Postdoctoral position available

7 February 2003

CORRELATED EFFECTS IN QUANTUM ELECTRONIC DEVICES

A 2-year postdoctoral position is available immediately at the University of New South Wales, to fabricate advanced coupled quantum electronic devices, and to perform detailed low temperature measurements to further the understanding of proximity effects and new correlated phases in closely spaced quantum electronic devices.

Research Fellow (Bilayers Project)

We have an opening for a postdoctoral researcher to play a key role in device fabrication and measurements of bilayer 2D hole gas systems for an ARC funded project "Proximity effects and new correlated phases in closely spaced quantum electronic devices" in the School of Physics. This is a collaborative project with NTT Basic Research Laboratories, Japan enjoying theoretical support from Boise State University, U.S.A. and from within the School.

The project involves the fabrication of advanced coupled quantum electronic devices, including development of new processing techniques where appropriate and the operation of cryogenic apparatus, including ^{4}He and dilution refrigerator systems for electrical measurement of these devices.

The applicant should hold a Ph.D. or equiv. in Physics or Elec. Eng and have experience with GaAs processing techniques, cryogenic systems and low noise electrical measurements. Experience with 2D hole systems or bilayer 2D systems is highly desirable.

Further details of both positions and application procedures can be found on the web at www.phys.unsw.edu.au/QED
Specific enquiries may be directed to Associate Professor Alex Hamilton on telephone (61 2) 9385 5736 or email alex.hamilton@unsw.edu.au Applications close 14 March 2003.

Background Information: Two-dimensional electron and hole systems in high-quality AlGaAs/GaAs heterostructures have received intense research interest over the last 20 years leading to the award of two physics Nobel Prizes for the Integer and Fractional quantum Hall effects in 1985 and 1998 respectively. In particular, the fractional quantum Hall effect highlights the remarkable quantum states that can arise from interactions between particles[1]. A natural extension of this work is to systems consisting of two 2D systems sufficiently closely spaced that the interactions between particles within each layer is of similar strength to the interactions between particles in different layers, where novel bilayer-coherent states can be formed[2,3]. This 'interlayer coherence' is predicted to produce effects[4] including superfluid-like behavior, Bose-Einstein condensation, Kosterlitz-Thouless phase transitions and Josephson-like tunnelling effects. Facilities available to this research program include:

- In addition to a dedicated ^{4}He cryostat with a 12T superconducting magnet, numerous low temperature electrical measurement systems are available in UNSW's School of Physics including 2 dilution refrigerators and a ^{3}He system, providing temperatures down to 0.01K and magnetic fields up to 18T.
- A well-established Class 100/3.5 cleanroom facility for GaAs and Si device processing including electron-beam and optical lithography equipment.
- Extensive structural characterisation capabilities including atomic force microscopy and transmission/scanning electron microscopy are available at the Electron Microscope Unit (UNSW).
- Optical characterisation equipment is available in the photoluminescence and photonics laboratory in the School of Physics at UNSW.

1 *The Fractional Quantum Hall Effect*, T. Chakraborty and P. Pietiläinen, Springer-Verlag, New York (1988).
2 *The Quantum Hall Effect Branches Out*, J.P. Eisenstein, Physics World – June 2001, 30.
3 *Fractional Quantum Hall Effect in Bilayer Two-dimensional Hole-gas Systems*, A.R. Hamilton *et al.*, Phys. Rev. B **54**, R5259 (1996).
4 *Spin and Isospin: Exotic Order in Quantum Hall Ferromagnets*, S.M. Girvin, Physics Today – June 2000, 39.