

RIKEN Seminar

Time & Date : March 10, 2011 PM 4:00-5:00

Place : Seminar room, 2nd floor, The Nanoscience Joint Laboratory

Language: English

“High-energy Resolution Scanning Tunneling Spectroscopic Study of C-face Epitaxial Graphene”

Dr. Young Jae Song

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Graphene, two dimensional carbon system sharing the same mother form with C60 and carbon nanotubes, is an ideal two dimensional electron system (2DES) with one atomic thickness and has unique electronic properties unlike any other materials yet studied [1]. Completely new physics emerges when quantum interactions dominate as graphene's relativistic electrons are put under the extreme conditions of low temperatures and high magnetic fields [2,3]. Here I introduce the first scanning tunneling spectroscopy measurements for the electron density of states of graphene in fields up to 14 T and at temperatures below 20 mK [4] by an ultra low temperature scanning tunneling microscope [5] that I constructed recently in NIST. The Landau levels, peaks in the density of states in a magnetic field, split into a quartet of states as both spin and valley (pseudo-spin) degeneracies are lifted. The valley splitting is much larger than the spin splitting and both show evidence of strong quantum exchange interaction effects. At particular fields when N=1 Landau level peak locates on the Fermi level, the spectroscopy shows evidence of a new series of fractional quantum Hall states such as filling factors of 11/2, 9/2 and 7/2 as well as enhanced spin/valley splitting by exchange coupling. The spatial mapping for graphene's even-filling, polarized odd-filling and fractional-filling states will be addressed, which has been a key issue as a phase-driven problem in 2DES for last decades.

References:

- [1] A. K. Geim and K. S. Novoselov, *Nature Materials* **6**, 183-191 (2007).
- [2] Yuanbo Zhang, Yan-Wen Tan, Horst L. Stormer, and Philip Kim, *Nature* **438**, 201-204 (2005).
- [3] Kirill I Bolotin, Fereshte Ghahari, Michael D Shulman, Horst L Stormer, and Philip Kim, *Nature* **462**, 196-9 (2009).
- [4] Song, Y. J. *et al.*, *Nature* **467**, 185 (2010).
- [5] Song, Y. J. *et al.*, Submitted to *Rev. Sci. Inst.* **81**, 121101 (2010) (invited review paper).

日時：平成23年3月10日(木) 16-17時

場所：ナノサイエンス実験棟 2階 セミナー室

使用言語：英語

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