MAR09-2008-000219

Abstract for an Invited Paper
for the MAR09 Meeting of
the American Physical Society

Ripples on graphene and their effect on lattice and electronic properties

MIKHAIL KATSNELSON, Radboud University Nijmegen

A discovery of graphene, a new allotrope of carbon [1], representing the simplest, one-atom thick, membrane, opens exciting perspectives in statistical physics of two-dimensional systems in general. As expected from theory of flexible membranes [2], free suspended graphene is corrugated (rippled) due to thermal bending fluctuations, which was confirmed by experiment [3] and atomistic simulations [4]. This makes graphene strongly anharmonic crystal leading to anomalous temperature dependences of its thermal expansion, elastic moduli and other thermodynamic and mechanical properties. The ripples are also a source of pseudomagnetic gauge field [5] acting on Dirac fermions which leads to important consequences for the electronic structure such as a formation of midgap states [6,7]. Quenched ripples can be also important sources of electron scattering limiting charge-carrier mobility in graphene [8]. Possible mechanisms of this quenching are discussed.

[1] K.S. Novoselov et al, Science **306**, 666 (2004).
[2] *Statistical Mechanics of Membranes and Surfaces*, ed. by D. R. Nelson, T. Piran, and S. Weinberg (World Sci, Singapore 2004).
[3] J.C. Meyer et al, Nature **446**, 60 (2007).
[4] A. Fasolino, J.H. Los, and M.I. Katsnelson, Nature Mater. **6**, 858 (2007).
[5] S.V. Morozov et al, Phys. Rev. Lett. **97**, 016801 (2006).
[6] F. Guinea, M.I. Katsnelson, and M.A.H. Vozmediano, Phys. Rev. B **77**, 075422 (2008).
[7] T.O. Wehling et al, Europhys. Lett. **84**, 17003 (2008).
[8] M.I. Katsnelson and A.K. Geim, Phil. Trans. Royal Soc. A **366**, 195 (2008).