Twist angle driven electronic structure evolution of twisted bilayer graphene

Wei Li

Department of Physics, Tsinghua University, Beijing 100084, China

weili83@tsinghua.edu.cn

In twisted bilayer graphene (TBG) devices, local strains often coexist and entangle with the twist-angle dependent moiré superlattice, both of which can significantly affect the electronic properties of TBG. Here, using low-temperature scanning tunneling microscopy, we investigate the fine evolution of the electronic structures of a TBG device with continuous variation of twist angles from 0.32° to 1.29°, spanning the first (1.1°), second (0.5°) and third (0.3°) magic angles. We reveal the exotic behavior of the flat bands and remote bands in both the energy space and real space near the magic angles. Interestingly, we observe an anomalous spectral weight transfer between the two flat band peaks in the tunneling spectra when approaching the first magic angle, suggesting strong inter-flat-bands interactions. The position of the remote band peak can be an index for the twist angle in TBG, since it positively correlates with the twist angle but is insensitive to the strain. Moreover, influences of the twist angle gradient on symmetry breaking of the flat bands are also studied.