In Coherence

Winter 2008 Newsletter for ARC Centre of Excellence for Coherent X-Ray Science

Italian/Australian Collaboration on Synchrotron Light Research

Dr Kevin Prince from Elettra, Sincrotrone Trieste S.C.p.A. di interesse nazionale, discusses the recent signing of the Memorandum of Understanding between Elettra and CXS.

Inside This Issue

In Brief	2
HERCULES Workshop Report	3
Avian Flu Public Lecture	3
Visiting Professor J Scott Tyo	4

ELETTRA is a multidisciplinary Synchrotron Light Laboratory, open to researchers in diverse basic and applied fields.

Collaboration agreements have recently been signed between the Italian Synchrotron Light Laboratory Sincrotrone Trieste and two Australian partners: the Centre of Excellence for Coherent X-ray Science (CXS), and the Australian Synchrotron.

These are the latest events in a continuing collaboration between Australian and Italian synchrotron scientists which began at the time of the Italian-Australian Technological and Innovation Conference and Exhibition, in 2002. This conference was organised by the Italian Embassy and was held in Melbourne. In the previous year, the Victorian government had announced that it would fund the construction of the Australian Synchrotron, so it was a very appropriate time to begin working together.

Since that time, the collaboration has proceeded in an informal manner, with a steady stream of Australian researchers visiting Sincrotrone Trieste to perform experiments, particularly in medical imaging and spectroscopy.

In April 2008, the first Italian user visited the Australian Synchrotron to perform experiments on a high temperature superconductor. Another activity has been a series of Australian-Italian Workshops on Spectroscopy and Imaging, which have been generously supported by Australian funding agencies and the Italian Embassy and have led to detailed collaboration projects. The next workshop is scheduled for the autumn of 2009 in Australia.

The collaboration agreements will formalise and facilitate existing contacts, and it is clear that the two facilities have much in common. A very new development is the construction of a new light source in Trieste, the Fermi Free Electron Laser, and CXS is working with groups from Sincrotrone Trieste to prepare experiments to be done at this facility.

CXS is a world leader in techniques such as lensless imaging with x-rays, which will profit greatly from the extremely high intensity of Free Electron Laser light.

Elettra is a national laboratory in Bassovisa on the outskirts of Trieste, Italy.

REGISTER NOW!

3rd CXS Annual Workshop 2008: Physicists and Biologists Working Together

Bio21 Melbourne, Australia

September 17 - 19th

Focusing on high resolution imaging of biological samples using synchrotron high harmonic lasers and x-ray free electron laser sources.

FEATURES INCLUDE:

- Major international and Australian speakers
- Australian Synchrotron tour or the Electronic Microscopy Facilty tour
- Presentations of recent research
- Workshop dinner

To register go to:

HTTP://131.172.132.43/CXS/

In Brief

Employment Opportunity:

A Research Fellow - Experiemental X-ray Physics position is currently available. The position is located with the University of Melbourne's CXS Experimental Methods Program. For further information please visit the CXS website at ***www.coecxs.org*** under Employment.

Publications:

Publications for this quarter include:

Davis JA, Dao LV, Do MT, Hannaford P, Nugent KA, Quiney HM, *"Noninterferometeric two-dimensional Fourier-tranform spectroscopy of multilevel system."* PRL. 100, 227401 (2008)

Streltsov VA, Titmuss SJ, Epa VC, Barnham KJ, Masters CL and Varghese JM. *"The structure of the Amyloid beta-peptide high affinity Copper II binding site in Alzheimer's Disease."* Biophy. J. (2008)

Belpassi L, Tarantelli, F, Sgamellotti A, Quiney HM, *"An all-electron 4-component Dirac-Kohn-Sham procedure for large molecules and clusters containing heavy elements"*, Physical Reveiw B, May (2008)

Williams GJ, Hanssen E, Peele AG, Pfeifer MA, Clark J, Abbey B, Cadenazzi G, De Jonge MD, Vogt S, Tilley L, Nugent KA, *"High-Resolution X-ray Imagining of Plasmodium Falciparum-Infected Red Blood Cells."* Cytometry: Part A, June (2008).

Barnett MR, Arhatari BD, Stanford N, Beer AG, Keshavarz Z, Ma X, *"Some Issues Relating to the Ductility of wrought Magnesium Alloys."* Magnesium Technology, Page 85 - 90, (2008)

Spycher C, Rug M, Pachlatko E, Hanssen E, Ferguson F, Cowman AF, Tilley L and Beck HP, *"The Maurer's cleft protein MAHRP1 is essential for trafficking of PfEMP1 to the surface of Plasmodium falciparum-infected erythrocytes."* Molecular Microbiology 68 (5) 1300 - 1314 (2008)

CXS Visitors:

Dr Bill Thomlinson, CEO of the Canadian Light Source, visited the Detector and Beamline Development Program at Monash University during his trip to Melbourne as a member of the AS Science Advisory Committee.

Associate Professor Anita Jones from the Collaborative Optical Spectroscopy and Micromanipulation Centre, Edinburgh University, Scotland visited the Short Wavelength Laser Source Program at Swinburne University of Technology from April to May 2008

Dr.Christoph Hofmann of the University of Freiberg visited the Ultra Cold Plasma Source Program at the University of Melbourne, June 2008

Prof. Y Koyama of Kwansei University in Japan visited the Short Wavelength Laser Source Program at Swinburne University of Technology, June 2008

Conferences & Workshops:

Steve Wilkins of the CSIRO Program gave a talk at the ESRF entitled *"Recent developments in Phase-Contrast Imaging at CSIRO and a progress report on the Imaging Beamline at the Australian Synchrotron."*

Professor Keith Nugent was an invited speaker at the Coherent X-ray Diffraction at NSLS-II Workshop in the USA, and the Wilhelm and Else Heraeus-Seminar: Matter in Coherent Light Workshop, Physikzentrum Bad Honnef, Germany, March 2008.

Professor Rob Lewis was a keynote speaker at the 5th Annual National Conference of the Australian Institute of Radiography, Melbourne, April 2008; and the Pacific Rim International Conference on Protein & 4th Asian Oceana Human Proteome Organisation, Brisbane, June 2008.

Associate Profressor Trevor Smith was an invited speaker at the 3rd Advanced Optical Techniques Workshop, in Shanzhen, China, May 2008, and at the 7th International Weber Symposium on Fluorescence Methodologies in Biochemistry and Medicine, Kauai, June 2008.

Associate Professor Andrew Peele gave an invited talk at the Shanghai Synchrotron/Australian Synchrotron Workshop on Advanced X-ray Imaging and CT Australian Synchrotron, May 2008.

The following CXS members gave invited talks at the CXS Biological Samples and Preparation Workshop at LaTrobe University, May 2008:

- Dr Benedicta Arhatari
- Corey Putkunz
- Dr Mark Pfeifer
- Dr Brian Abbey

The CXS Workshop in Detectors for Coherent X-ray Diffractive Imaging was held at Monash University, May 2008.

The CXS Physics of Ultracold Matter and Scattering Workshop was held at the University of Melbourne, June 2008.

Professor Leann Tilley was an invited speaker at the Institut National de la Transfusion Saguine, Paris, France, June 2008.

Welcoming New Members:

CXS would like to welcome our latest member, Dr Wilfred Fullagar, Research Fellow, Detector and Beamline Development Program at Monash University.

In the Media:

CXS featured in Australian Life Scientist Magazine, Vol 5, Issue 3, May/June 2008, in an article titled *Shining a light on membrane proteins, pages 64 - 66.*

The article, *Disease Arms-Race Looks to Powerful New X-ray Tools,* appeared in the June issue of Swinburne News, page 10.

HERCULES Workshop: ESRF Grenoble, 2008

Dr Connie Darmanin of the CSIRO program, provides a first hand account of the HERCULES Workshop in Grenoble.

Higher European Research Course for Users of Large Experimental Systems (HERCULES) workshop started on 17th February 2008 and concluded on 20th March 2008. It was a five week course that involved training on various techniques used for proteins relating to X-ray and neutron sources. A group of 80 people were selected internationally to attend this workshop and most came from a physics background while about 20 of us were from a biological background.

ESRF, Grenoble

We had a vast number of lectures on the basic fundamentals of X-ray crystallography and physics. Tutorials and practical classes were arranged so that we could see the instrumentation and beamlines at the ESRF and ILL. Practicals at the ESRF were organised by the beamline scientists and a trip to SOLEIL Saint-Aubin, the new synchrotron source in Paris, was also organised where we were shown around the facility and attended a few practicals on the beamlines.

The theory side of the course covered topics such as X-ray absorption spectroscopy, time-resolved fluorescence and circular dichroism studies, X-ray protein crystallography, neutron protein crystallography, small angle X-ray scattering , X-ray optics and detectors and protein dynamics by neutron scattering; just to name a few. I found the most valuable part of the course was the practicals which were held at the ESRF. There were several practicals which I had the opportunity to be involved with and discuss possibilities carrying out experiments relating to my work. I attended the following practicals: powder diffraction, far-infra red spectroscopy, time resolved X-ray diffraction all of which I found very interesting.

While attending the HERCULES workshop I was fortunate enough to make some international connections which I hope to continue. I was able to make many contacts with international scientists and arranged the possibilities of carrying out circular dichorism experiments with David Clarke at DIAMOND in the UK and I am in the process of organising some samples to send to him for testing.

I was also able to set up a collaboration with Dr Irene Margiolaki, a protein powder diffraction expert. She demonstrated a powder diffraction practical where we were shown how to set up samples, mount samples on the machine, and collect and analysis the data. This methodology was of great importance to me because it is currently the field that I am working in.

After this practical I had several meetings with Dr Irene Margiolaki where we discussed aspects of my work and ongoing communication when I return to Australia. Powder diffraction of proteins is still a novel technique and not many people have expertise in this area.

Avian Influenza Public Lecture

CXS hosted the second in its free Public Lecture series on 29th April 2008 at the University of Melbourne.

Dr Varghese discussed Influenza drug resistance studies and where we stand on the verge of a potential new pandemic arising from the virulent Avian strains that are now emerging worldwide.

The lecture was well received by the public, resulting in various requests for copies of the video recording of the event.

As a world renowned scientist having solved the structure of influenza neuraminidase with Dr Peter Colman at CSIRO in 1983, Dr Varghese was involved in the development of RelenzaTM, the first structure based anti-viral drug designed.

Since then he has worked on the structural basis of drug resistance to neuraminidase inhibitors and has carried out seminal studies on the design of drugs against rapidly mutating targets. He was involved in determining the structures of several medically important protein structures and is currently working on Alzheimer's Disease and brain receptor structures in the CSIRO P-health Flagship.

To view the video of this lecture go to: **www.coecxs.org** under education.

Dr Jose Varghese, CSIRO Program, was guest speaker at the 2nd CXS Free Public Lecture

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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 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, 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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Associate Professor Tyo visits CXS

Rossyln Ball introduces one of CXS' visiting Professors.

Visiting
Associate Professor J. Scott Tyo

Associate Professor J. Scott Tyo visited CXS from 29 May until 17 July 2008.

Prof. Tyo is from the College of Optical Sciences at the University of Arizona, Tucson, AZ USA having joined the UA in 2006, where he now leads a research group exploring advanced electromagnetic remote sensing in the optical and microwave regimes. His current work is focused on exploiting polarization, spectral, and coherence information in order to enhance scene and target data in remotely sensed images. Prof. Tyo received the BSE, MSE, and PhD degrees in Electrical Engineering from the University of Pennsylvania in Philadelphia. He served as an officer in the US Air Force from 1994 - 2007 and performed tours of duty as a research engineer at the US Air Force Research Laboratory in Albuquerque, NM and as an Assistant Professor at the US Naval Postgraduate School in Monterey, CA. He was a professor in the Electrical and Computer Engineering Department at the University of New Mexico in Albuquerque, NM from 2001 – 2006.

Prof. Tyo is a Fellow of the International Society for Optical Engineering (SPIE) and a Senior Member of the IEEE. He is also a member of the Optical Society of America (OSA) as well as Commissions B & E of the International Radio Science Union. In 2003 he was a recipient of the US National Science Foundation's Faculty Early Career Award, and he was a recipient of the US Defense Intelligence Agency's Chief Scientist Award for Excellence in 2007. He served as an Associate Editor for IEEE Antenans and Wireless Propagation from 2003 - 2007, and is currently serving as a Topical Editor for Applied Optics.

At the University, Prof. Tyo has eight graduate students in the Optics, ECE, and Atmospheric Sciences departments working on various aspects of the research program. He teaches undergraduate physical optics to the juniors, and teaches graduate Fourier optics to the first-year students. In addition he is the College of Optics liaison for the undergraduate senior design program. As well as his appointment at the University he is the Director of Engineering for a small company called K&A Wireless that makes wireless video transmitters and associated image processing software. This company is developing a range of software products for use in infrared imagers, and has recently grown to about a 15-person operation.

Prof. Tyo's wife Liz Ritchie has her PhD in Meteorology from the Applied Math Faculty at Monash University and is now a professor at the University of Arizona in the Atmospheric Sciences Department and studies the dynamics of Tropical Cyclones. She grew up in Mt. Waverley, and her father still lives there. Prof. Tyo and his wife have a couple of joint projects on the use of remote sensing, imaging, and pattern recognition to TC forecasting. They also have two children, Matthew 4 and Katie 3 who attended kindergarten in Diamond Creek and practised their Aussie slang during their stay in Melbourne.

During the time of his visit to CXS Prof. Tyo and his family stayed in Hurstbridge with his wife's brother. Prof. Tyo and his family also visited other family members on the Gold Coast and spent time in Alice Springs, Uluru, and Coober Pedy.