nanoX invited scientist

OLEG MAKAROVSKIY

Position ASSOCIATE PROFESSOR

Affiliation THE UNIVERSITY OF NOTTINGHAM

Host lab at NanoX LNCMI Team Nano-objects and semiconducting nanostructures

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Dates of stay 15/11/21-15/12/21

Brief Biodata

Present appointment:
Associate Professor, School of Physics and Astronomy, University of Nottingham, UK
Previous appointments
2011- 2019 Assistant Professor, School of Physics and Astronomy, University of Nottingham
2000 - 2011 Research Fellow, The School of Physics and Astronomy, University of Nottingham
Education 1996 - 2000 Ph.D. in Physics, Charles University (Prague, Czech Republic)

Research project during the visit at nanoX

Room Temperature Quantum Hall Effect and high magnetic field transport in graphene based heterostructures with 0D and 2D layers

Despite significant effort and promising preliminary results on quantum Hall effect (QHE) in single layer graphene (SLG),1 the room-temperature QHE resistance standard has not been realised yet. Graphene grown on SiC is considered as the most promising 2D material to replace conventional GaAs QHE resistant standard2-3 as it has extremely long (> 50 T), “giant” QHE resistance platea,4 very good mechanical properties and high critical electric current. However, SiC-grown devices can only operate below nitrogen (77 K) temperature, and control of carrier concentration remains challenging because of their incompatibility with Si/SiO2 technology. These limitations restrict fabrication of gated SiC-graphene transistors and halt their industrial applications. In this proposal we will study fundamental properties of novel graphene-based heterostructures fabricated on conventional Si/SiO2 substrates, which incorporate novel 2D (hBN, InSe) and/or 0D (quantum dots and perovskite nanocrystals) materials. We will also assess their potential for quantum metrology applications. Two specific objectives of this proposal are:
1) To study high temperature (>200 K) QHE in multilayer graphene-based heterostructures.
2) To study novel charge-transfer and interaction phenomena in 0D/2D heterostructures subject to ultrahigh magnetic fields

If relevant, add a figure

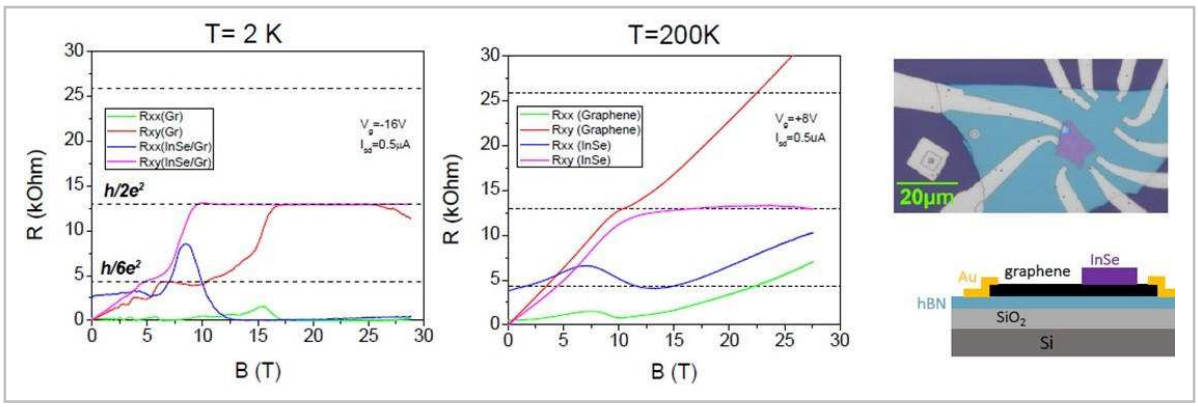

Figure 1. Quantum Hall Effect in the pristine exfoliate graphene and InSe/graphene at T = 2K and T = 200 K, optical image and layer structure of the used sample. This device was fabricated in The Graphene Institute