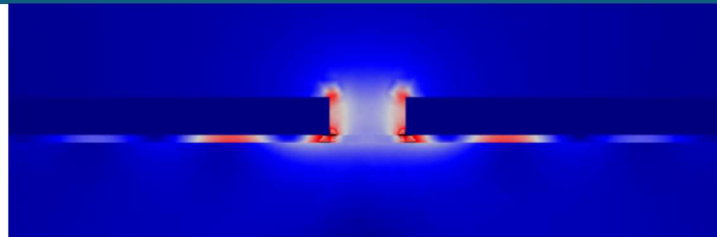
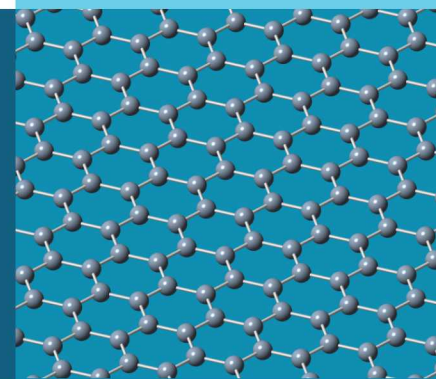




Designer Phonons

Infrared Functionality via Vibration



Thomas Beechem

Team

SNL: A. Jarzembksi, E. Paisley, C. Saltonstall, J. Shank, S. Smith

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PSU: JP Maria, R. Engel-Herbert

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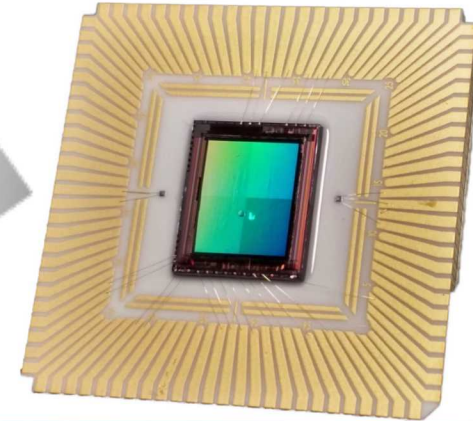


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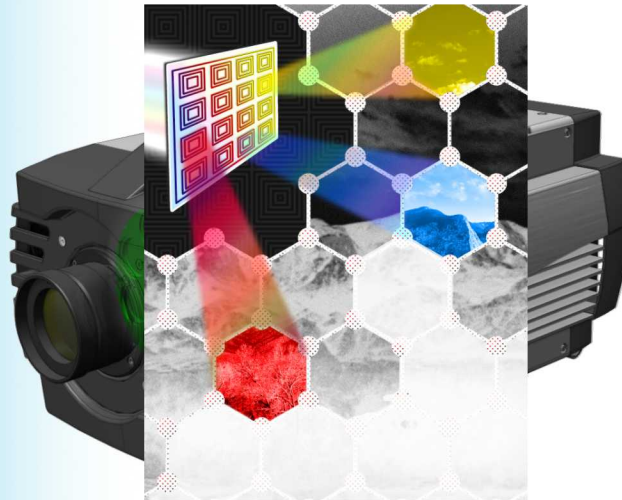
Vision: Dynamic Multi-Functional IR Sensing



Imagine



Right Now



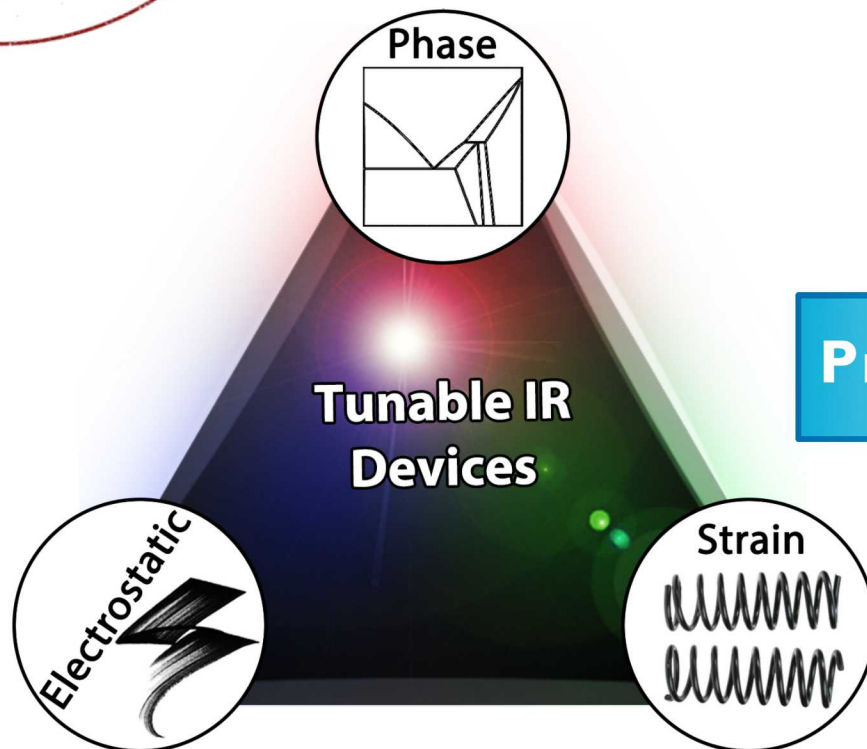
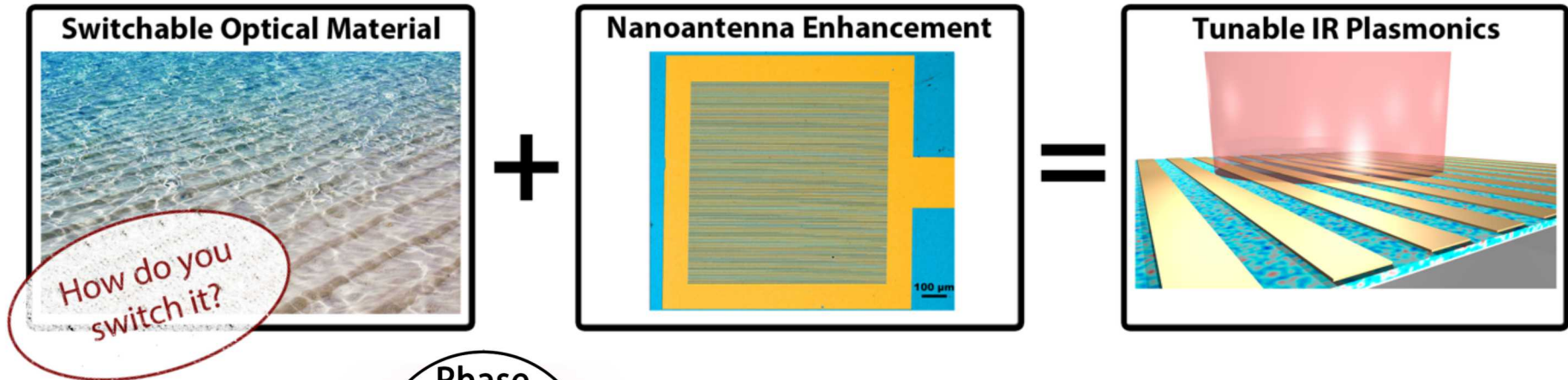
Problems:

1. One color for whole array
2. Moving Parts



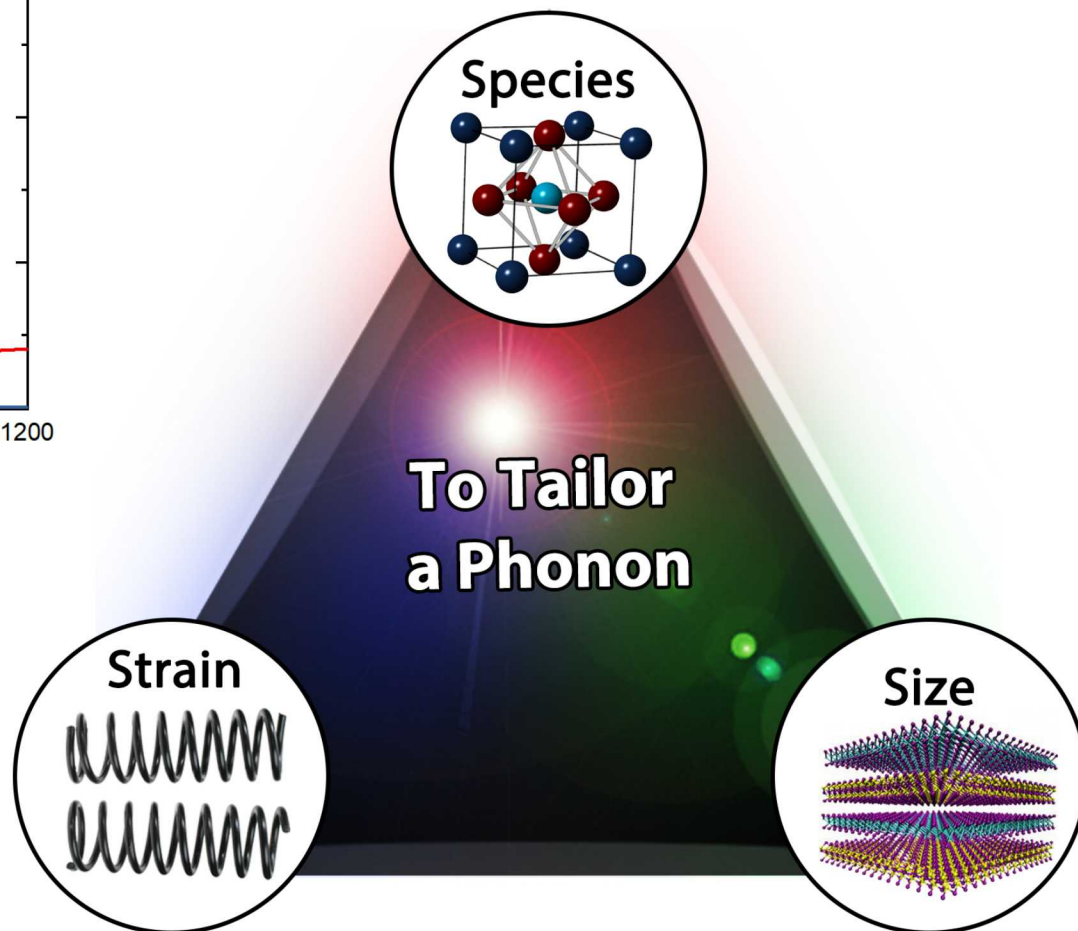
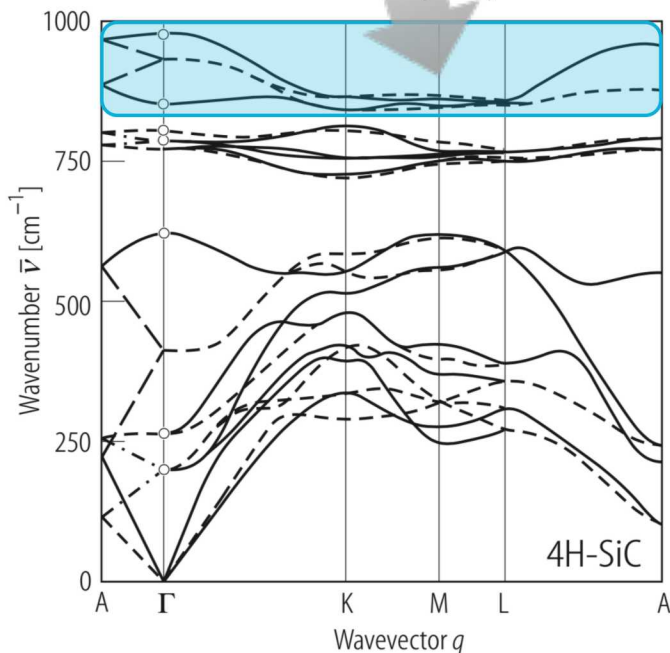
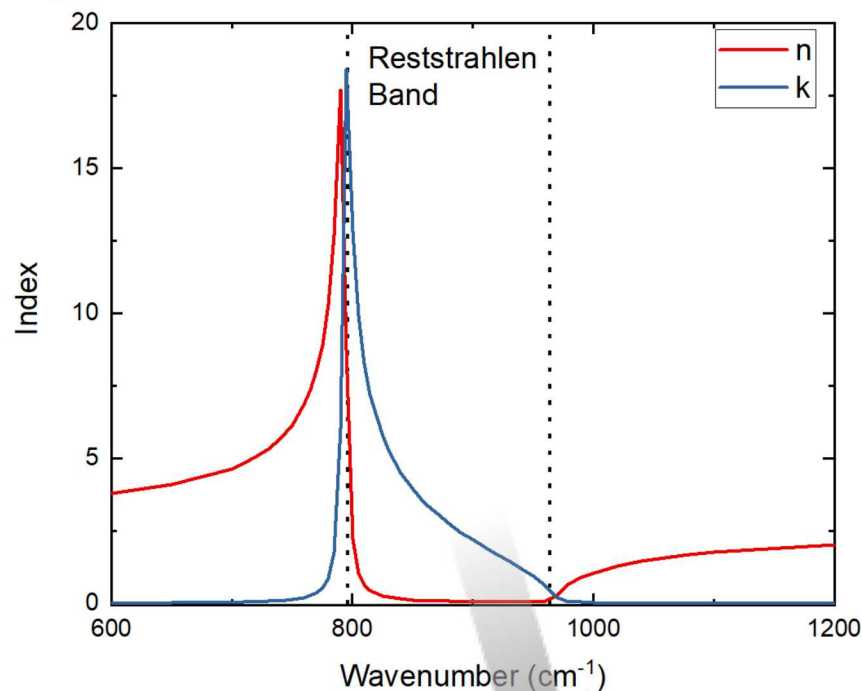
Tuning Light with Vibration

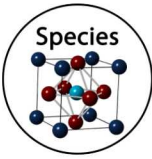
Need: Dynamic, Tunable, Infrared Devices



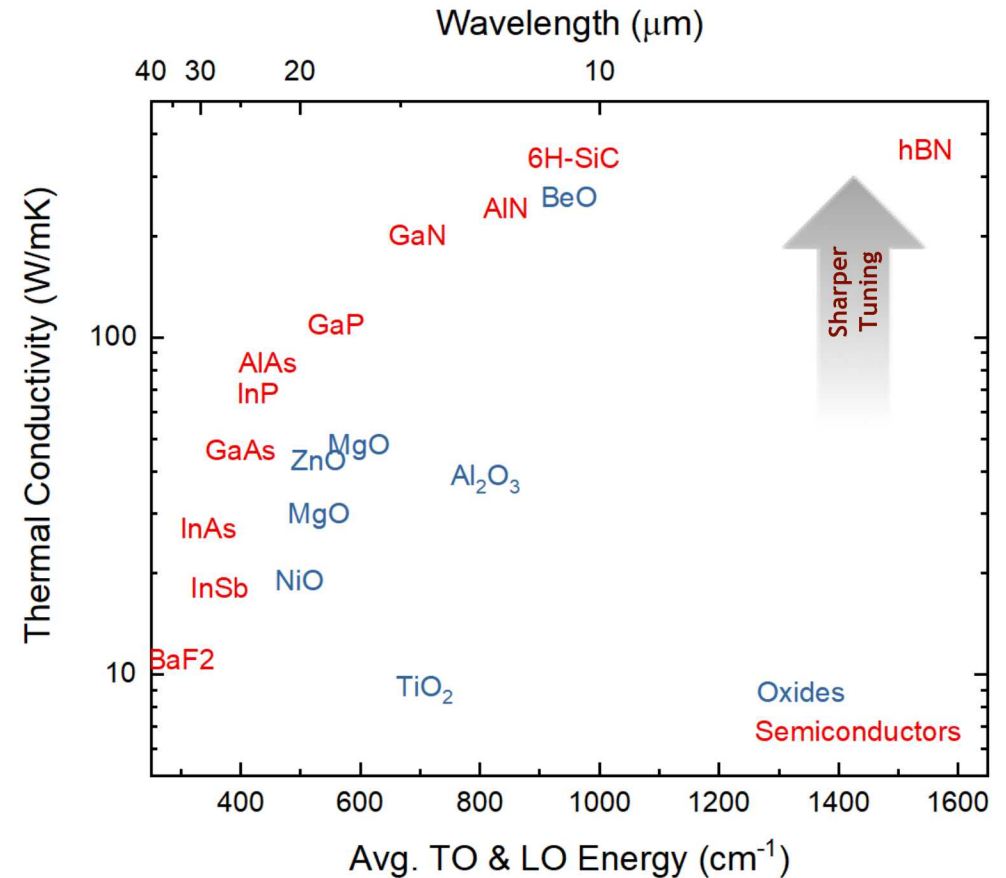
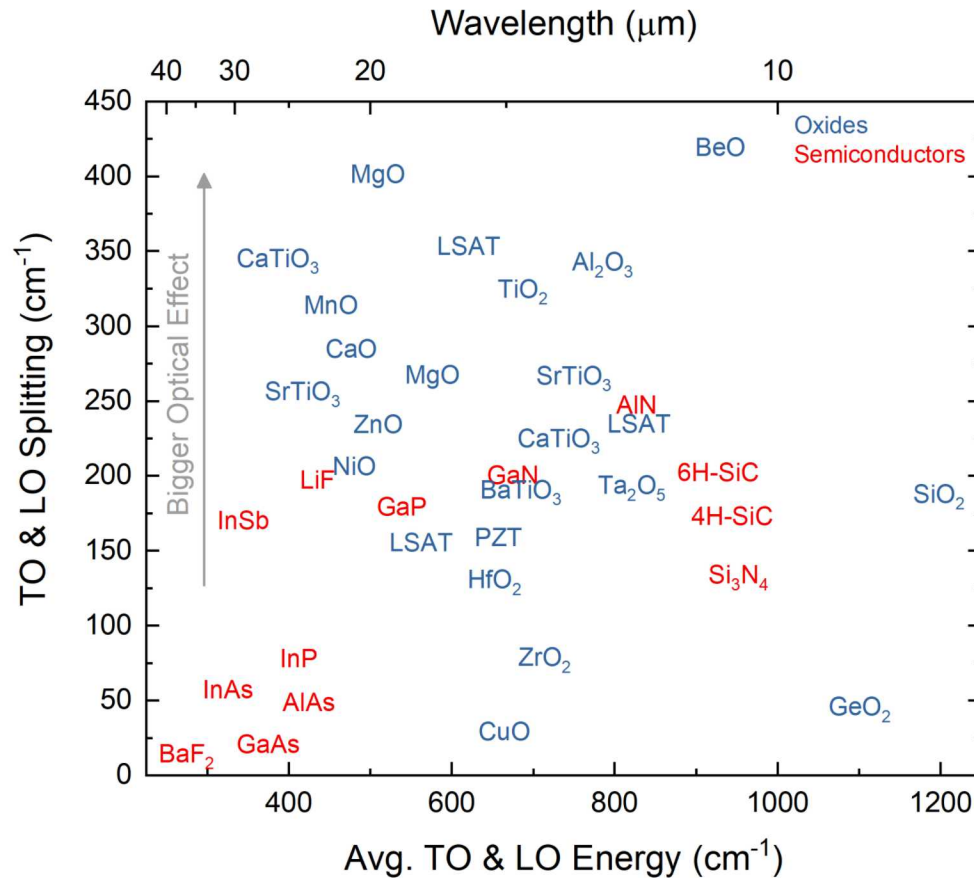
Premise: Phonons for tuning

Idea: Designer Phonons for Infrared Optics

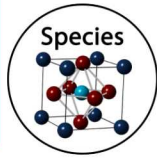




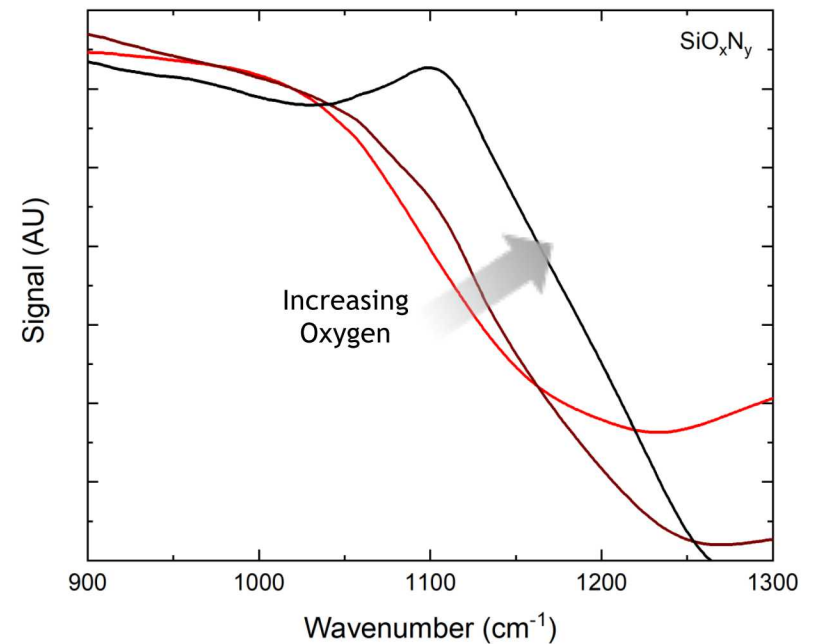
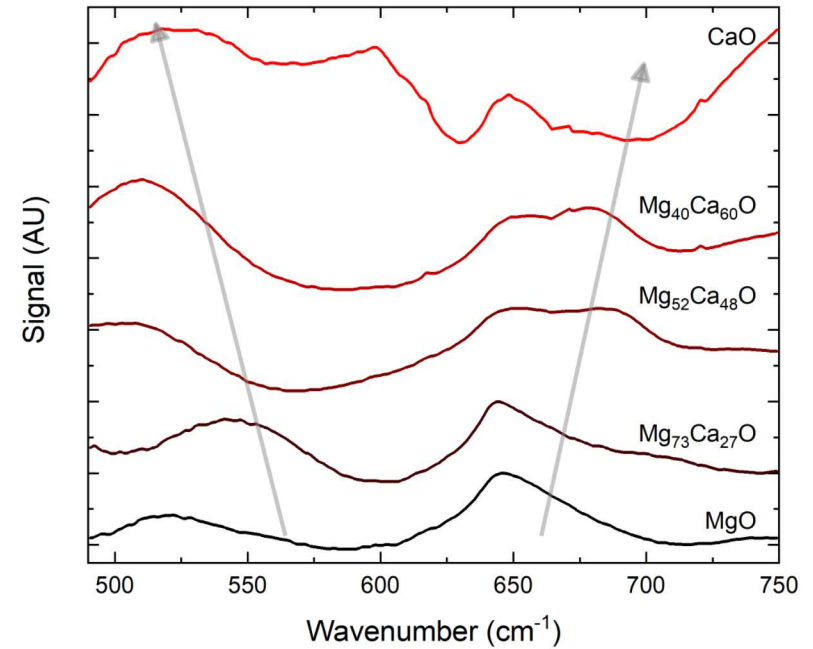
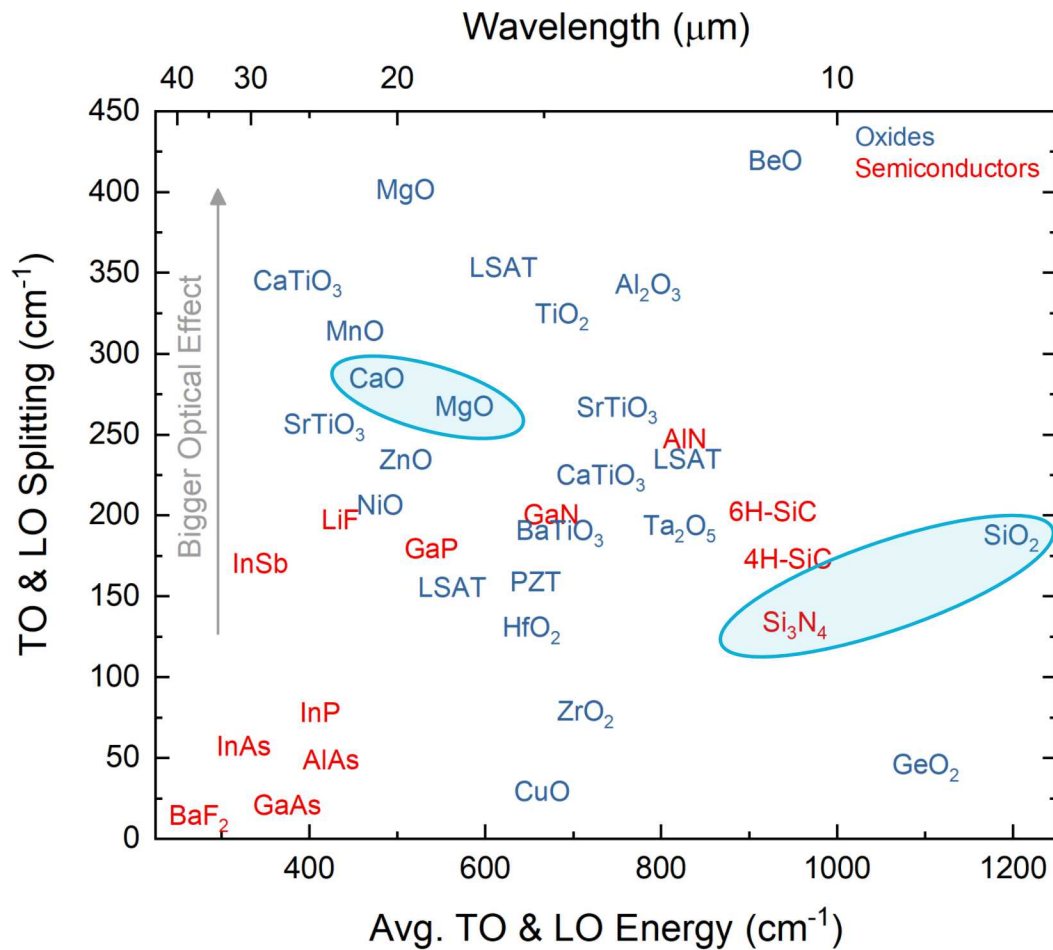
Phonon's Optical Vista

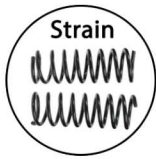


Question: Can you design them?



Designing Optical Response via Phonon Alloys

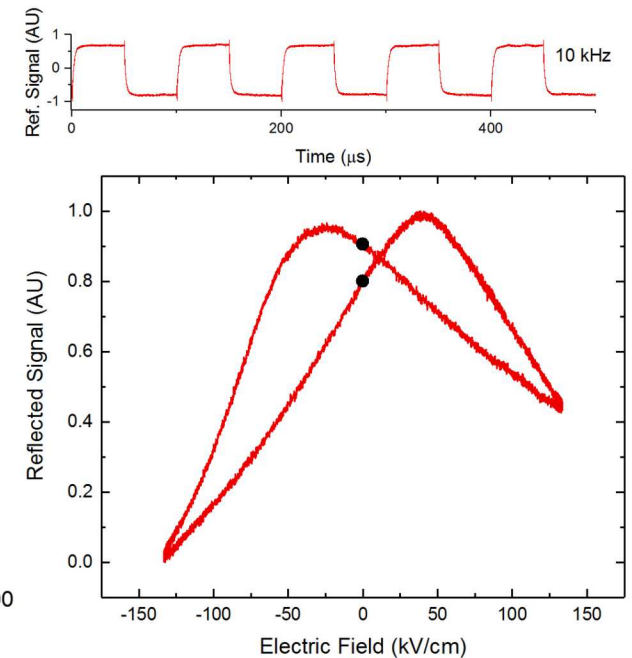
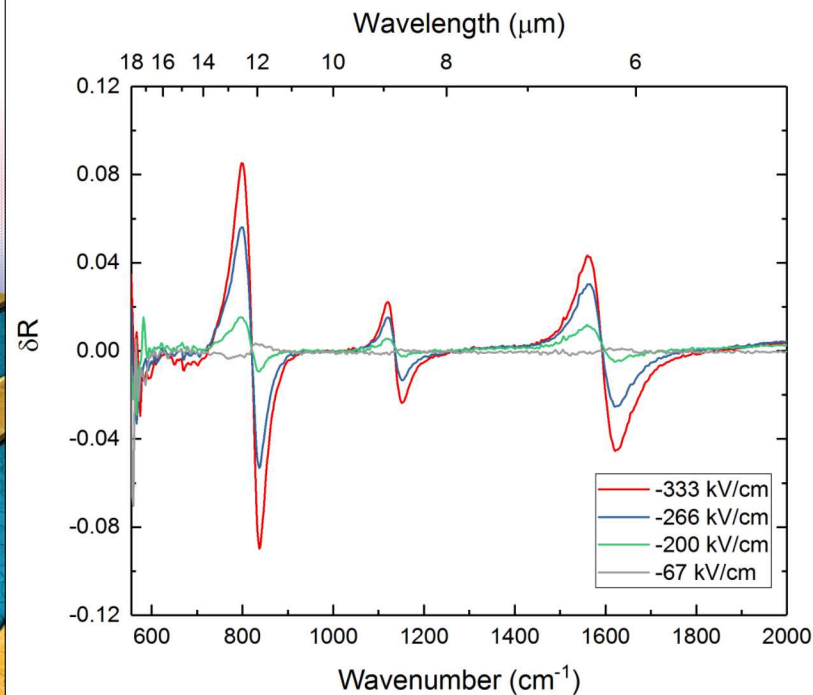
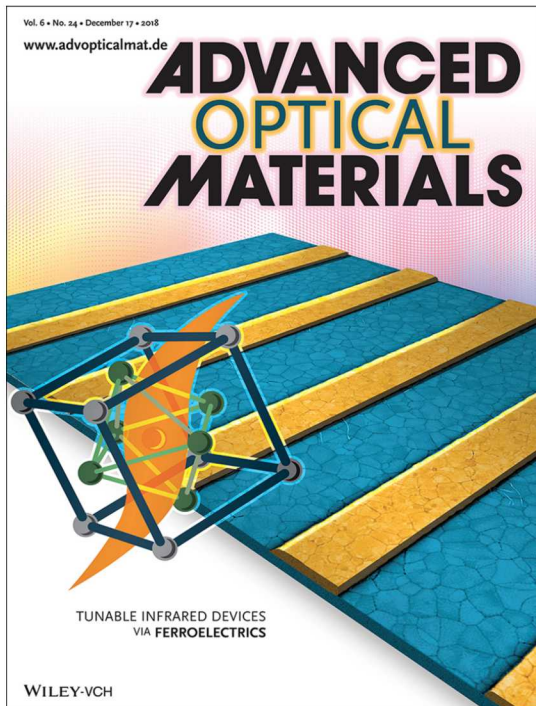
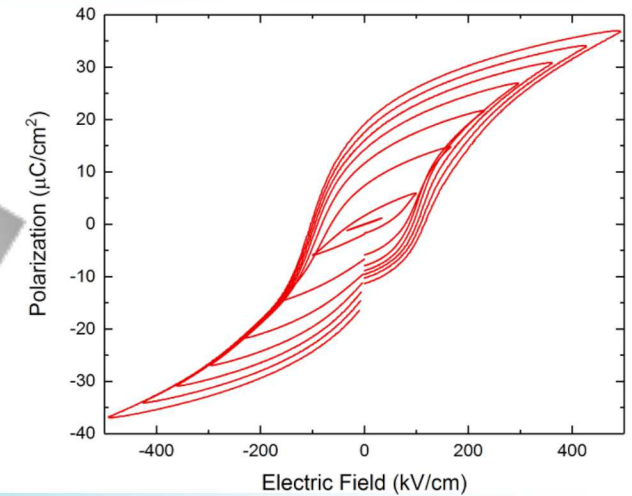
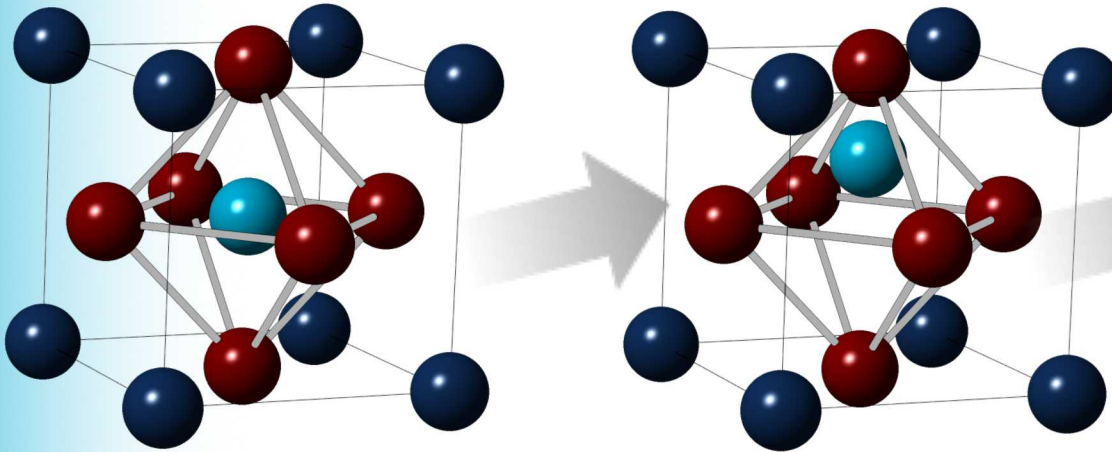


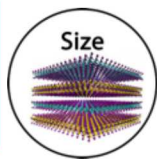


Tunable Plasmonics via Tunable Phonons



Affects Phonons?





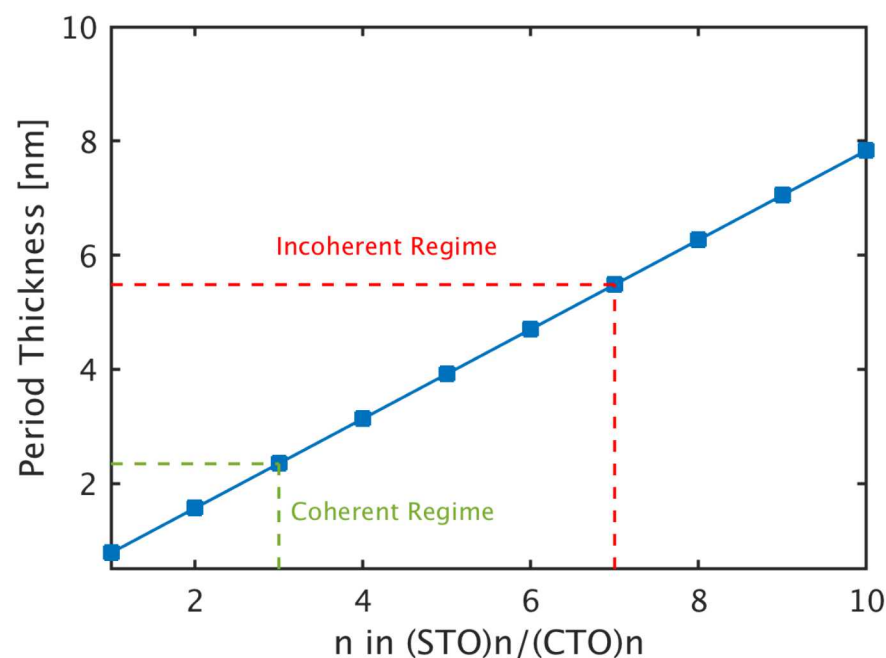
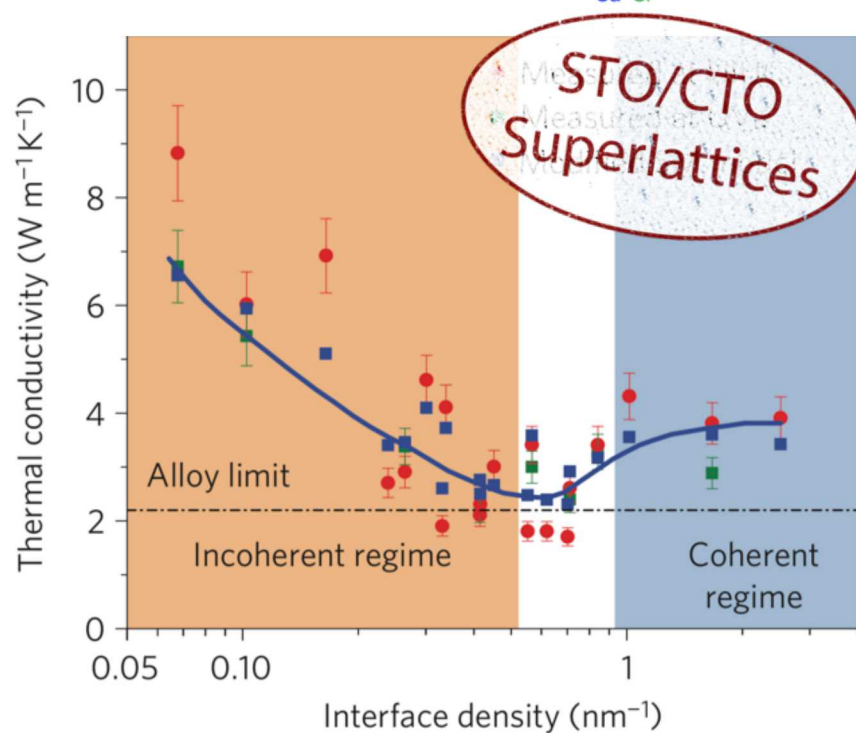
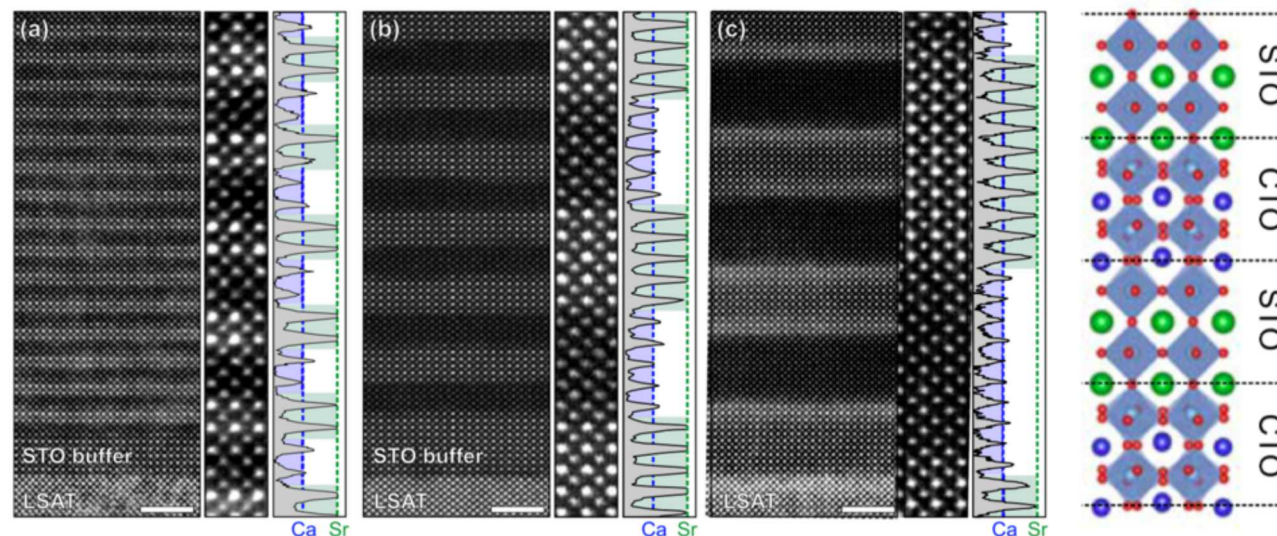
Coherency in Optical Response



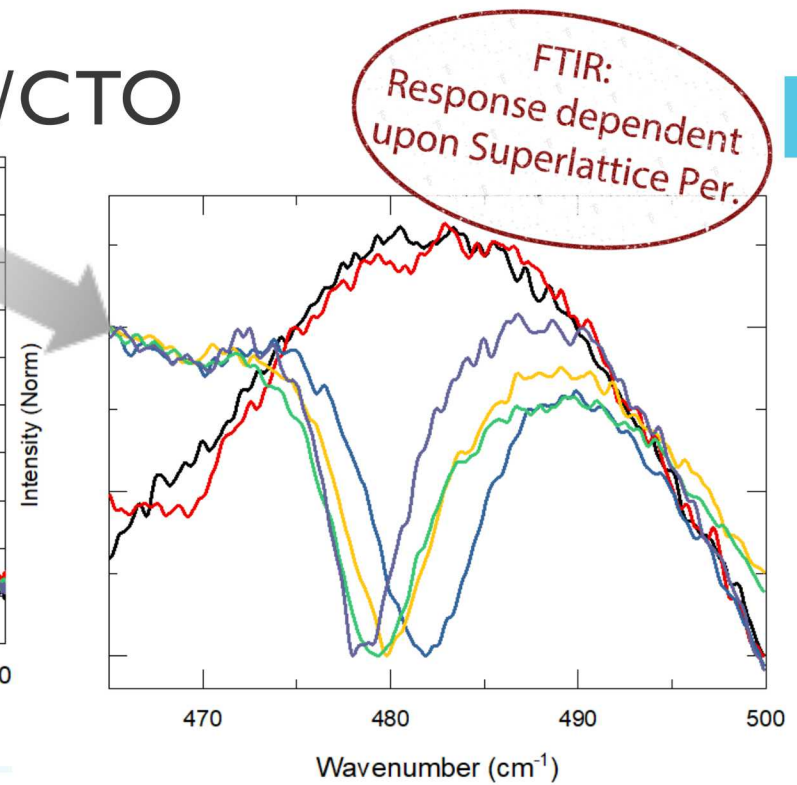
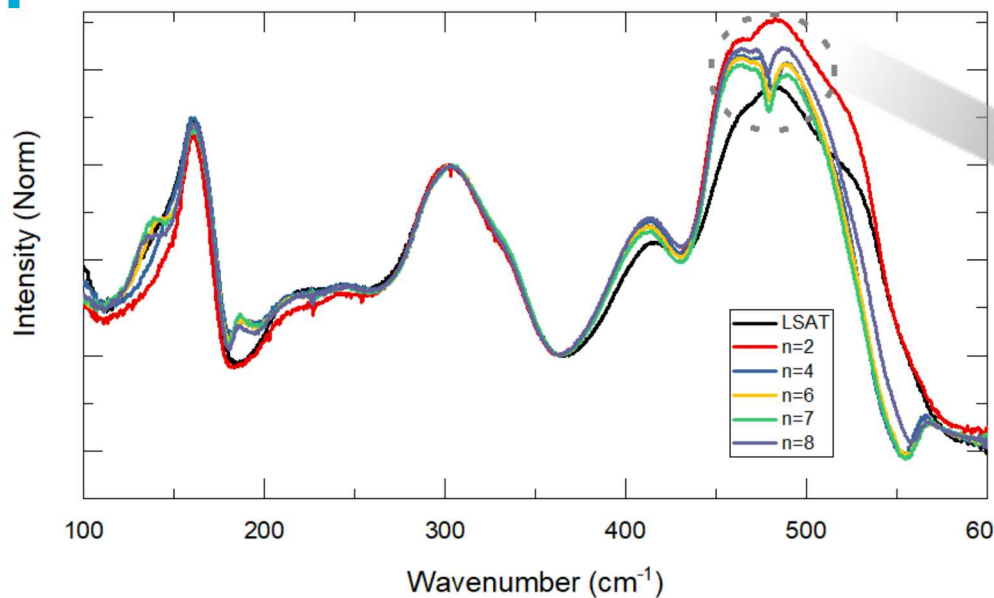
PennState

VANDERBILT UNIVERSITY

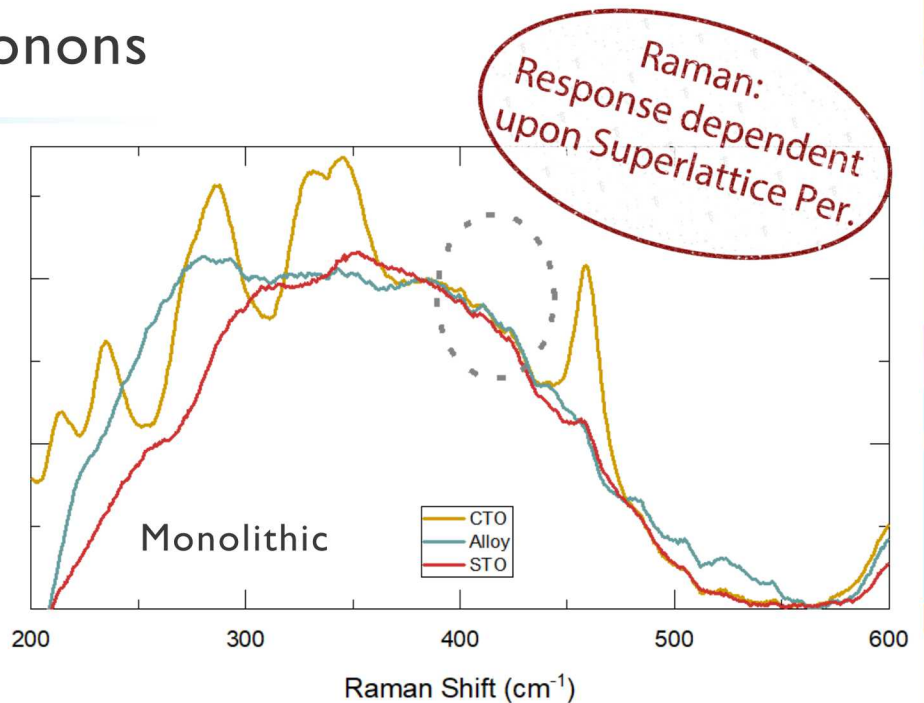
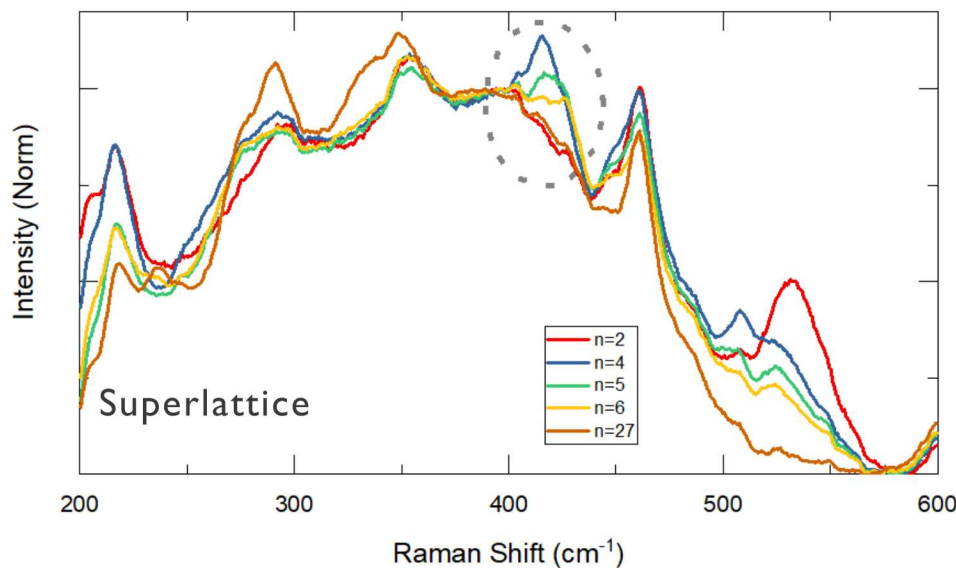
UNIVERSITY of VIRGINIA



9 Epitaxial Superlattices: STO/CTO

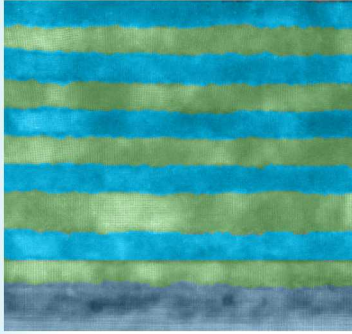


Takeaway: Periodicity changing phonons



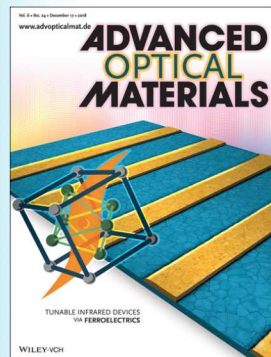


Premise



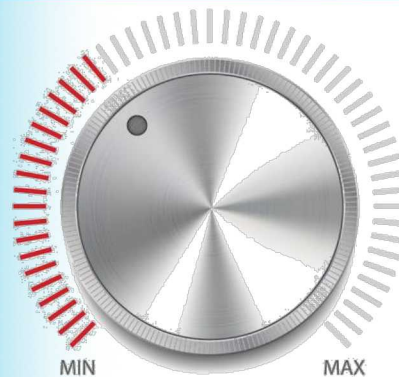
Phonons impact optical properties.
Tailoring phonons sculpts optical functionality

Path



Designer phonons for metasurfaces
Designer metasurfaces using phonons

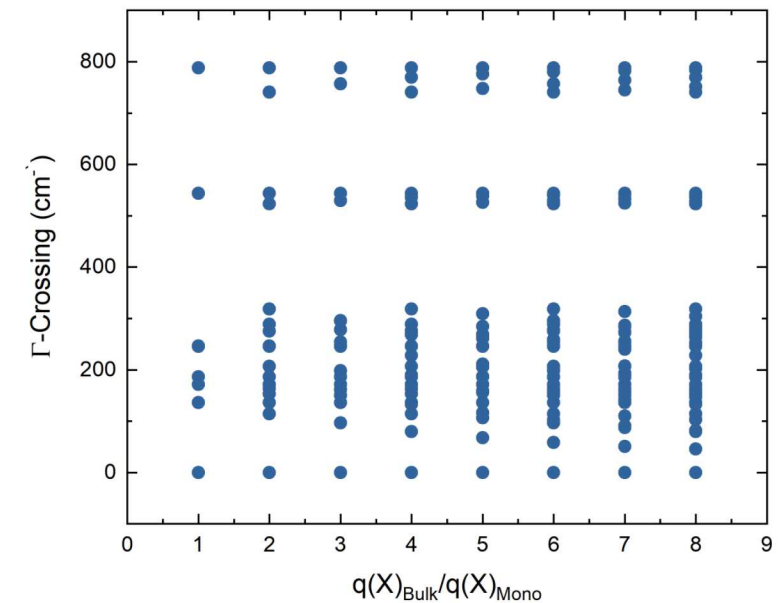
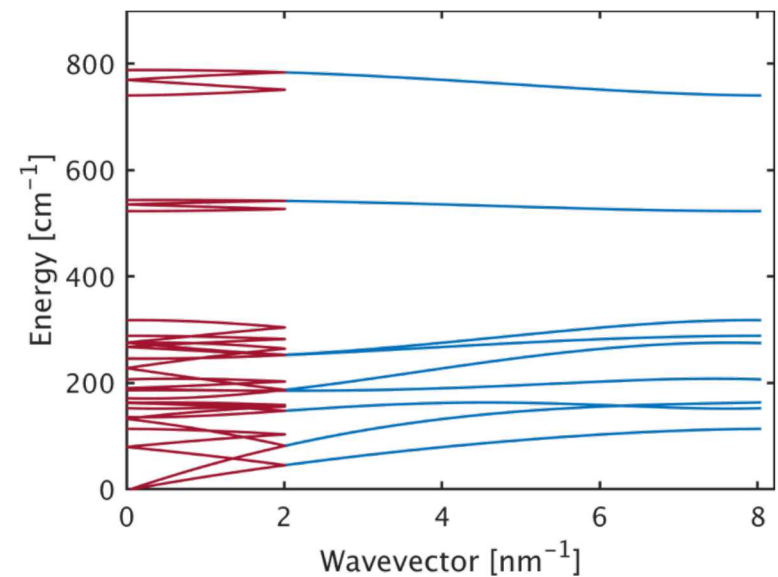
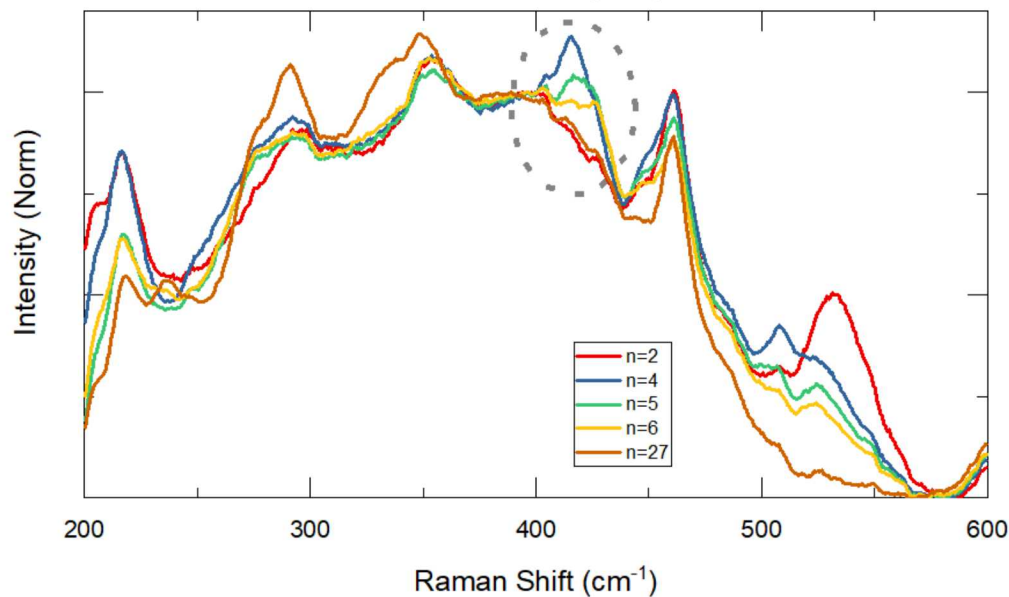
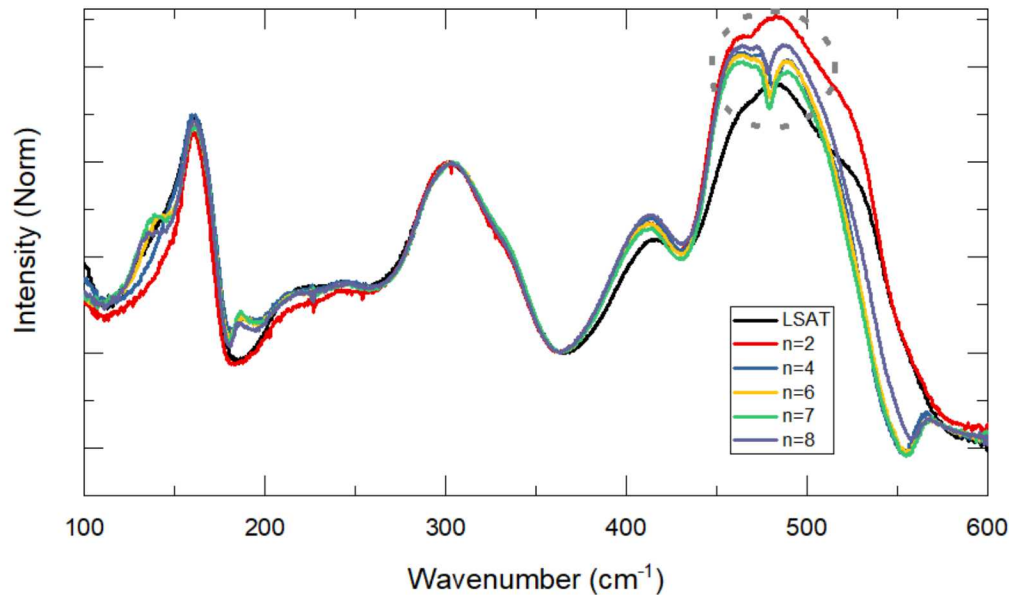
Pursuit



Knobs to:
Manipulate phonon modes
Probe phonon physics
Create functionality



Hypothesis 1: Formation of “coherent” superlattice phonon modes



Possibilities...Coherence & Localization

Hypothesis 2: Localization in 3 flavors

