Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Two-dimensional massless Dirac fermions and Fermi level matching with Dirac points in alkaline-metal doped few-layer black phosphorus[1]
SEUNG SU BAIK, YOUNG-WOO SON, Korea Institute for Advanced Study, HYOUNG JOON CHOI, Yonsei University — Since the inception of atoms-thick black phosphorus (BP) in 2014, bandgap tuning of BP has been one of the central issues in BP-based field-effect-transistors and optoelectronic devices. As other layered materials held by van der Waals forces, BP bandgap is modulated by the control of layer thickness and external perturbations such as strain and electric field. Recently, BP bandgap was shown to be fine-tuned by the simple method of potassium (K) doping on the BP surface [1,2]. Marked physical properties of K doped BP are summarized as the emergence of two-dimensional (2D) massless Dirac fermions and its stability with respect to the spin-orbit interaction. However, for the practical use of K doped BP in actual devices, the location of emerged Dirac points is required to be shifted-back to around the Fermi level. In this talk, based on first-principles calculations, we report the shift-back method of Dirac points by means of various co-dopings, and the distribution of alkaline-metal atoms on the BP surface. The switchable massless Dirac fermions discussed here may open a new way for the development of high performance devices in 2D materials beyond graphene. [1] J. Kim et al, Science **349**, 723-725, (2015). [2] S. S. Baik et al, Nano Lett. **15**, 7788-7793 (2015).

[1]This work is supported by KISTI supercomputing center (Project No. KSC-2016-C2-0015).

Seung Su Baik
Korea Inst for Advanced Study

Date submitted: 20 Nov 2016 Electronic form version 1.4