[QMS2020 invited talk]

Correlated States in van der Waals heterostructures

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A van der Waals bonded solid consists of sheets of two-dimensional (2D) atomic layers with strong bonding in-plane. When these crystals are grown naturally, the stacking order along the out-of-plane dimension is dictated by the van der Waals force, typically leading to all layers of the crystal being oriented in the same in-plane direction. Recently, it has become possible to synthetically create materials where the individual layers have arbitrary in-plane direction relative to each other. These materials are of great interest theoretically since they realize new crystal structures not achievable in nature, with new emergent properties predicted. One of the key experimental findings in one such material last year was the presence of superconductivity and Mott insulating behavior in twisted bilayer graphene, properties that the individual layers do not display by themselves. In this talk, I will describe STM and transport properties of three such materials: (a) twisted bilayer graphene, where we measure the electronic structure of the material that is a Mott insulator (b) twisted bilayer WSe2, where we also observe Mott insulating behavior and (c) twisted double bilayer graphene, where we have evidence from STM for excitonic insulator behavior as well as the presence of chiral topological edge states in the interior of the material.