Poster-2-15

Electron-phonon coupling across a WS_2/hBN van der Waals interface

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Electronic states in a two-dimensional system and bosonic excitations in an adjacent substrate may be strongly coupled. These interfacial interactions are still poorly characterized in van der Waals heterostructures, where one would expect that they play a marginal role. However, recent optics experiments report remarkably large coupling between excitons in a monolayer transition metal dichalcogenide and the underlying hexagonal Boron Nitride (hBN) substrate [1]. Here, we investigate the nature and magnitude of such interactions in the electronic states of a WS_2/hBN heterostructure via angle-resolved photoelectron spectroscopy. We resolve dispersing satellites separated from the intense quasiparticle WS_2 valence band by energies comparable to Γ phonon modes in hBN. We derive a spectral function model to describe the interfacial coupling between charges in the WS_2 layer and the lattice vibrations of the polar hBN substrate, which we employ to provide a qualitative estimation of the interaction strength. Finally, we evaluate the entity of this coupling at large out-of-plane WS_2-to-hBN distance in a WS_2/graphite/hBN heterostructure. Our findings will define the impact of many-body interfacial correlations in the transport properties of a two-dimensional semiconductor across a van der Waals gap.

[1] Jin, C., Kim, J., Suh, J. et al. Nature Phys 13, 127-131 (2017).