In Coherence

Summer 2012

Newsletter for ARC Centre of Excellence for Coherent X-Ray Science

Spectacular Physics Education at CXS

Inside This Issue

CXS is proud of its reputation for mentoring and educating scores of students through the Growing Tall Poppies program (GTP). The goal of this program has always been to engage students in the physical sciences and see how improved the students are by working with CXS scientists and their projects.

The engagement over the first three years of the program has seen the up-scaling of the GTP program delivery towards Santa Maria College students during the school's work experience week.

This up-scaled and closer relationship between CXS and Santa Maria College has been established so statistics can be tracked to obtain meaningful results on how this sort of program can change students' attitude towards science and encourage students to undertake Physics in Year 12.

Santa Maria statistics now reveal that over the last three years many of the Santa Maria College students participating in the project have gone on to study Physics at Year 11.
The increase in the retention of Year 11 students into Year 12 has expanded from an average of 50% in the six years prior to the Growing Tall Poppies (GTP) program, to 93% since the GTP implementation at Santa Maria College. This is a significant upward trend thanks to this intervention program, and having reliable data that can be analysed statistically has provided CXS with a good indication of whether to allocate resources into outreach programs such as GTP.

CXS is currently in the process of making this information available through public literature so it can share the success of this program.

Deborah Baker, Santa Maria Secondary College Principle; Dr Eroia Barone-Nugent, GTP Teaching Consultant; and Tania Smith, CXS Chief Operating Officer

The agreement between CXS and Santa Maria College offers another benefit too, one that is also important – a meaningful outreach outcome from its' ARC funding when students are given a once-in-lifetime opportunity to develop a deeper relationship with a research organisation that places a human face to the science. Deborah Backer, Santa Maria College Principal says, "GTP provides an authentic learning opportunity for our students to be engaged, active, and passionate about the world they live in and highlights the value of an on-going partnership with Scientists from CXS."

Coming Events

CXS Writing Worskhop

12 - 13 June 2012

Stonelea Country Estate

Archeron

CXS will be hosting a paper writing workshop for interested CXS members. 20 place are avaible for this free two day workshop.

For further information or to request a place please contact Grant Van Riessen via email on:

G.vanRiessen@latrobe.edu.au

or telephone Tania Smith on

8344 5444.

In Brief

Publications:

Publications for the first quarter of 2012 include:

Richards, GH., Wilk, KE., Curmi, PMG., Quiney, HM. and Davis, JA.,*"Coherent Vibronic Coupling in Light-Harvesting Complexes from Photosynthetic Marine Algae."* Journal of Physical Chemistry Letters, 3, 272-277 (2012)

Davis, JA., Hall, CR., Dao, LV., Nugent, KA., Quiney, HM., Tan, HH. and Jagadish, C., *"Three-dimensional electronic spectroscopy of excitons in asymmetric double quantum wells."* Journal of Chemical Physics, 135, 044510 (2011)

Tucker, EJ., Hershamn, SG., Kohrer, C., Belcher-Timme, CA., Patel, J., Goldberger, OA., Christodoulou, J., Silberstein, JM., McKenzie, M., ryan, MT., Compton, AG., Jaffe, JD., Carr, SA., Calvo, SE., RajBhandary, UL., Thornburn, DR. and Mootha, VK.*"Mutations in MTFMT underlie a human disorder of formylation causing impaired mitochondrial translation."* Cell Metabolism, 14, 428-434 (2011)

Conn, C.E., Darmanin, C., Mulet, X., LeCann, S., Kirby, N., and Drummond, C.J.*"High-throughput analysis of the structural evolution of the monoolein cubic phase in situ under crystallogenesis conditions."* Soft Matter, 8 (7), 2310 - 2321 (2011)

Putkunz, C.T., D'Alfonso, A.J., Morgan, A.J., Weyland, M., Dwyer, C., Bourgeois, L., Etheridge, J., Roberts. A., Scholten, R.E., Nugent, K.A., and Allen, L.J., *"Atom-scale ptychographic electron diffractive imaging of boron nitride cones."* Physical Review Letters, 108, 073901(2011)

Kielpinski, D., and Gat, O. *"Phase-coherent repetition rate multiplication of a mode-locked laser from 40 MHx to 1 GHz by injection locking."* Optics Express, 20, 2717 (2011)

CXS Visitors:

Felix Frank from Imperial College visited the Short Wavelength Laser Source Program at Swinburne University in February.

Jacob Taylor of the Joint Quantum Institute USA visited the Attosecond Sciences Program at Griffith University in February.

Ron Steer from the University of Saskatchewan visited the Short Wavelength Laser Source Program at Swinburne University in March.

Conferences & Workshops:

Dr Harry Quiney attened the *Biomolecular Imaging using Free-Electon Lasers Seminar* at European XFEL GmbH, Hamburg, in February.

Professor Mike Ryan was a session chair at the *Lorne Protein Conference* in February.

Associate Professor Trevor Smith was an invited speaker at the *2nd Molecular Materials Meeting, Singapore,* in January.

Associate Professor Robert Scholten was an invited Speaker at the *Banff Meeting on Structural Dynamics,* Canada in February.

Media:

Megan Dearnley's work, *Parasite goes bananas before sex*, has received extensive media coverage in Health Canal, Science Alert, EurekaAlert!, Physorg.com, Futurity, The Times of India and The Melbourne Newsroom.

The Attosceond Science Program's Robert Sang and Dave Kielpinski appeared on an episode of Channel 10's Scope on "Green", in February.

Farewell to Members:

- Che Stafford finished his CXS Vacation Scholarship.
- Maria del Crespo, Jesse Rudd-Schmidt, Sarah Frankland and Catherine Palmer have finished their PhD.
- Liisa Hirvonen has returned to the UK.
- Adam Palmer completed his contract.

Welcoming New Members:

Theory and Modelling Program:
- Andrew Martin
- T'Mir Julius

Short Wavelength Laser Source Program:
- Antoine Dubrouil

Biological Sciences Program:
- Luke Formosa
- Coralie Millet
- Chen Xie

Ultracold Plasma Source Program:
- Rory Spiers
- Richard Taylor

Attosecond Science Program:
- Aidan Jessen

Awards:

Congratulations to Ben Norton, PhD student who took second place in the Canon Extreme Imaging competition for his work in high-resolution imaging of single atoms. Press coverage of this work included Cosmos magazine and the website of National Georgraphic.

Victor Streltsov has recveived a Japanese Society for Promotion of Science (JSPS) Fellowship under the JSPS Invitation Fellowships Program for Research in Japan. He will conduct research, attend seminars, give lectures etc in the host insitution, Nagoya Institute of Technology, for a period of 30 days.

Tilley's Team Travel to new Technology Territory

Late last year Professor Leann Tilley, CXS Deputy Director, and her Biological Science Program team moved to their new home in the Department of Biochemistry & Molecular Biology, The University of Melbourne at the Bio21 Institute in Flemington Road, Parkville.

The physical move took only a week but the work-time lost for the group amounted to around two months, due to the tapering down of experiments and the time that it took to pack.

Three companies assisted with the move and the successful transportation of the large equipment and dangerous chemicals – which was no mean feat - but the group survived and so did the equipment. Research life for Tilley's lab continues to expand.

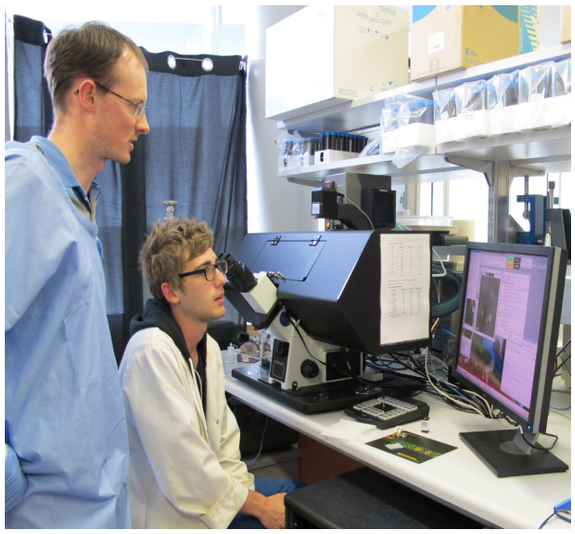
The team was sad to leave its home at La Trobe University, a place where friendships were formed, experiments evolved and achievements always applauded, but now that they're settled at Bio21 in Parkville, the team is quick to point out some of the things they like about working in the new location, such as the open plan space and the interaction between all the groups located in the same building.

One of the advantages of the group moving to Bio21 was increased access to the Advanced Microscope Facility within the Institute, which is managed by former lab member Eric Hanssen. In addition, since relocating, the Tilley lab has taken delivery of two new microscope systems; the Deltavision Elite & OMX Blaze system.

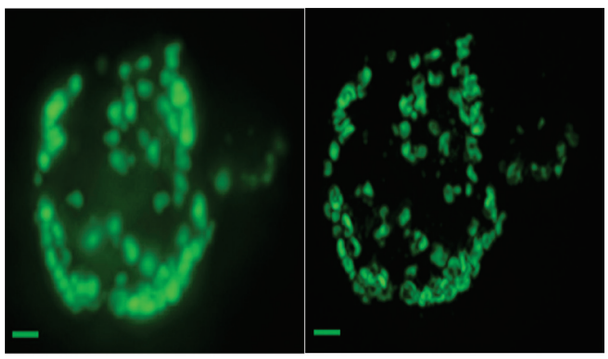
The Deltavision Elite microscope complements the existing confocal microscopes within the Department. It is ideally suited to imaging malaria parasites (especially for live cell imaging) and is being heavily used by the Tilley lab and other members of the Department.

The OMX Blaze system uses 3D Structured Illumination to break the diffraction barrier and enable researchers to image at eight fold better volume resolution than convention light microscopes. This $1 million piece of equipment was funded via a successful ARC-LIEF grant and contributions from partner institutions - The University of Melbourne, La Trobe University, Monash University and WEHI. This system is the latest version of the 3D-SIM technology, which allows very fast imaging of live cells at biologically relevant timescale (up to 60ms/frame).

The science team was rapidly inducted into the close-knit Institute family with a welcome reception hosted by the Department, invited seminars at Departmental and Institute events and a series of short presentations with the parasitology research groups in the Department that were designed to demonstrate the different streams of research across the groups and to impart scientific information. The group is now very much settled in and work is back at full pace, with exciting times ahead.



Dr Paul McMillan and Steven Batinovic study results from the new fluorescence DeltaVision Elite microscope



A comparison between conventional and OMX imaging. Scale bars are 1 um

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The ARC Centre of Excellence for Coherent X-ray Science (CXS) is an Australian Government Initiative which began in July 2005 to explore what can be achieved with coherent X-ray optics; including an understanding of exotic phenomena such as X-ray phase discontinuities.

CXS headquarters is located at the University of Melbourne in Victoria, Australia, with participating nodes at La Trobe University, Monash University, Swinburne University of Technology, Griffith University and the CSIRO. Its mission is to be the world leader in the development of non-crystallographic techniques for the determination of protein structures.

“In Coherence” is produced quarterly (or there abouts) by CXS. Contributions are welcome and should be forwarded to Ms. Tania Smith, CXS Chief Operating Officer, University of Melbourne, Parkville, Vic, 3010, fax to +61 3 9347 8912, email: cxsenquiries@ph.unimelb.edu.au or Ms. Rosslyn Ball, Administration, email: r.ball@ph.unimelb.edu.au

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NADIA Software Package Available for Free

CXS has developed a number of important X-ray analysis algorithms that it has made available to other members of CXS and to the wider scientific community. The Theory and Modelling Program has created a standard software package for these algorithms and for basic X-ray diffraction data analysis. In particular, it softward allows users to be introduced to the CXS image reconstruction algorithms in a user-friendly way.

Currently, the following algorithms/functions have been implemented:

- Planar CDI reconstruction (with an example of real data reconstruction and with a simulation of the same sample)
- Fresnel CDI reconstruction (including white field reconstruction) and an example is provided. The software allows complex constraints on the reconstructed wave-field to be easily applied.
- Ptypography and phase-diverse reconstruction.
- The shrink-wrap algorithm.
- Retrieving the autocorrelation function.
- File conversion - HDF, TIFF, PPM and binary (double format) are supported as input. PPM and binary are supported as output. Binary files representing complex fields (fftw standard) are also supported (as input and output).

The package has been written in C++ and is structured as:

- A C++ library which users can import into there own code (only interfaces with C/C++ at the moment): libCOECXS.a or libCOECXS.so
- A set of IDL routines which allow the C++ library to be used within IDL.
- Command line tools: a set of .exe files. This is less flexible than the library, but simpler to use for people who are unfamiliar with C/C++.
- A set of examples showing how to use the library and command line tools.

If time allows and there is a need for it, a simple GUI may also be constructed.

A comprehensive description of the code is given in the doxygen documentation on the site. This should be useful, in particular, to users familiar with C++ and wanting to use the library option as it lists the various functions available.

To access to software please follow the following link:

http://www.coecxs.org/joomla/index.php/research-and-projects/nadia-software-project.html