Seminarankündigung

Dienstag, 17. Dezember 2019
13:00 Uhr

ZNN, Seminarraum EG 0.001

“The curse and blessing of defects in 2-D materials”

We explore how atomically sharp hetero structures such as boundaries, vacancies and substitutes in 2-D materials create new protected quantum states using photo low temperature Scanning Tunneling Microscopy. Two dimensional materials have attracted scientist from physics, over chemistry to material science engineering since they provide an enormous playground to interdisciplinary explore and design entirely new material properties:
Electronic, optical, magnetic and/or chemical properties are substantially modified when transitioning from a bulk material to an atomically thin material. For example, a 3 layer thick transition metal dichalcogenide absorbs hardly any photons while only a single layer can absorb more then 10% of the impeding photons. Much effort has been placed to create atomically pristine 2-D materials, however, recently the impact of defects and how they can substantially modify the novel material properties yet again have become a major focus of research. For example, unidentified defects in MoS2 have driven single photon emission and enhanced photo catalytic behavior. We have used photo STM/AFM and correlation microscopy spectroscopy to study vacancies and atomic substitutes with atomic precision and correlate the atomic structure with the resulting electronic and optical properties. This enables us to understand how few atomic scale modifications may impact the macroscopic functionality of 2-D materials. In particular we are interested in defects and heterogeneities that can host localized electronic states that can hold quasiparticle excitations with long coherence time for potential applications as next generation quantum information material systems. I will discuss mirror twin boundaries that from charge density waves in the midst of semiconducting 2-D MoSe2 (Nature Physics 12, 751–756, 2016), how 2-D MoSe2 and 2-D WS2 have a zoo of intrinsic point defects (ACS Nano, 13, 9, 10520-10534, 2019) that modify substantially electronic properties (Nature Communications 10, 3382, 2019), such as individual S vacancies that create extremely high spin orbit coupling (Phys. Rev. Lett. 123, 076801, 2019). Finally, I will share some exciting new results where atomic substitutes substantially modify electron phonon coupling and show single photon emission with atomic resolution

Prof. Dr. Alexander Weber-Bargioni
Molecular Foundry
Lawrence Berkeley National Laboratory
USA