Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Gated Raman Spectroscopy of Twisted Bilayer Graphene SHENGQIANG HUANG, KANOKPORN CHATTRAKUN, MATTHEW YANKOWITZ, ARVINDER SANDHU, BRIAN LEROY, The University of Arizona — The interaction of charge carriers with lattice vibrations in graphene exhibits many intriguing physical phenomena. Raman spectroscopy is a powerful non-destructive technique to probe these interactions. In twisted bilayer graphene, the electronic band structure and phonon dispersion depend on the rotation angle between the layers. Here we present a systematic Raman spectroscopy study of twisted bilayer graphene, using a 532 nm laser, with controllable charge densities up to $2\times10^{13}\text{cm}^{-2}$. The twist angle is first identified by the observation of a moire pattern in STM measurements. In the angle range between 5 and 8 degrees, the R′ peak softens and weakens with increasing charge density. Near 12 degrees, the G peak is enhanced due to the increased density of states in twisted bilayer graphene. However, the G peak area quickly decreases with increasing charge density. Lastly, we observed several unusual effects for the G peak for all angles from 2 to 10 degrees as a function of increasing charge density. We found that the G peak broadened, split and oscillated in position. All these results demonstrate that twisted bilayer graphene has rich optoelectronic properties.

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Date submitted: 13 Nov 2013 Electronic form version 1.4