Spatially resolved Moiré physics in twisted WSe_2 homostructures from advanced TEM

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Abstract

Rotational misalignment in twisted van der Waals structures, both homo-and hetero-types, open new avenues for nanoscale electronic property modulation. This phenomenon leads to remarkable effects such as Moiré-induced excitons and spatial modulation of the band gap energies [1]. In this work, we study twisted WSe_2 homostructures through advanced Transmission Electron Microscopy. We use Electron Energy Loss Spectroscopy [2] complemented with Machine Learning techniques [3] to map the local electronic properties. We achieve the atomic-level imaging of the Moiré superlattice, identify the presence of Moiré-induced excitons. We observe two distinct excitons at 1.7 and 2.2 eV and track these across both across spatial and energy dimensions. Our results contribute to the exciting field of Moiré physics in 2D materials and have potential impact for applications in nanoelectronics, nanophotonics, and quantum communications.

References

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Figures

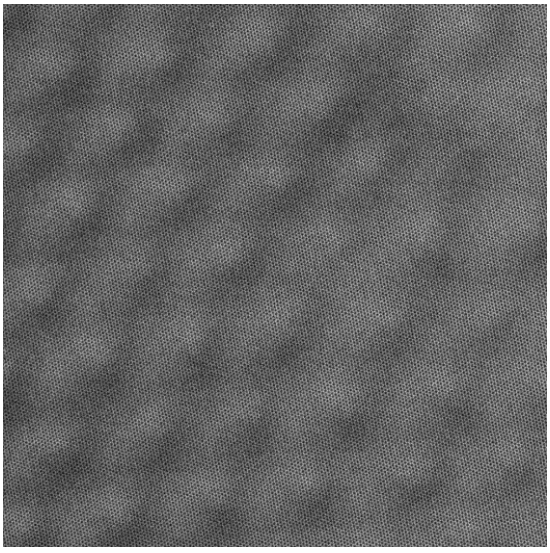

Figure 1: Annular dark-field electron microscopy image of a moiré superlattice in a twisted tungsten-diselenide homostructure, demonstrating the creation of a new moiré unit cell whose effective enlargement of the periodicity within the lattice scales the electrical potential and offers new physics for excitons.