Seminarankündigung

Dienstag, 7. Mai 2019
17:15 Uhr

WSI, Seminarraum S 101

"Signatures of interlayer moiré excitons in twisted van der Waals heterobilayers "

Lateral superlattice patterning is a powerful approach to manipulating the electronic properties of crystalline solids which has been employed in quasi-2D material systems for decades[1]. More recently, the formation of a moiré superlattice in artificially stacked van der Waals structures has been achieved either by stacking materials with dissimilar lattice constants or with a nonzero interlayer twist angle. This has led to the discovery of fractional quantum hall states and the observation of Hofstadter's butterfly in graphene/boron nitride heterobilayers (HBLs)[2-3], and superconductivity in magic-angle graphene bilayers[4]. In 2D semiconductor HBLs, it is expected that a moiré pattern will introduce a periodic potential which can localize excitons and modulate their optical selection rules[5].

We have recently reported experimental evidence of interlayer excitons confined by a moiré superlattice potential in HBLs of WSe2 and MoSe2[6]. These suspected moiré excitons retain many of the fundamental properties of free excitons previously observed in WSe2/MoSe2 HBLs such as long radiative lifetime and strongly circularly polarized photoluminescence (PL), but with PL linewidths 100s of times narrower. The preservation of the helical optical selection rule suggests that the trapping sites retain the C3 symmetry of the underlying lattice. Furthermore, Zeeman splitting measurements reveal that the exciton g-factor is homogeneous across many emitters and takes only two values, either -15.9 or 6.7, and is set by the interlayer twist angle, consistent with the two different possible valley pairings for interlayer excitons. This evidence, along with excitation power and energy dependence of the interlayer exciton PL, suggests a smooth trapping potential which respects symmetry in both layers, key features of a moiré superlattice.

[1] Lorke *et al., Phys.Rev. B* **44**, 3447 (1991)
[2] Dean *et al., Nature* **497**, 598-602 (2013)
[3] Hunt *et al., Science* **340**, 1427-1430 (2013)
[4] Cao *et al., Nature* **556**, 43-50 (2018)
[5] Yu *et al., Phys.Rev.Lett.* **115**, 187002 (2015)
[6] Seyler *et al., Nature* **567**, 66-70 (2019)

Nathan P. Wilson
Department of Physics
University of Washington Seattle
USA