Flattened Band and AA+AB on bilayer graphene heterostructure

Sandy Adhitia Ekahana[1,2], Aalok Tiwari[1], Souvik Sasmal[1], I-Hsuan Kao[1], Chris Jozwiak[2], Eli Rotenberg[2], Aaron Bostwick[2], Simranjeet Singh[1], Jyoti Katoch[1]

[1]Department of Physics, Carnegie Mellon University,
Pittsburgh, Pennsylvania 15213, USA
[2]Advanced Light Source, E. O. Lawrence Berkeley
National Laboratory, Berkeley, California 94720, USA

Stacking two-dimensional(2D) materials to form van der Waals (vdW) heterostructures provides an unprecedented ability to tune electronic structures and engineer novel interfaces. Among these materials, α-$RuCl_3$ has recently attracted significant attention as a Mott insulator, and interfacing with graphene induces massive charge transfer from the Graphene layer to itself, significantly modifying graphene's electronic properties. By employing angle-resolved photoemission spectroscopy with nanoscale spatial resolution (nanoARPES), we study the electronic structure of bilayer graphene (BG) when interfaced with α-$RuCl_3$ and hexagonal boron nitride(hBN) and further tune the Fermi level of the heterostructure via potassium atom deposition. Our experiment reveals that the graphene Dirac band is flattened and gapped (Δ~0.4 eV) at the area of BG/hBN while the BG/$RuCl_3$/hBN reveals the presence of semi-metallic states at Dirac point as a result of AA+AB stacking.

Keywords: bilayer graphene, ARPES, flat band.

Acknowledgement: Work supported by the DOE award no. DE-SC0025490.