Bandstructure engineering in 2D quantum materials

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Two-dimensional (2D) quantum materials have continued to attract broad interest in the field of condensed-matter physics. One of the exciting opportunities with these materials is the tunable band structure with various "tuning knobs", such as strain and electric field. In this talk, I will introduce our studies on bandstructure measurements and engineering with angle-resolved photoemission spectroscopy (ARPES). We developed the mechanism of the widely tunable band gap in black phosphorus[1], which can also be used to discover the 2D Dirac semimetal phase protected by space-time inversion symmetry[2]. With the light of variable polarization, we could visualize beautiful order of pseudospin (quantum phases) in the band structure, and how it evolves across the topological phase transition[3]. If time permits, I will also introduce the discovery of Holstein polaron[4], a novel composite particle of an electron dragging the cloud of lattice vibrations (phonons) in surface-doped MoS_2.

References

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