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Surface Transport and Quantum Hall Effect in Ambipolar Black Phosphorus Double Quantum Wells[1] JIAWEI YANG, SON TRAN, NATHANIEL GILLGREN, TIMOTHY ESPIRITU, YANMENG SHI, University of California, Riverside, KENJI WATANABE, TAKASHI TANIGUCHI, National Institute for Materials Science, SEONGPHILL MOON, HONGWOO BAEK, DMITRY SMIRNOV, National High Magnetic Field Laboratory, MARC BOCKRATH, RUOYU CHEN, CHUN NING LAU, University of California, Riverside, UNIVERSITY OF CALIFORNIA, RIVERSIDE TEAM, NATIONAL INSTITUTE FOR MATERIALS SCIENCE COLLABORATION, NATIONAL HIGH MAGNETIC FIELD LABORATORY COLLABORATION — Quantum wells (QWs) is the most important class of devices in the study of two-dimensional (2D) systems. Here we demonstrate facile formation of black phosphorus-based wide QWs that host double layers of charge carriers. In contrast to tradition QWs, each 2D layer is ambipolar, and can be tuned into n-doped, p-doped or intrinsic regimes. Fully spin-polarized quantum Hall states are observed on each layer, with Landé g-factor that is attributed to exchange interactions. Our work opens the door for using 2D semiconductors as ambipolar single, double or wide QWs with unusual properties such as high anisotropy.

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