

# Stacking-dependent Interlayer Couplings in 2D Materials

Kaihui Liu

*School of Physics, Peking University, Beijing 100871, China*

When the characteristic length of a material shrinks to 1 nm scale, many distinct physical phenomena, such as quantum confinement, enhanced many-body interactions, strong van der Waals inter-material couplings and ultrafast charge separation, will appear. To investigate the related fascinating low-dimensional physics, we need a tool to quantitatively link the atomic structures to the physical properties of these very small nano-materials. In this talk, I will introduce our recently developed in-situ TEM + ultrafast nano-optical spectroscopy technique, which combines capability of structural characterization in TEM and property characterization in nano-optical spectroscopy on the same individual nano-materials. Several examples of using this technique to study the mechanical/electronic couplings and ultrafast charge transfer in 2D bilayer systems will be demonstrated [1-4].

## References:

- [1] Kaihui Liu, Liming Zhang, Ting Cao, Chenhao Jin, Diana Qiu, Qin Zhou, Alex Zettl, Peidong Yang, Steven Louie, and Feng Wang\*. "Evolution of Interlayer Coupling in Twisted MoS<sub>2</sub> Bilayers", **Nature Communications** **2014**, 5, 4966
- [2] Xu Zhou, Jingxin Cheng, Yubing Zhou, Shiwei Wu\*, Hailin Peng\*, Kaihui Liu\* and et al., "Strong Second-Harmonic Generation in Atomic Layered GaSe", **JACS** **2015**, 137, 7994-7997.
- [3] Jing Liang, Jin Zhang, Zhenzhu Li, Hao Hong, Peng Gao, Zhirong Liu, Zhongfan Liu, Zhipei Sun\*, Sheng Meng\*, Kaihui Liu\*, and et al. "Monitoring Local Strain Vector in Atomic-Layered MoSe<sub>2</sub> by Second-Harmonic Generation", **Nano Letters** **2017**, 17, 7539
- [4] Ziheng Ji, Hao Hong, Jin Zhang, Chuanhong Jin\*, Liying Jiao, Kebin Shi\*, Sheng Meng and Kaihui Liu\* and et al. "Robust Stacking-Independent Ultrafast Charge Transfer in MoS<sub>2</sub>/WS<sub>2</sub> Bilayers", **ACS Nano** **2017**, 11, 12020