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The evolution of electronic structures in few-layer black phosphorus by infrared spectroscopy. GUOWEI ZHANG, Fudan Univ, ANDREY CHAVES, Universidade Federal do Cear, SHENYANG HUANG, CHAOYU SONG, Fudan Univ, TONY LOW, University of Minnesota, HUGEN YAN, Fudan Univ — Black phosphorus (BP) is a newly discovered two-dimensional material with puckered lattice structures, exhibiting many intriguing properties, such as tunable direct bandgap, in-plane anisotropy and relatively high carrier mobility. In this work, we report the first systematic infrared study of mechanically exfoliated few-layer BP using FTIR (Fourier transform infrared spectrometer), with thickness ranging from 2 to 15 layers and photon energy spanning from 0.25 to 1.36 eV. Each few-layer BP exhibits a thickness-dependent unique infrared spectrum with a series of absorption resonances, which reveals the underlying electronic structure evolution and serves as an IR fingerprint. The evolution of electronic structures in few-layer BP is well understood within the framework of a tight binding model. Our study paves the way for BP applications in infrared optoelectronics.

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