

Seminar

Thursday, February, 1, 2024, 13:00 h, PHY 5.0.20

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Development of time-resolved ARPES and Floquet band engineering

The time-periodic light field has emerged as a control knob for manipulating quantum states in solid-state materials, leading to tailored electronic properties on an ultrafast timescale [1], dubbed as Floquet engineering. Despite extensive research interests over the past decade, the experimental realization of Floquet engineering in semiconductors remains a crucial step. As a technique that can directly resolve electronic structure under a light field, time- and angle-resolved photoemission spectroscopy (trARPES) is powerful for studying Floquet engineering. In this talk, I will present our recent progress in the development of trARPES instrumentation [2-5]. By utilizing trARPES, we realized Floquet engineering in the model semiconductor black phosphorus. Light-induced dynamical gap opening is observed upon near-resonance pumping with strong pseudospin selectivity [6]. Furthermore, by pushing to lower pumping photon energy, we realized below-gap pumping induced Floquet engineering in black phosphorous [7], which provides a comprehensive understanding of Floquet engineering in semiconductors and also provides guidance for extending Floquet engineering into more materials.

Reference

- [1] C. Bao et al., Nat. Rev. Phys. **4**, 33 (2022)
- [2] C. Bao et al., Rev. Sci. Instrum. **92**, 033904 (2021)
- [3] C. Bao et al., Rev. Sci. Instrum. **93**, 013902 (2022)
- [4] H. Zhong, C. Bao et al., Rev. Sci. Instrum. **93**, 013902 (2022)
- [5] C. Bao et al., Nano Lett. **22**, 1138 (2022)
- [6] S. Zhou, C. Bao et al., Nature **614**, 75 (2023)
- [7] S. Zhou, C. Bao, B. Fan et al., Phys. Rev. Lett. **131**, 11640 (2023)