北京大学量子材料科学中心
International Center for Quantum Materials, PKU

中心系列讲座 ICQM Weekly Seminar Series

"Electronic Conduction Properties of Single Semiconductor and Metal Nanowires"

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Time: 4:00am, Nov. 16, 2011 (Wednesday)

时间：2011年11月16日（周三）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

In this seminar talk, I will discuss our low-temperature experimental studies of the electronic conduction properties of semiconducting ZnO and metallic RuO_2 and AuPd nanowires. (1) The electrical conduction mechanisms in the intensely studied, natively doped ZnO nanowires will be addressed. Based on four-probe measurements in a wide temperature range 1–300 K, we propose a "split-impurity-band" model to explain the electrical conduction processes in this intriguing nanoscale semiconductor. (2) Time-dependent universal conductance fluctuations (UCF's) in weakly disordered RuO_2 nanowires at liquid-helium temperatures will be discussed. Our observation reveals pronounced temporal UCF's which originate from the scattering of electrons with dynamic defects (two-level systems). Our measured UCF amplitudes, which reached a fraction of e^2/h at temperatures below 1 K, are quantitatively explained by the theory of Shechao Feng. (3) I will briefly present our recent studies of the electron-phonon relaxation time in AuPd wires in the quasi-ballistic limit of $q_T l > 1$, where q_T is the wave number of a thermal phonon and l is the electron mean free path. Our results demonstrate an unexpected electron-phonon relaxation mechanism that originates from scattering of electrons with transverse vibrations of defects and impurities.

About the speaker

Professor Juhn-Jong Lin received his B.S. degree from National Chiao Tung University (NCTU, Taiwan) in 1979, and Ph.D. degree from Purdue University (USA) in 1986. He joined the Physics Department of National Taiwan University in 1988, after two years as a postdoctoral research fellow at the University of Michigan and the University of Virginia. He has been associated with the NCTU since 1997, and is a NCTU Distinguished Professor of Physics. His research areas cover the mesoscopic and nanoscale physics, focusing particualrly on the quantum transport properties and electron dephasing/decoherence mechanisms in low-dimensional systems.