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Efficient Electrical Control of Thin-Film Black Phosphorus Bandgap[1] BINGCHEN DENG, Yale Univ, VY TRAN, Washington University, HAO JIANG, University of Massachusetts, CHENG LI, YUJUN XIE, QIUSHI GUO, XIAOMU WANG, Yale Univ, HE TIAN, HAN WANG, University of Southern California, JUDY CHA, Yale Univ, QIANGFEI XIA, University of Massachusetts, LI YANG, Washington University, FENGNIAN XIA, Yale Univ — Recently rediscovered black phosphorus is a promising layered material for electronics and photonics. Dynamic control of its bandgap is desirable to extend the black phosphorus device functionalities. Here we reveal the unique thickness-dependent bandgap tuning properties in intrinsic black phosphorus thin films under an external electric field. We demonstrate that for optimum black phosphorus thickness, the bandgap can be continuously tuned from about 300 to below 50 meV using a moderate electric field readily achieved by regular dielectrics. Such dynamic tuning of bandgap can enable novel device applications and allow for the exploration of new physical phenomena.

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