



Queensland Micro- and Nanotechnology Centre



July - December 2010

NEWSLETTER

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As the year draws to an end, it is wonderful to look back at the Centre achievements over the past year and, in particular, the last six months. This has only been possible due to the dedicated work of the QMNC members! Our grants successes in the last rounds were very notable with outstanding success rates in the ARC Future Fellowship, Discovery Project and Linkage Project rounds relative to the national averages. The grants received are summarised later in the newsletter. I am particularly pleased to see that this will bring some new researchers to the Centre through support with Fellowships and ARC funded positions. Final contracts associated with our funding of \$2.25m through the Australian National Fabrication Facility have been prepared, and we will be in a position to purchase new equipment early in the new year.

The demonstrated commitment of the members through participation in the Retreat was great. Special thanks to John Ness for facilitating it, and Sue Berners-Price for her presentation. It gave us an opportunity to discuss how we are going and what we need to do to enhance our position in the University. We are also grateful to the other members of our Advisory Board whose support and advice is always greatly appreciated.

Welcome and congratulations to the new Vacation Scholars, Rhys Friend, Michael Kelly, Akshay Maan, Martha Mberu, Imran Noor, Darryl Pyle and Tim Webb, who will work on various projects in the QMNC for 4 weeks over the summer vacation. We look forward to hearing about their work at the end of this period.

It was nice to see so many people able to come along to the Christmas party and as you can see from the photos it was a very relaxed and happy event!!

Best wishes to all for a peaceful Christmas season and a successful and happy year in 2011.

Debra

New Starters

STAFF

Barbara Johnston

Barbara commenced with the QMNC as a Research Fellow in November 2010. Barbara has just completed a PhD in the Australian Rivers Institute and will be working with Debra on a QMNC project utilising her expertise in statistical mechanics, dynamical systems theory, complexity and nonequilibrium molecular dynamics simulations. Barbara is located in room 1.11 of the QMF building, xtn 58057.



Glenn Walker



Glenn recommenced with the QMNC as a Research Assistant in November 2010 after taking a leave of absence for the past 7 months, acting as support driver for a friend who was cycling around Australia raising money for cancer research. Glenn completed his final year IAP project within the QMF and he contributes to the group by focusing on providing proof of concept for SiC on Si products and boost activities for process development. Glenn is located in room 1.04 of the QMF building, xtn 58002.

STUDENTS

Mr Clotario Tapia Bastidas - RHD student (Supervisor – Evan Gray)

Clotario is an international student from Ecuador who was offered PhD candidature in the Centre during October. His research topic is Design of Materials for Clean Energy Applications. Clotario will be working with Evan Gray and Jim Webb to measure the tiny amount of hydrogen desorbed from stress corrosion cracked structural steels used in building turbogenerators for electricity supply. The project is a collaboration with Prof Andrej Atrens, University of Queensland and Alstom, a Swiss generator manufacturer.

We welcome all new staff and students to the QMNC

QMNC RETREAT

The Centre hosted its Inaugural Retreat on Tuesday 9 November at Comfort Inn Robertson Gardens. 36 staff and students attended and it was facilitated by Dr John Ness, Technical Director, EM Solutions and QMNC Board member. A special presentation was given by Prof Sue Berners-Price, PVC (SEET) and research presentations were provided by Sima Dimitrijevic, Evan Gray, Xiangdong Yao, John Dobson, Greg Hope, Peter Johnston, Faisal Mohd-Yasin and Debra Bernhardt.

The Retreat was very beneficial to all members by providing opportunities for knowledge sharing and networking. Several outcomes were also identified which will be useful for the progression and development of the QMNC. Special thanks are given to all presenters, students and staff who made the event such a success. More photos are appended to the newsletter.



Group Shot – QMNC Staff and Students

PVC (SEET) giving special presentation



Research

Tim Gould and John Dobson have been working with an overseas group including Sebastien Lebegue (U. Nancy) and Georg Kresse (U. Vienna, VASP) to obtain the first reliable (theoretical or experimental) result for the layer binding energy of graphite. This number is of significance for self-assembly of graphitic nanostructures, where the dispersion (van der Waals) forces are anomalous. The numerical results were obtained within the Random Phase Approximation to ensure an accurate treatment of the vdW effects, which are not described correctly in the usual Local and Gradient Density Functional Approximations. This calculation was not feasible previously because of the need for very fine sampling of the Brillouin zone near the Dirac points in this semi-metallic system. The same unusual semi-metallic electronic bandstructure is responsible for the striking conductivity and Hall effect properties of graphene, whose discovery led to the award of this year's physics Nobel Prize to Novoselov and Geim. The graphite layer binding results from the QMNC collaboration appeared in November in Phys. Rev. Letters (PRL 105, 196401 (2010)).



Orrie Dancewicz undertook an IAP project in Semester 2 under the supervision of John Dobson. As an outcome of this project, there is some possibility of a fundamental Force Microscopy experiment eventuating, as a collaboration between the QMNC and Prof Nunzio Motta of QUT.

Conferences

Reports from some of the conferences attended by QMNC Members:

John Dobson was co-organiser of a **CECAM workshop** in Lausanne, Switzerland, in July on the topic of "van der Waals forces in DFT, RPA and beyond". There were 50 attendees, mostly invited, and the meeting was funded by CECAM (European Centre for Atomic and Molecular Calculations).

The statistical physicists enjoyed a number of conferences in the last six months. **StatPhys 24** was a major international conference that was held in Cairns 19-23 July. Centre members gave a number of presentations:

- James Reid (talk) "Non-monotonic relaxation of a simple system"
- Debra Bernhardt (talk) "The role of the dissipation function in classical statistical thermodynamics."
- Owen Jepps "Polygonal channels: insights into real-world transport?"
- Sarah Brookes "The Dissipation Theorem"
- Stuart Davie "Phase Transitions Using Free Energy Calculations"

Debra, Sarah and Owen also attended the satellite meeting **Liquids out of Equilibrium** which was held in Sydney 12-16 July.

From 26-30 November, Debra attended **StatPhys-Kolkata VII**. This meeting was held as a part of the Silver Jubilee Celebration of the Satyendra Nath Bose National Centre for Basic Sciences, Kolkata in collaboration with the Saha Institute of Nuclear Physics, Kolkata, and Debra presented a talk "Fluctuation Theorems for Many Particle Systems" in the inauguration session at the start of the conference. International experimental and theoretical researchers were hosted at the meeting and there were lively discussions over the 5 days. Satyendra Nath Bose's contributions to science were especially recognised at the conference.



Satyendra Nath Bose



Seminars – 2nd Semester 2010

- **Mimicking Photosynthesis**, Prof Ken Ghiggino, Masson Professor, 2010 Royal Society of Chemistry Australasian Lecturer, School of Chemistry, University of Melbourne (August)
 - **Computational Modelling and Simulation in Heart Rhythm Research**, Dr Blanca Rodriguez, University of Oxford (August)
 - **Controlled Drug Release from Encapsulated Nanometer Liposomes using High Intensity Focused Ultrasound**, Prof Junru Wu, Professor in Physics, Affiliations Physics Department and Materials Science Program, University of Vermont (August)
 - **Mixed Gas Adsorption Studies of Carbon Dioxide and Methane on Coal and Related Material**, Mr Greg Staib, PhD candidate, QMNC (September)
 - **Generating a New Strain of FPGA Infrastructure by Application of SiC Based Non-Volatile Memory Device**, Mr Jeremy Tay, PhD candidate, QMNC (October)
 - **Hydrogen Bonding in Ionic Liquids**, Mr Sebastian Lehmann, Dipl.-Chem., Wilhelm Ostwald Institute for Physical and Theoretical Chemistry, University of Leipzig (December)
 - **Influence of different charge sets on structural and dynamical properties of 1-n-butyl-3-methylimidazolium bromide**, Ms Miriam Kohagen, Dipl.-Chem., Wilhelm Ostwald Institute for Physical and Theoretical Chemistry, University of Leipzig (December)
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Visitors

We have had several visitors to the QMNC including:

- Trade Commissioner for Europe and Russia – Monday 18 October
- Chinese delegation from Xidian University – Monday 1 November
- Sebi Lehmann and Miriam Kohagen Wilhelm Ostwald Institute for Physical and Theoretical Chemistry University of Leipzig – both gave seminars on Monday 6 December

All visitors thoroughly enjoyed visiting our Centre, touring our world-class facility and meeting our researchers who are at the forefront of their fields.

Longer term visitors to the Centre include:

- Guo Hui (1/9/10 – 31/8/11) – (Jisheng Han)
 - Randolph Pax (1/10/10 – 31/12/12) – (Evan Gray)
 - Shilun Qiu (31/1/2011 – 13/2/2011) – (Xiangdong Yao)
 - Ye Peng (early 2011 for 12 months) – (Xiangdong Yao)
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New Grants

Congratulations to the recipients of the following new grants:

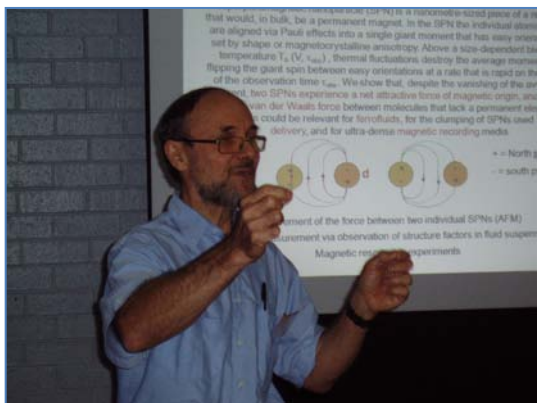
- **ARC Future Fellowship - Guangshan Zhu** – “Targeted synthesis of porous materials towards gas sorption and separation” - \$801,000
- **ARC Linkage Project –Xiangdong Yao**, Lianzhou Wang, Huijun Zhao, **Debra J Bernhardt**, Matthew S Dargusch, Liejin Guo and Youjun Lu – “Solar-driven massive hydrogen production from biomass and biomass/coal mixtures by supercritical water gasification” - \$600,000 and support from Control Technologies International and Ningxia Searcher Heat-Superconduct Technology Co Ltd
- **ARC Discovery Project – Debra J Bernhardt** – “Computational studies of melting and the solvation properties of ionic liquids” - \$360,000
- **ARC Discovery Project – Debra J Bernhardt** – “Dissipation and relaxation in statistical mechanics” - \$420,000
- **ARC LIEF – Peter A Lay, Evan M Gray** and others – “Innovative synchrotron science - program for access to the Australian National Beamline Facility and cutting-edge beamlines at international synchrotrons” - \$800,000
- **ARC LIEF - Edith M Sevick, Vincent R Daria, Debra J Bernhardt, Prof Denis J Evans, Hans A Bachor**– “Optically controlled containers for experiments in soft matter” - \$150,000
- **Commercialisation Australia - Barry Harrison** "Stored Charge Random Access Memory (QsRAM) a novel semi conductor memory technology with terabit memory capacity" with a value of \$462k, which he obtained as part of QsSemiconductor Australia Pty Ltd.
- **Griffith Enterprise Innovation Fund - Alan Iacopi** – “Novel SiC growth – R+D in pursuit enabling patent application, useful and novel processing technique providing productivity improvements and enhanced process capability” - \$40,000
- **Griffith Enterprise Innovation Fund - Alan Iacopi** - "Plasma etching of SiC, possibly using a standard photo resist mask, with selectivity to Silicon" - \$43,000
- **AINSE Research Award – Jisheng Han** – “SIMS analysis on GaN3C-SiC/Si blue LEDs” - \$13,460
- **AINSE Research Award – Gretel Heber** – “An X-ray reflectometry study of octanohydroxamate interaction with copper” - \$8,580
- **Griffith Grant for Learning and Teaching – Leng Leng Lim and Owen Jepps** – “Taking the complexity out of Complex Analysis – improving student engagement through peer teaching and peer assessment” - \$4,200
- **Griffith University New Research Grant – Faisal Mohd-Yasin** – “Studies of noise sources of capacitive-sensing MEMS accelerometers” - \$17,000
- **AMRF – Jim Webb** – “Investigation of intermediate compounds in the direct hydrogenation of Magnesium Diboride” - \$9,074.19

Congratulations

Congratulations to PhD student, Tara Congo, who gave birth to a baby daughter, Nadia in October. Best wishes to Tara and her partner Izmir on this happy event. It was lovely to see Tara and Nadia at the QMNC Xmas party.



Images from the QMNC Inaugural Retreat



John Dobson giving presentation



**Lester Barnsley, Greg Staib, Matt Crossley –
QMNC PhD students**



Evan Gray and John Dobson



**John Ness (Facilitator and QMNC
Board member) with Debra**

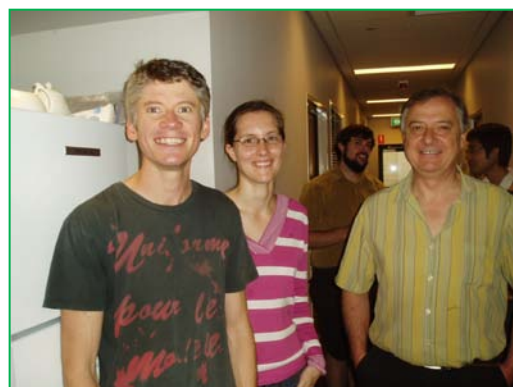


**James Reid (Postdoc), Joe Barnsley
and Stuart Davie (PhD students)**



**Sarah Brookes (PhD student), Gretel Heber
(Postdoc) and Lily Wang (Research Fellow)
enjoying afternoon tea**

Images from the QMNC Xmas Party





MERRY
CHRISTMAS AND
HAPPY NEW YEAR
TO ALL