2023 Seed Intellectual Merit
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Structured Strain and Deformations in Van der Waals Quantum Material Heterostructures

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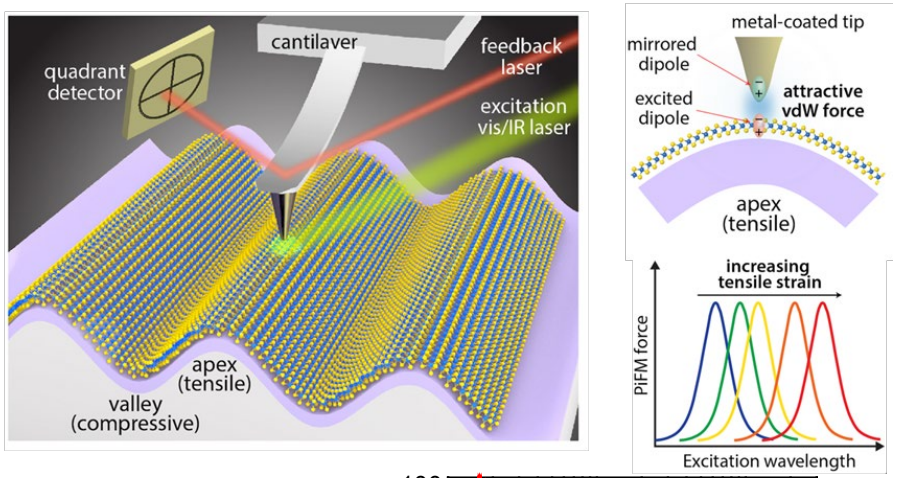
Achievements:

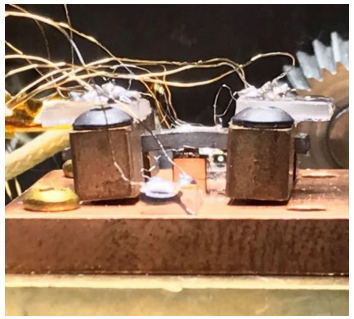
- Demonstration of topological phase transitions induced in $HfTe_5$ by uniaxial strain
- Demonstration of a new technique to control heterostrain in vdW multilayers via AFM nanomanipulation
- Demonstration of photo-induced force microscopy (PiFM) coupled with tunable visible illumination to map and spectroscopically analyze effects of strain on optical properties.

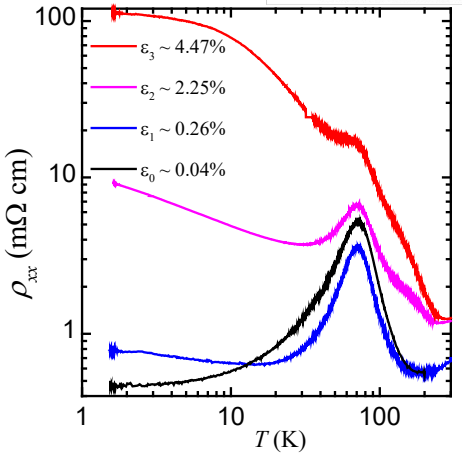
Importance: Due to the weak interlayer bonding in van der Waals (vdW) layered materials, neighboring atomic layers can support large differences in strain. Such heterostrain, offers a unique way to modify electronic and optical properties of vdW quantum materials. This seed project's achievements offer major advancements in both the control and characterization of heterostrain, as well as showing dramatic changes in topological electronic properties induced by strain.

These results set the stage for a new IRG focused on the effects of heterostrain and deformations in multilayer vdW materials.

Strain-induced Absorption Shift in PiFM







topological phase transition induced by strain

Glavin NR, **Nam S**, "2D layered materials and heterostructures: Past, present, and a bright future", *Matter*, **6**, 4 (2023). https://doi.org/10.1016/j.matt.2022.11.030