Strain Engineering Moiré Excitons in 2D Heterostructures

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Tunable-moiré superlattices hold potential for programmable quantum emitters, exotic quantum phases and resonant-hybridization of excitonic states. In this poster, I will discuss our results on strain-tuning interlayer and intralayer moiré excitons in 2D Transition Metal Dichalcogenides (TMDCs). Employing electrostatic actuation [1], we apply upto 2% controllable, tensile strain to suspended heterobilayers at 5K. Photoluminescence and reflectivity measurements reveal the excitonic energies to be red-shifting with different strain gauges on the order of tens of meV/%, thus enabling fingerprinting of valley-character for moiré excitons [2]. We also exhibit control over many-body interactions showing i) energetic resonance between inter- and intralayer moire species, and ii) strain-tunable dipolar interactions between interlayer excitons.

References

[1] Hernández López, P. et al. Nat Commun **13**, 7691 (2022)
[2] Kumar, A.M. et al. Nat Commun **15**, 7546 (2024)

Figures

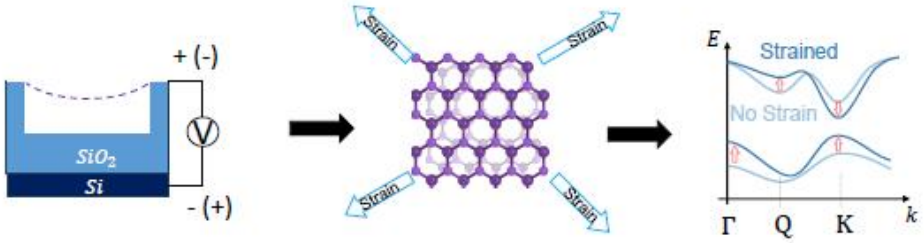

Figure 1: Platform for applying tunable strain at cryogenic temperatures. Suspended heterostructure is strained biaxially by electrostatic actuation. Different valleys in the momentum-space shift according to their orbital character enabling fingerprinting and tuning.

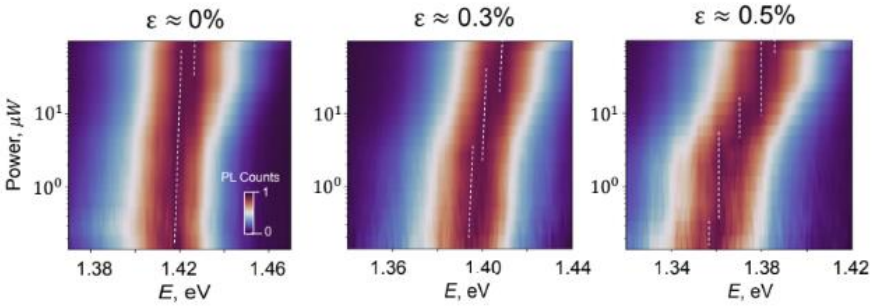

Figure 2: Strain-tunable interlayer exciton (IX) states. Changing moiré period with strain *(ε)* allows higher IX states to be populated for the same excitation powers.