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Moiré-excitons in $MoSe_2/WSe_2$ heterobilayers

The creation of moiré patterns in crystalline solids is a powerful approach to manipulate their electronic properties, which are fundamentally influenced by periodic potential landscapes. In two-dimensional (2D) materials, a moiré pattern with a superlattice potential can form by vertically stacking two layered materials with a twist and/or finite lattice constant difference. This unique approach has led to emergent electronic phenomena, including the fractal quantum Hall effect [1–3], tunable Mott insulators [4, 5], and unconventional superconductivity [6, 7]. Furthermore, theory predicts intriguing effects on optical excitations by a moiré potential in 2D valley semiconductors [8–10], but these signatures have yet to be experimentally detected. In this talk, I will report our experimental evidence of interlayer valley excitons trapped in a moiré potential in $MoSe_2/WSe_2$ heterobilayers. We observe quantum-dot-like photoluminescence of interlayer excitons with the inheritance of unique valley-contrasting properties from the heterobilayer bulk. Twist angle dependent studies further support our observation of moiré excitons. Our results open opportunities for 2D moiré optics with twist angle as a unique control knob.

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