CENTRE FOR NANOSCIENCE AND NANOTECHNOLOGY SEMINAR SERIES

TOPIC: **Interaction Effects in Electron Transport in One-Dimensional Quantum Wires**

SPEAKER: Professor Sir Michael Pepper
Cavendish Laboratory, University of Cambridge, UK

TIME: 12:00-1:00pm, Thursday 29 June 2006 (No RSVP required)

VENUE: Ground Floor Lecture Theatre,
Chemical and Biomolecular Engineering Building 1,
The University of Melbourne

ABSTRACT:

By varying the electrostatic confinement from patterned gates, electron transport in two dimensions can be converted into one. In particular, the use of GaAs heterostructures has shown striking results due to the relative absence of electron scattering. Electron transport in one-dimensional ballistic quantum wires has been, by and large, described using the Landauer formula where the conductance is expressed in terms of transmission and reflection probabilities of electron waves. The overall conductance is given by: $T(2e^2/h)n$; where T is the transmission coefficient; and n is the number of one-dimensional subbands occupied, which can be changed by varying the confinement potential. This behaviour has been observed in very great detail and in the ballistic regime it is possible to observe wide plateaux of quantised resistance.

A description beyond this non-interacting picture has now become necessary to understand some of the recent experimental observations. These include the *0.7 structure*, a conductance structure at $0.7(2e^2/h)$ in zero magnetic field, *0.7 analogue*, very similar to the 0.7 structure in a high magnetic field when there is crossing of two spin levels and plateaux at 0.5 $(2e^2/h)$ observed occasionally and to which the 0.7 tends with decreasing carrier concentration. Detailed studies of the 0.7 structure suggest spontaneous lifting of the spin degeneracy as a cause, which is supported by a number of theoretical studies. Further evidence also comes from studies of thermopower, shot noise, and magnetic focusing. A review of some of these results, recent work on quantum wires fabricated by different techniques will be presented.

Further details available at: www.cnst.unimelb.edu.au/news/seminars.html