Unusual RG flow and possible temperature-dependent transition in strongly disordered monolayer graphene grown on SiC

Chi-Te Liang
梁啟德

Department of Physics, National Taiwan University, Taipei 106, Taiwan

Graduate Institute of Applied Physics, National Taiwan University, Taipei 106, Taiwan

Department of Physics, Stanford University, Stanford, CA 94305, USA
Epitaxial graphene on SiC


Semi-circle and $T$-driven flow lines


Renormalization Group (RG) flow

$$\sigma_{xx} = \rho_{xx} / \left[ (\rho_{xx})^2 + (\rho_{xy})^2 \right]$$

$$\sigma_{xy} = \rho_{xy} / \left[ (\rho_{xx})^2 + (\rho_{xy})^2 \right]$$
An experimental study on $\Gamma(2)$ modular symmetry in the quantum Hall system with a small spin splitting

C F Huang$^{1,2}$, Y H Chang$^{1,7}$, H H Cheng$^3$, Z P Yang$^3$, H D Yeh$^{1,2}$, C H Hsu$^1$, C-T Liang$^1$, D R Hang$^{3,5}$ and H H Lin$^6$

Interested in the insulating regime where $\sigma_{xx}$ approaches zero.

Y.-T. Wang et al., JPCM 24, 405801 (2012)
Low Carrier Density Epitaxial Graphene Devices On SiC

Yanfei Yang,* Lung-I. Huang, Yasuhiro Fukuyama, Fan-Hung Liu, Mariano A. Real, Paola Barbara, Chi-Te Liang, David B. Newell, and Randolph E. Elmquist

Sample I

Sample II

$T = 2.52 \text{ K}$
Sample III

$\rho_{xx} (k\Omega)$ vs $B (T)$

$\sigma_{xx} (\mu S)$ vs $B (T)$
Crossing point in $\sigma_{xy}$: quantum phase transition at $T=0$ driven by magnetic field

L.-I. Huang et al., RSC Adv. 6, 71977 (2016).
Strongly disordered monolayer graphene grown on SiC

Cusp-like RG flow
Dr. Shun-Tsung Lo (羅舜聰)
Department of Physics, National Cheng Kung University, Tainan, Taiwan

Disordered two-dimensional (2D) materials, disordered 2D materials and superconductivity
Chemical-doping-driven crossover from graphene to “ordinary metal” in epitaxial graphene grown on SiC†

Chiashain Chuang, a,b,c Yanfei Yang, a,d Sujitra Pookpanratana, a
Christina A. Hacker, b a Chi-Te Liang, b,c# and Randolph E. Elmquist #,b,#

![Graph showing the ratio of $\tau/\tau_0$ against electron density $n$ in units of $10^{11} \text{ cm}^{-2}$ for Device 1 (black squares) and Device 2 (red circles) with error bars.](image-url)
Summary

• Observation of cusp-like RG flow
• Temperature-dependent transition?
• Monolayer epitaxial graphene is a good disordered system for probing interesting physics
• More theoretical and experimental work needed