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**Introduction of Interfacial Charges to Black Phosphorus for a Family of Planar Devices** LIHONG BAO, GUOCAI WANG, SHIXUAN DU, Institute of Physics, CAS, SOKRATES PANTELIDES, Vanderbilt University, HONG-JUN GAO, Institute of Physics, CAS — As a young member in the family of two dimensional materials, black phosphorus (BP) has attracted great attention since its discovery due to its high hole mobility and a sizable and tunable bandgap, which meets the basic requirements for logic circuits applications. Naturally, for realization of complementary logic operation, the challenge lies in how to control the conduction type in BP FETs, i.e., the dominant carrier types, holes (p-type) or electrons (n-type). However, the absence of reliable substitutional doping techniques makes this task a great challenge. **Introducing interfacial charges** into 2D materials has been proven to be a **successful** way to control conduction. In this work, we, **for the first time, demonstrate that capping a thin BP layer with a layer of cross-linked PMMA can modify the conductivity type of the BP by a surface charge transfer process, converting a BP layer dominated by hole conduction in the absence of an external electric field (p-type) to one dominated by electron conduction (n-type)**. Combining BP films capped by cross-linked PMMA with standard BP, a **family** of **planar devices** can be created, including BP **gated diodes and bidirectional recitifiers** (rectification ratio $>10^{2)}$ and BP l**ogic inverter** (gain0.75) which are capable of performing current rectification, switching, and signal inversion operations. The device performance demonstrated here suggests a promising route for developing 2D-based electronics.

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