北京大学量子材料科学中心

International Center for Quantum Materials, PKU

ICQM Informal Seminar

Bio-Nano Hybrids for Chemical Detection

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Time: 4:00pm, Sept. 17, 2012 (Monday)

时间：2012年9月17日 （周一）下午4:00

Venue: Room 607, Conference Room A , Science Building 5

地点：理科五号楼607会议室

Abstract

We have explored all-electronic chemical detectors based on bio-nano hybrids, where the biomolecule (DNA or protein) provides chemical recognition and a carbon nanotube (NT) or graphene transistor enables electronic readout. This sensor class represents a promising approach towards sensitive detection of liquid- and vapor-phase anayltes. NT or graphene transistors are functionalized with proteins through an amide bond using a robust process based on carboxylated diazonium salts. Control of protein orientation is achieved through the use of a Ni-nitrilotriacetic acid (Ni-NTA) chemistry with affinity for the histidine tag on an engineered protein. We used this approach to create a nanoelectronic interface to olfactory receptor proteins (ORs) that were embedded in synthetic nanoscale cell membrane analogues. Olfactory receptor proteins (ORs) are the most numerous class of G-protein coupled receptors (GPCRs), a large family of membrane proteins that are important pharmaceutical targets. We have also very recently used similar methods based on an engineered antibody to demonstrate detection of a cancer biomarker at levels of 1 pg/mL, far more sensitive than methods used in the clinic today. Non-covalent functionalization of carbon nanotube transistors is achieved through self-assembly of monolayers of single-stranded DNA on the NT sidewall. The DNA is used not for its self-recognition properties but rather for its chemical recognition for small molecule analytes.

About the Speaker

A. T. Charlie Johnson received a B.S. from Stanford University, and a M.S. and Ph.D. from Harvard University, all in Physics. He was a European Union ESPRIT Postdoctoral Fellow at the Delft University of Technology in the Quantum Transport group of Prof. Hans Mooij, and a National Research Council Postdoctoral Research Fellow at the National Institute of Standards and Technology, with the Cryoelectronic Metrology group. Since 1994, he has led an independent research group at Penn, focused on nanostructure physics and nanoelectronics. Johnson worked extensively in the science of carbon nanotubes, making significant contributions to the understanding of thermal and electronic transport in this important nanomaterial. More recently he has been activein the area of vapor- and liquid-phase molecular sensing using functionalized nanotube field effect transistors, as well as graphene electronics and synthesis of wafer-scale graphene.