Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Experimental Investigation of the Electronic Properties of Twisted Bilayer Graphene by STM and STS LONGJING YIN, JIABIN QIAO, WENXIAO WANG, WEIJIE ZUO, LIN HE, Beijing Normal Univ — The electronic properties of graphene multilayers depend sensitively on their stacking order. A twisted angle is treated as a unique degree of freedom to tune the electronic properties of graphene system. Here we study electronic structures of the twisted bilayers by scanning tunneling microscopy (STM) and spectroscopy (STS). We demonstrate that the interlayer coupling strength affects both the Van Hove singularities and the Fermi velocity of twisted bilayers dramatically. This removes the discrepancy about the Fermi velocity renormalization in the twisted bilayers and provides a consistent interpretation of all current data. Moreover, we report the experimental evidence for non-Abelian gauge potentials in twisted graphene bilayers by STM and STS. At a magic twisted angle, about 1.11, a pronounced sharp peak is observed in the tunnelling spectra due to the action of the non-Abelian gauge fields. Because of the effective non-Abelian gauge fields, the rotation angle could transfer the charge carriers in the twisted bilayers from massless Dirac fermions into well localized electrons, or vice versa, efficiently. This provides a new route to tune the electronic properties of graphene systems, which will be essential in future graphene nanoelectronics.

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Date submitted: 04 Nov 2015 Electronic form version 1.4