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**Direct observation of the layer-dependent electronic structure in phosphorene** LIKAI LI, Fudan University, JONGHWAN KIM, CHENHAO JIN, Physics Department at UC Berkeley, GUO JUN YE, University of Science and Technology of China, DIANA Y. QIU, FELIPE H. DA JORNADA, Physics Department at UC Berkeley and LBNL, ZHIWEN SHI, Physics Department at UC Berkeley, LONG CHEN, Chinese Academy of Science, ZUOCHENG ZHANG, FANGYUAN YANG, Fudan University, KENJI WATANABE, TAKASHI TANIGUCHI, National Institute for Materials Science, Japan, WENCAI REN, Chinese Academy of Science, STEVEN G. LOUIE, Physics Department at UC Berkeley and LBNL, XIAN HUI CHEN, University of Science and Technology of China, YUANBO ZHANG, Fudan University, FENG WANG, Physics Department at UC Berkeley — Phosphorene, a single atomic layer of black phosphorus, has recently emerged as a new two-dimensional (2D) material that holds promise for electronic and photonic technology. Here we experimentally demonstrate that the electronic structure of few-layer phosphorene varies significantly with number of layers, in good agreement with theoretical predictions. The interband optical transitions cover a wide, technologically important spectrum range from visible to mid-infrared. In addition, few-layer phosphorene is observed to photoluminesce at energies that correlate well with the layer-dependent bandgap transitions. The strongly layer-dependent electronic structure of phosphorene, in combination with its high electrical mobility, gives it distinct advantages over other two-dimensional materials in electronic and opto-electronic applications.

Likai Li
Fudan University

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