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Bandgap engineering of two-dimensional semiconductors

Layered two-dimensional (2D) semiconductors, such as black phosphorus and transition-metal dichalcogendies, have emerged as a class of materials that may impact our future electronics technologies. Controlling their band structure widely with external parameters is important not only for application in various electronic and optical devices, but also to systematically study a novel quantum state of matter. In this talk, I will introduce our recent angle-resolved photoemission spectroscopy (ARPES) studies on a novel mechanism to modulate the band gap of black phosphorus [1] and 2*H* transition-metal dichalcogenides [2]. The widely tunable band gap of black phosphorus could be exploited to create a topologically nontrivial state with a pair of Dirac fermions protected by its unique crystalline symmetry [3]. Electron doping to the surface of transition-metal dichalcogenides can also be used to explore a novel compsite particle arising from intervalley electron-phonon coupling [4].

References

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