Electron correlation and topology in rhombohedral graphene

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Rhombohedral stacked multilayer graphene is an ideal platform to search for correlated electron phenomena, due to its pair of flat bands touching at zero energy and further tunability by an electric field. Furthermore, its valley-dependent Berry phase at zero energy points to possible topological states when the pseudospin symmetry is broken by electron correlation. In this talk, I will first show our efforts on the optical spectroscopy study of trilayer graphene/hBN moire superlattice. We observed optical signatures of flat moire band formation and Mott insulator due to band splitting at half-filling. Then I will talk about DC transport measurements of pentalayer graphene without a moire with the hBN substrates. We observed a plethora of correlated and topological states including a ferro-valleytronic half-metal, a correlated insulating state and Chern insulator states. Our results point to a new direction of exploring electron correlation and topology in natural 2D crystals where the layer number plays a critical role