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Title of the Presentation: Resonant excitation of moiré exciton in a $WSe_2/MoSe_2$ heterobilayer

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Short Biography:

Dr. Keisuke Shinokita obtained his B.Sc. (2008), M.Sc. (2010), and D.Sc. (2013) degrees from Kyoto University. He was a postdoctoral fellow at University of Groningen (2013-2015), a guest researcher at Max Born Institute (2015-2017), and a program-specific assistant professor at institute of advanced energy (IAE) in Kyoto University (2017-2020). Since 2020, he has been working at IAE in Kyoto University as an assistant professor. His main topic is to study novel light-matter interaction in two dimensional materials.

Abstract:

Moiré patterns with angular mismatch in van der Waals heterostructures composed of atomically thin semiconducting materials are a fascinating platform to engineer the optically generated excitonic properties towards novel quantum phenomena. The moiré pattern as a periodic trap potential can give rise to spatially ordered ensembles of zero-dimensional exciton (moiré exciton), which offers the possibility for dense coherent quantum emitters and quantum simulation of many-body physics [1].

Here, we report the novel excitonic features of the moiré exciton in a twisted $WSe_2/MoSe_2$ heterobilayer based on near-resonant photoluminescence excitation (PLE) spectroscopy. Figure 1 shows the photoluminescence (PL) spectra with different excitation energies. Several peaks observed in the PL spectra reflect the response of the interlayer exciton trapped with the moiré potential, or moiré exciton. The PL spectral shape strongly depends on the excitation energy. The specific moiré exciton emission was enhanced under excitation with ~25 meV excess energy, suggesting highly selective excitation. The excess energy is almost consistent with phonon energy of 29 meV. These results suggest that the moiré excitons are selectively excited with resonant phonon scattering process [2]. The results presented here of the resonant moiré exciton-phonon interaction, which could pave a new way for the exploration of novel quantum phenomena of the moiré exciton towards potential applications in quantum optics.

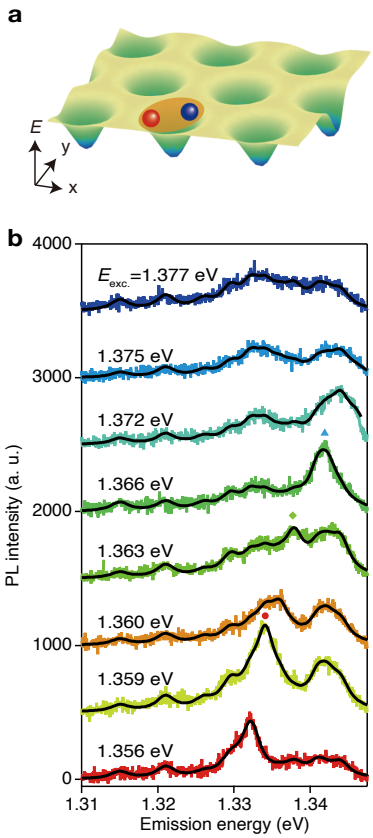

Fig. 1. **a** Schematic of the moiré potential and moiré exciton. **b** PL spectrum obtained under near-resonant excitation from $E_{exc.}$=1.356 to 1.377 eV. The black lines are fitted with multiple Lorentz functions.

[1] K. Seyler et al, Nature 66, 567 (2019).
[2] K. Shinokita, K. Matsuda et al., Arxiv:2012.08720.