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**Previously Represented as:**



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 and the CSIRO. Its mission is to be the world leader in the development of non-crystallographic techniques for the determination of protein structures.

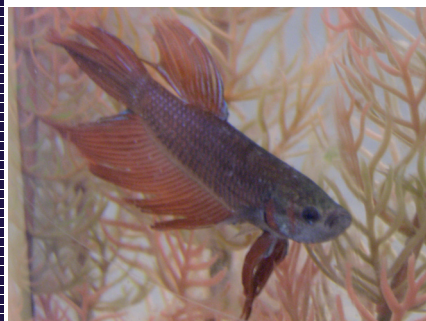
"In Coherence" is produced quarterly by CXS. Contributions are welcome and should be forwarded to Ms. Tania Smith, CXS Chief of Operations, University of Melbourne Vic 3010, faxed +61 3 9347 8912, Email: [tsmith@ph.unimelb.edu.au](mailto:tsmith@ph.unimelb.edu.au) or Ms. Rosslyn Ball, Administration, Email: [r.ball@ph.unimelb.edu.au](mailto:r.ball@ph.unimelb.edu.au)

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Special thanks to Harry Quiney, Emma Duglas and Rosslyn Ball for their contributions to the September 2006 edition.

### The CXS Mascot



Meet Fluffy, the CXS mascot, who has already learnt how to play dead!

"My name is "Fluffy" and I am the new CXS office mascot.

I am a Veil Tailed Betta (Thai/Siamese Fighting Fish). I'm shy and sensitive, yet quick to anger and I dislike my own kind (weird huh!). So don't hold a mirror up to me or I'll put my fins up for a fight!

As you can see I have been in a scrape so my tail has been chewed up a bit but it should grow back to its full glory in no time (or so they tell me).

I can jump about 3 inches when cheesed off, and seeing as I'm in a tank this could be suicide, so please keep me happy

and I'll reward you by being a great office mascot.

It's been proven that Fighting Fish like me recognize their owners and have even been know to do tricks! So I've been told I'm to learn how to ring a bell or jump through a hoop; or something like that!

Yeah right! Good luck with that one! Hehehe!"

### Positions Vacant

**Research Assistant/Research Fellow (4 positions)**  
**School of Physics, Faculty of Science, Monash University**

Physicists and Engineers are required for the Detector Program of the CRC for Biomedical Imaging Development. Applicants will hold a relevant tertiary qualification and must have skills in at least one of: X-ray detector design; data acquisition system design; system level modeling, data processing algorithm development; software development; high precision mechanical and thermal design; mixed mode full custom application specific integrated circuit design; procurement and production support. Appointment will be made at a level appropriate to the successful applicant's qualifications, experience and in accordance with the classification standards for each level.

Salary range: \$44,747-\$60,728 / \$63,925-\$75,912 pa Level A/Level B plus superannuation

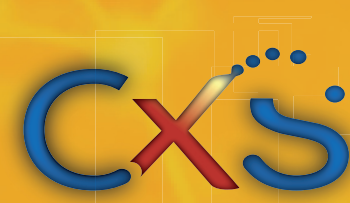
Duration: Three-year appointment

Location: Clayton campus

Contact: Mr. Andrew Berry on 9905 8600 or email [andrew.berry@sync.monash.edu.au](mailto:andrew.berry@sync.monash.edu.au)

Ref No: 175

Applications close: Friday, 6 October 2006



# In Coherence

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### Up & Coming Events

12th IUBMB Conference, 26 Sept —

1 October 2010, Melbourne, Australia.

The University of Melbourne Seminar on Science with Synchrotrons: Dr. David Paterson presents — Microspectroscopy:

A Versatile X-ray Microprobe

12pm, Friday 6 October 2006,

James Hardie Theatre, Architecture

Building, University of Melbourne



Dr. Mark Tobin gives the first seminar in a series on Science with Synchrotrons

### No Man's an Island

The ongoing collaboration between the Theory and Modeling team and the Experimental Methods teams has resulted in the recent submission of a manuscript on the reconstruction of a gold nanofabricated object from a Fresnel imaging experiment, and another on the role played by phase curvature in resolving structures in the presence of partially coherent illumination. The two groups have been active in exploring the consequences of partially coherent illumination in imaging experiments based at third-generation synchrotron sources, and the complete characterization of these sources within our experimental imaging configurations.

The Theory team continues to develop new phase retrieval techniques and a family of algorithms that determine structures based on the direct minimization of the fitting error by a conjugate gradient approach. Another approach to the imaging problem under current investigation is the solution of the non-linear integral equation that relates the structure to its autocorrelation through a variant of the generalized Newton-Raphson scheme.

The Short Wavelength Laser Source team is also working with the Theory Group to determine the phase of molecular polarizability in time-resolved molecule-laser pulse interactions. A large body of data now exists for these interactions in which the magnitude of the frequency-dependent response of the system is known as a function of the time structures of two incident laser pulses. The approach under current investigation is derived from the phase retrieval methods of X-ray imaging and a detailed knowledge of the time-structure of the incident pulses. The Theory Group is currently preparing to move to shift its attention to the study of non-linear quantum electrodynamic processes in laser-molecule interactions in order to investigate possible imaging applications of fourth-generation XFEL devices and table-top high-harmonic generation sources.

### Synchrotron Seminar Series Starts

The first Friday in September saw the inaugural seminar in a series on Science with Synchrotrons presented by the University of Melbourne.

Dr. Mark Tobin, Beamline Scientist at the Australia Synchrotron, gave an informative presentation on Infrared Microspectroscopy at the Australian Synchrotron to an appreciative gathering of approximately 25 people.

With the Australian Synchrotron due to come into operation in March 2007, and an infrared beamline to be installed as part of the first phase of beamline development, it was an appropriate time to explore synchrotron bending magnets and how this enhanced performance has led to applications of synchrotron infrared spectroscopy to diverse fields from biology to earth science and art conservation to materials processing.

Mark has now set the stage to introducing people to the potential of this facility and how it can be used in our research work.

We thank Mark for his contribution and look forward to our future presenters who include: David Paterson, Chris Glover and Nigel Kirby.

## The Lab Safety Zone!

Ok, quick quiz — ask yourself:

Do you always wear protective equipment in labs when necessary?  
Are you aware of the location and use of safety devices in your lab?  
If a spillage occurs, do you know the emergency procedures?  
Do you know the name and number of your safety officer and where to find the emergency numbers in the lab?

If you answered NO to any of these questions you NEED to get up-to-date with the lab safety rules in your area.

Although each lab have specific emergency procedures that apply to its particular products and equipments, there are a few basic guidelines to remember:

Become familiar with the emergency procedures in place at your Institution.

Know the exact location of the safety devices (eyewash fountains, spill kits, first aid kits, fire extinguishers etc.) and make sure you know how to use them.

Always wear appropriate safety equipment (lab coat, safety glasses/goggles, the right kind of gloves, etc).

When using unfamiliar equipment, ask for assistance and become familiar with operating instructions.

When working with hazardous and dangerous products, take extreme precautions to protect yourself and others.

Do not work alone in laboratory.

This list is non-exhaustive. Remember that ensuring safe laboratory working conditions is everyone's responsibility.

So plan your work ahead, be aware of potential hazards and dangerous situations, get training if necessary and when in doubt, ask for help.

Here's to safe and happy research!



## Tour de Europe!

In the eighteenth century, the Grand Tour of Europe was undertaken by Goethe, Stendhal, Dickens, Byron, Shelley and Dumas. During the month of September 2006, this scholarly tradition was continued by Nugent and Quiney, who undertook a similar cultural journey through the more picturesque parts of Europe to investigate the latest developments in Coherent X-ray Science.

Nugent attended a conference in Baden Baden, delivering an invited paper on the work being done by CXS to the XTOP 2006 Conference. This meeting discussed advances in X-ray imagery and defraction. Keith presented the overview of development in X-ray imagery and

highlighted new results published by CXS.

Quiney visited the laboratory Professor John Marangos at Imperial College London to broaden the collaboration of CXS into laser molecule interactions as a imaging tool; a longer visit of about one month will be undertaken early in 2007.

He then spent ten days working with the group of Professors Sgamellotti and Tarantelli at the University of Perugia, with whom he develops new techniques in relativistic molecular quantum electrodynamics.

Next it was off to the University of Oxford, where he delivered a Theoretical

Chemistry seminar (see In Brief) and then he attended a of the life of R.J.P. Williams FRS, one of the founders of the Oxford Enzyme Group (1968 - 1990), which was on of the earliest attempts to establish a formal interdisciplinary collaboration between chemistry, biology, and X-ray crystallography.

## Introducing Dr. Rotha Yu



Dr. Rotha Yu plans to see the coliseums

Dr. Rotha Yu, a research fellow in the Theory and Modeling team of CXS, immigrated to Australia from Cambodia at the aged of 16.

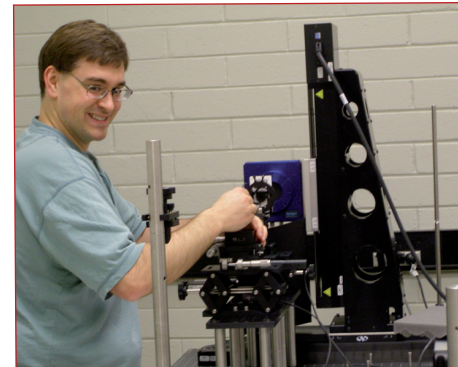
Rotha graduated with a Bachelor of Science (Hons) and a PhD (Theoretical Physics) from Monash University and spent the following two years working at Monash as a post doc.

His current position in CXS allows him the opportunity to work on the phase retrieval problem in X-ray diffraction imaging, in which he aims to get an exact non-iterative solution to the phase problem.

Outside of research Rotha enjoys hitting the badminton around the court, regularly visiting his local swimming pool and going to the movies with family and friends; with Gladiator being a favourite.

Rotha hopes to travel to Europe in the future.

## Welcome to Tracey Island!



Dr. Garth Williams placing a lens in the beamline in the Coherent Scattering Studies Lab

The new Coherent Scattering Studies Laboratory, located in room D013, School of Physics at the University of Melbourne, is now up and running.

Developed to investigate the robustness of coherent diffractive imaging, this lab houses a 3cm CCD detector that can move at a range of 30 x 30 cm and also has an optical table to provide stability.

This equipment is able to alter and steer light sources, and can change illumination properties at the lens and the sample. The lab is also set up for testing and doing phase space tomography experiments.

The Coherent Scattering Studies labs team of researchers currently comprising of Dr. Garth Williams and Dr. Chanh Tran, along with Optics students Lachlan Whitehead, Clare Henderson and Samuel Flewett.

"We are trying to see what kind of resolution we can get and that's where the big detector comes into play." Garth explains. The team has already begun examining the effects of the curvature of wave fronts to more easily retrieve data for investigation.

For further information on the laboratory or its experiments contact Garth on 8344 7541.

## In Brief

### Publications:

The first cross disciplinary CXS paper was published, *X-ray unltramicroscopy using integrated sample cells*. D. Gao, S.W. Wilkins, D.J. Parry, T.E. Gureyev, P.R. Miller, E. Hanssen, *Optics Express* (2006) 7889-94.

Other publications include: *Genesis of and trafficking to the Maurer's cleft secretory compartment of malaria parasite-infected erythrocytes*. C. Spycher, M. Rug, N. Klonis, A.F. Cowman, H. Beck, L. Tilley, *Molecular and Cellular Biology* 6(11):4074-85.

*Fresnel Coherent Diffractive Imaging*. G.J. Williams, H.M. Quiney, B.B. Dhal, C.Q. Tran, K.A. Nugent, A.G. Peele, D.Paterson and M.D. de Jonge. *Physical review Letters PRL* 97, 025506 (2006)

### Scientific Progress:

The CSIRO team are please to announce progress on deconvolution of the powder diffraction data from Oka, Japan, for stacks of 2-D crystals of purple membrane.

The Short Wavelength Laser Source team are eagerly awaiting the installation of the new multi-pass amplifier system and the XUV monochromator, which is scheduled for the end of 2006 at Swinburne University of Technology. Using the existing ultrafast laser system

at Swinburne University (1mJ, 100fs), harmonic generation up to approximately 40 eV (~30 mm) has been achieved in argon.

Electron diffraction of single crystals of hemazoin has been undertaken by the Biological Science team.

RA Stephen Holmes-Brown has optimised protein expression methodologies of membrane proteins and is attempting refolding assays.

### Conferences & Workshops:

A one day workshop on GIXD was held at CMMT in July with Dr. Ian Gentle as the invited speaker.

Dr. Mike Ryan was an invited speaker at the International network of Protein Engineering Centers 2006, Elsinore Denmark.

Eric Hanssen gave an invited presentation : "New insights in  $\beta$ ig-h3 folding" at the 4th European Meeting on Elastin, Hotel-Dieu, Lyon, France, July 2006.

Dr. Harry Quiney delivered a Theoretical Chemistry seminar at the University of Oxford on the work being done by CXS and the recent developments in molecular-laser interactions and X-ray imagine techniques.



Roche Molecular Biochemical Medal winner, Dr. Mike Ryan

### Awards:

Congratulations to Dr. Mike Ryan for receiving the Roche Molecular Biochemicals Medal (May 2006) from the Australian Society for Biochemistry and Molecular Biology.