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High Mobility Two-Dimensional Electron Gas in Black Phosphorus LIKAI LI, Fudan University, GUOJUN YE, University of Science and Technology of China, VY TRAN, Washington University in St. Louis, St. Louis, GUORUI CHEN, Fudan University, HUICHAO WANG, JIAN WANG, Peking University, KENJI WATANABE, TAKASHI TANIGUCHI, National Institute for Materials Science, LI YANG, Washington University in St. Louis, St. Louis, XIANHUI CHEN, University of Science and Technology of China, YUANBO ZHANG, Fudan University — Black phosphorus has recently emerged as a new member in the family of two-dimensional (2D) atomic crystals. It is a semiconductor with a tunable bandgap and high carrier mobility - material properties that are important for potential optoelectronic and high-speed device applications. In this work, we achieve a record-high carrier mobility in black phosphorus by placing it on hexagonal boron nitride (h-BN) substrate. The exceptional mobility of the 2D electron gas created at the interface allows us to observe quantum oscillations for the first time in this material. The temperature and magnetic field dependence of the oscillations yields crucial information about the black phosphorus 2DEG, such as cyclotron mass of the charge carriers and their lifetime. Our results pave the way to future research on quantum transport in black phosphorus.

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