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【124】ARPES study of few layer black phosphorus crystals

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The electronic structure of 2D materials undergoes significant changes as their thickness is reduced down to the atomic limit. In few layer black phosphorus (BP) crystals, a promising semiconductor for optoelectronic and electronic applications, the bandgap increases drastically and the effective mass at the valence band and conduction band edges changes significantly. Here, we present the first direct electronic structure measurements on ultrathin BP. As BP is an air sensitive material, this is achieved by encapsulating exfoliated flakes in graphene or hBN. Our results reveal the quantum well states in the valence band and give a mapping of the anisotropic bandstructure of thin BP flakes. In particular, we determine the anisotropic effective mass at the valence band edge.

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