Quantum Transport at Nanoscale: From Heterostructures to Graphene

A lecture for PhD and MSc students in physics
by **dr hab. Adam Rycerz**

Spring semester 2017/18, every Tuesday at 16.15, room No. A-1-03

[USOSweb code: WFAIS.IF-Y477.0]

In the last few decades a significant progress has been made in controlled fabrication of systems with reduced dimensionality, such as semiconducting heterostructures (1980s), carbon nanotubes (1990s), or graphene and other atomically-thin 2D conductors (2000s). Apart from providing unique opportunities for testing predictions of quantum mechanics, these systems stimulated the development of theoretical and computational tools capable of describing novel quantum-transport phenomena occurring at nanoscale.

Main part of the lecture is focussed on theoretical description of electrical conductivity of one- and two-dimensional nanostructures, including quantum dots and wires. I will overview the conductance quantization phenomena and foundations of the Landauer-Büttiker formalism, experiments and theory on shot noise in electronic systems, and Coulomb blockade in quantum dots. The magnetic field effects will be considered next, including the weak localization and the Aharonov-Bohm effect. Selected unusual features of atomically-thin 2D conductors (such as graphene) will also be presented.

REGISTRATION (*via USOSweb*) **starts from January 26, 2018 (!)**

Background: A scanning electron microscope image of a graphene sheet suspended between two electrodes. *Credit: Lau lab, UC Riverside*