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Characterizing resistivity anisotropy in black phosphorous flakes with 5-point method[1] LINTAO PENG, Applied PhysicsEECS, Northwestern Univ, SPENCER A. WELLS, CHRISTOPHER R. RYDER, MARK C. HERSAM, Materials Science and Engineering, Northwestern Univ, MATTHEW GRAYSON, Applied PhysicsEECS, Northwestern Univ — Black phosphorous (BP) thin flakes have been recently studied as a promising candidate material for electronics and optoelectronics. The anisotropy caused by the in-plain structural asymmetry plays a significant role in transistor performance optimization, and polarized optical detection. Here, we present a simple method to characterize the electrical transport anisotropy of BP devices of arbitrary shape. It requires 5 or more contacts at the periphery and consists of a sequence of van der Pauw measurments with various pairs of current and voltage terminals. Identifying the sample shape and contact geometry with a conformal map, we can uniquely define the two components of the resistivity tensor as well as the in-plane a- and c- axis directions. Raman spectroscopy confirmed the axis orientation as determined by our method. Further temperature dependence and gate dependence were measured to illustrate consistency of this method. Theoretically, this method could be applied to identify anisotropic resistivity components of any other low-symmetry 2D materials.

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