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Careers at the Australian Synchrotron
We Need a Head of Science

1. FROM THE DIRECTOR: THE ROAD TO SUCCESS

If you have visited the Australian Synchrotron recently, you will have noticed a real buzz about the place.



Prof. Robert Lamb

With well over 300 users having walked through our doors since we opened in July 2007, our first five beamlines are in action day and night. We have also hosted hundreds of visitors keen to find out how the synchrotron can help them achieve their research objectives, or simply to learn more about what actually happens inside Australia's newest and brightest research facility.

Outside our main building, construction of the new Imaging and Medical Therapy Centre is rapidly transforming the north-west corner of our site. Inside the synchrotron building, the remaining four of the first nine beamlines are rapidly taking shape.

In fact there is so much activity going on here that visitors regularly ask: "Why if the synchrotron is officially open is there so much building work going on?". The answer is that the request for new science continues to grow unabated. As we continue to successfully engage with new communities, we will need to build many more beamlines and associated facilities.

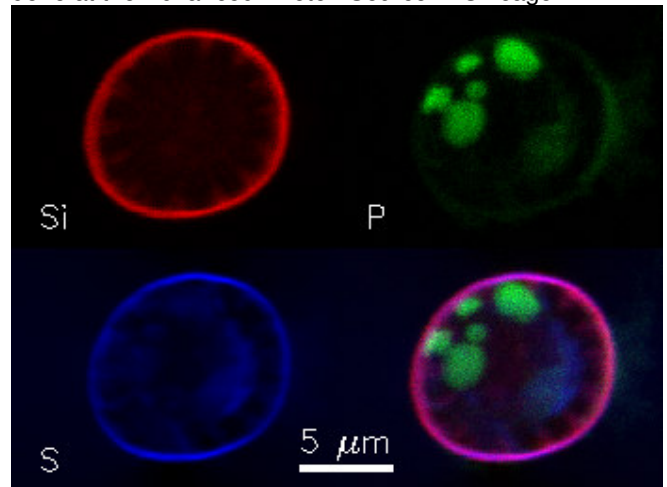
As Lily Tomlin once said, "the road to success is always under construction". At the Australian Synchrotron, that pretty much sums up our current aspirations.

Call for beamtime proposals opens 11 June—see page 4

2. DEEP SECRETS REVEALED

A synchrotron has revealed new information about phosphorus in marine sediments. Phosphorus is essential for the growth of marine organisms, which account for much of the planet's carbon dioxide uptake.

The findings are presented by Julia Diaz et al. [1] in *Science*, May 2008. The Australian Synchrotron's David Paterson and Martin de Jonge collaborated on the work, done at the Advanced Photon Source in Chicago.



The images above show silicon, phosphorus and sulphur in the diatom *Cyclotella*. The bottom RH image overlays the three elemental maps. Data taken at APS by de Jonge et al.

In nutrient-rich surface waters, diatoms and other marine phytoplankton store phosphorus in the form of polyphosphate, a linear polymer containing as many as 100 orthophosphate units. However, because most oceans have phosphorus levels that limit biological growth, polyphosphate is usually considered an insignificant contributor to marine phosphorus cycles.

The researchers used synchrotron microspectroscopy to reveal that decaying diatoms and other phytoplankton carry significant quantities of polyphosphate down to the seabed, where it can remain for many decades. Polyphosphate particles also appear to act as mineral templates for the formation of apatite, a type of calcium phosphate mineral.

Based on their synchrotron results, Diaz and her colleagues described the plankton as part of a 'biological pump' that involves the production, transport and eventual transformation of polyphosphate into stable calcium phosphate minerals.

Because marine organisms affect atmospheric carbon dioxide levels by taking up significant amounts of carbon, the researchers speculate that fluctuations in phosphorus availability resulting from changes in diatom abundance may have influenced the climate in past geological ages. The authors note that highly sensitive synchrotron-based x-ray fluorescence techniques were "key to the direct identification" of polyphosphate as a relatively minor component of sediment and plankton samples. They consider synchrotron x-ray spectromicroscopy to have a unique "capacity to simultaneously image and chemically characterise minimally prepared particulate samples at submicrometre resolution".

The Australian Synchrotron microspectroscopy beamline will have similar capabilities and will be operational in early 2009. If you are interested in microspectroscopy experiments at the Australian Synchrotron, contact David Paterson david.paterson@synchrotron.org.au or Martin de Jonge martin.dejonge@synchrotron.org.au or go to: http://www.synchrotron.org.au/content.asp?Document_ID=491

[1] *Marine Polyphosphate: A Key Player in Geologic Phosphorus Sequestration*, J. Diaz, E. Ingall, C. Benitez-Nelson, D. Paterson, M. D. de Jonge, I. McNulty, J. A. Brandes. *Science* 320 (2008).

3. STUDENT INVOLVEMENT

Two of the Australian Synchrotron's foundation investors have taken advantage of their merit and preferred access time to introduce undergraduate students to synchrotron investigative techniques.

La Trobe and Monash University students recently had first-hand experience on the IR and soft x-ray beamlines

and gained valuable experience in beamline sample preparation, data collection and data analysis.



Mark Tobin on the IR beamline with 3rd year physics students from Monash University (Photo: Steve Morton, Monash University)

4. IR: THE FINAL FRONTIER

The last frontier of infrared spectroscopy—the far infrared (tera-hertz) region—is now accessible at the Australian Synchrotron.

The Australian Synchrotron is one of only two facilities in the world to have a functional high-resolution far-IR beamline with a user program.

High resolution far-infrared ($< 1000 \text{ cm}^{-1}$) spectroscopy is typically used to study the structure and properties of gas-phase molecules by probing their large amplitude motions. The technique provides insights into energy flows within molecules, weak attractive forces between atoms and molecules, metal atom bonding to other chemical groups, and the structures of long carbon chain molecules observed in outer space. To date, however, the far-infrared region has not been as well used as the neighbouring microwave and mid-IR spectral regions, mainly due to problems with standard laboratory sources and detectors.

Synchrotrons offer a 'continuous' source of far-IR light that is around 10 to 100 times brighter than commonly used thermal sources, and a superior signal to noise ratio. This substantially reduces the time taken to record spectra, for example from 25 days using a standard SiC global source in the 500 cm^{-1} region to just 12 hours at the Australian Synchrotron. Even better performance is expected below 500 cm^{-1} , where synchrotron radiation has a greater advantage over thermal sources.

A high-resolution FT spectrometer on the far-infrared branch-line of the IR beamline can achieve a resolution of 0.00096 cm^{-1} . The spectrometer is equipped with an array of detectors and optical components to cover the far-infrared spectral window. Samples can be heated to

around 100°C, with the capacity to cool samples to liquid helium or nitrogen temperatures expected to be available within the next few months.

The high-resolution far-IR beamline is particularly useful for gas phase spectroscopy (e.g. to study gases with ozone depletion potential such as HCFCs and CFCs), but can also be used for spectroscopic studies of condensed phase samples. The region below 1000 cm^{-1} provides information on large amplitude modes of vibration of molecules, offering unique insights into the potential for molecules to undergo particular reactions or transformations.

For more information, contact Dominique (Dom) Appadoo dominique.appadoo@synchrotron.org.au

5. BEAMLINE FOCUS

Soft X-ray Beamline

In *Lightspeed* April 2008, we neglected to mention the funding source for the new soft x-ray endstation. That gives us an excuse to show you another photo of this good-looking endstation, which was purchased by the Australian Synchrotron Research Program (ASRP) with funding from the Major National Research Facilities Program.



Bruce Cowie, head of the soft x-ray beamline at the Australian Synchrotron, inspects the new endstation. (Photo: Sandra Morrow)

SAXS/WAXS Beamline

The installation of the SAXS/WAXS (small angle / wide angle x-ray scattering) beamline is well underway.

The beamline optics were delivered in April and the installation of cabling and components is progressing well. All components up to the monochromator (mask, collimator, white beam slits, pumps and gauges) have been installed and are currently baking out. The monochromator, experiment shutter, mirror system, and the beam conditioning table are all in position. The endstation is coming together rapidly. The sample table is due to arrive in June; assembly of the very large optical

table designed to position and support the 7m SAXS camera and the WAXS camera will begin at about the same time. Many of the parts for the SAXS camera and its positioning system on the optical table are being fabricated. Beamline controls development is going well, and the critical task of developing the beamline controls software is also underway.



Looking downstream from right at the storage ring shield wall): the first ion pump, fixed mask, Bremsstrahlung collimator, white beam slits, white beam fluorescent screen and the double crystal monochromator installed and pumping down.

Nigel Kirby, SAXS/WAXS Beamline Scientist

Microspectroscopy Beamline

IDT has completed the first installation phase of beamline optical components, including the horizontal focusing mirror tank and massive granite blocks for the beam defining apertures. The Microspectroscopy beamline utilities are complete and the external work spaces are being fitted out.



David Paterson heads the microspectroscopy beamline team at the Australian Synchrotron.

Daryl Howard will join the Microspectroscopy team next month as scientific support officer. Currently at the University of Otago, Daryl has a PhD in chemistry and a research background in vibrational spectroscopy.

David Paterson, Microspectroscopy Beamline Scientist

6. HIGH-LEVEL INDONESIAN VISIT

On 7 May 2008 the Australian Synchrotron had the pleasure of hosting the Indonesian Consul General, Mr Budiardman Bahar and two consular officials, Mr Abelian Yodha, Vice Consul for Information Social and Cultural Affairs, and Mrs Ratna Harjana, Vice Consul for Economic Affairs.

After a presentation by Australian Synchrotron Director Rob Lamb, and senior machine scientist Mark Boland, the consular party toured the facility. They were very impressed by the broad-ranging applications of synchrotron science and are interested in developing an MOU between Indonesian scientific organisations and the Australian Synchrotron. They are also keen to promote user access for scientists in Indonesia and develop interchange projects for visiting fellows and PhD students.

7. AUSTRALIAN SYNCHROTRON IN THE NEWS

The Australian Synchrotron was in the media spotlight again in May 2008 when a film crew from ABC TV program Catalyst was on site to record footage for a program on forensic science. Catalyst presenter Graham Phillips, who has a PhD in astrophysics, was very impressed with the science of the machine and its applications. We hope this visit has whetted their appetite to film more about the limitless applications of synchrotron science. This episode is expected to air at 8 p.m. on Thursday 19 June.



Catalyst presenter Graham Phillips (left) in action at the Australian Synchrotron

Also in May, the x-ray absorption spectroscopy beamline featured in *Australasian Science* in the latest of a series of

articles highlighting the Australian Synchrotron's unique capabilities.

8. BEAMTIME PROPOSALS

AUSTRALIAN SYNCHROTRON CALL FOR PROPOSALS

The next call for proposals for round 2008/3 (September – December) will open on 11 June 2008 and close on 1 July 2008. This call will be for beamtime at the Australian Synchrotron (merit and foundation investor), the Advanced Photon Source (XOR beamlines 1, 2, 4 and 20 and ChemMatCARS) and the Australian National Beamline Facility at the Photon Factory. All proposals for these facilities must be submitted through the synchrotron portal, which can be accessed via http://www.synchrotron.org.au/content.asp?Document_ID=5338.

If you would like to discuss your ideas with the beamline scientists at the Australian Synchrotron, please allow plenty of time.

http://www.synchrotron.org.au/content.asp?Document_ID=131

For a list of proposed dates for the rest of 2008, go to: http://www.synchrotron.org.au/content.asp?Document_ID=5305.

More information about applying for beamtime at the Australian Synchrotron: user.office@synchrotron.org.au

USER SURVEY

We are seeking feedback on your experience as a user of the Australian Synchrotron. Your comments will help us improve the services and facilities available for users. If you have completed an experiment at the Australian Synchrotron, please download the survey form from: http://www.synchrotron.org.au/content.asp?Document_ID=5329

NSRRC (TAIWAN) CALL FOR PROPOSALS

The current call for proposals for the National Synchrotron Radiation Research Centre (NSRRC) in Taiwan will close on 2 June 2008. Synchrotron users should submit applications directly through the NSRRC website: <http://portal.nsrcc.org.tw/>

9. TRANSFER OF ASRP OPERATIONS TO AUSTRALIAN SYNCHROTRON

The Australian Synchrotron Research Program (ASRP) will cease operations on 30 June this year. From 1 July 2008, all international synchrotron access and travel funding will be handled through the Australian Synchrotron User Office rather than ASRP. This will cover facilities currently managed by the ASRP, including beamlines at the Advanced Photon Source (ChemMatCARS and XOR beamlines 1, 2, 4 and 20), the

Australian National Beamline Facility at the Photon Factory and NSRRC in Taiwan.

Please contact us at (user.office@synchrotron.org.au) if you have any questions about this transition.

10. TELL US ABOUT YOUR PUBLICATIONS

We would like all users to provide us with details of any publications relating to work done at the Australian Synchrotron. This is a standard requirement for all synchrotron users.

Your publications will be noted in our annual report. The information may also be used for publicity purposes, with appropriate acknowledgement.

Please send abstract and full reference details, plus an electronic copy of the full paper if available, to user.office@synchrotron.org.au

11. ACCEL08 SCHOOL & WORKSHOP

The accel08 Accelerator Science School and Workshop held in Melbourne in March-April 2008 attracted students and researchers from around Australia and overseas.

Conducted by the Australian Synchrotron and The University of Melbourne School of Physics, the school was attended by 37 students from Queensland, New South Wales, Victoria, New Zealand, USA and Canada. The bulk of the expert lecturing was provided by Prof. Ted Wilson (CERN and Oxford University) on accelerator physics. Dr David Paterson (Australian Synchrotron micro-spectroscopy beamline), Dr Jose Varghese (CSIRO), Dr Rohan Dowd and Martin Spencer (Australian Synchrotron accelerator physics) and Dr Jeff Corbett (SLAC) provided stimulating lectures on their research fields.



Prof. Ted Wilson in action at accel08, lecturing about vacuum chamber sizes.

The accel08 Workshop was aimed at university and industry researchers. Prof. Zhentang Zhao (SSRF), Dr Jeff Corbett (SLAC) and other speakers gave updates on the latest developments in the lightsource community. Dr Emmanuel Tsesmelis (CERN) and Dr Hitoshi Hayano (KEK) talked about the ongoing research and development of future accelerators such as CLIC, LHC and ILC. The meeting strengthened existing collaborations, attracted new students to the Accelerator Physics Group and started new collaborations among Australian researchers.

12. MACHINE ADVISORY GROUP

The Australian Synchrotron's Machine Advisory Group (MAG) met for the first time on 4 April 2008.

The MAG consists of the heads of machine groups in Sweden (Professor Mikael Eriksson, MAX Lab), the USA (Dr Jeff Corbett, Stanford Linear Accelerator Center) and ANKA (Dr Erhard Huttel, Institut für Synchrotronstrahlung Germany). The group reports to the Australian Synchrotron senior management team through the facility director.

The group's report noted that: "In summary, we believe that the Australian Synchrotron is a 'damn good machine' (anonymous) and has provided excellent training for accelerator physicists and links to the academic community."

13. EVENTS DIARY

EVENTS IN AUSTRALIA

TEACHING SYNCHROTRON PHYSICS 2008 In-service course for VCE teachers

13 June 2008

Monash Science Centre and Australian Synchrotron

This one-day professional development workshop will include lectures, demonstrations, hands-on practical sessions, a tour of the Australian Synchrotron, handouts, advice on classroom activities and information on additional resources available to teachers. The program will be presented by qualified teachers and synchrotron scientists.

To find out more about this event, contact Dan O'Keefe, Australian Institute of Physics (Vic. Branch) Education Committee, on 03 9561 7602 or at danok@bigpond.com

IUMRS-ICEM 2008: Synchrotron Radiation (Symposium J)

International Conference on Electronic Materials

28 July – 1 August 2008

Hilton Sydney, Sydney, Australia

Topics covered in the synchrotron radiation symposium at IUMRS-ICEM 2008 will include:

- Advances in x-ray microscopy techniques and instrumentation
- Novel methods for non-destructive characterisation of materials
- Three-dimensional imaging methods
- Characterisation of interfaces and microstructural defects
- Structure and deformation of nanostructured and thin-film materials
- Advances in theoretical and/or computational imaging.

More: <http://www.aumrs.com.au/ICEM-08/Symposia/?S=9>

L'Oréal Australia For Women in Science Fellowships

Applications for the 2008 L'Oréal Australia For Women in Science Fellowships close Friday 20 June 2008. The fellowships recognise scientific excellence by early-career women in the life sciences, material sciences, physical sciences, mathematics or engineering, who have completed their PhD or equivalent in the last five years.

More: www.scienceinpublic.com/loreal.

ARC Centre of Excellence for Coherent X-ray Science 3rd Annual Workshop

Physicists and Biologists Working Together

17 – 19 September 2008

Bio21 Institute, Melbourne, Australia



ARC Centre of Excellence for
COHERENT X-RAY SCIENCE

This workshop will focus on high resolution imaging of biological samples using synchrotron and laser X-ray sources, as well as pioneering electron and light microscopy techniques and protein structure determination techniques.

Top international speakers will present their work in the areas of:

- advanced microscopy
- cellular and subcellular imaging
- coherent diffractive imaging
- membrane protein structure determination
- optics and imaging
- sources and detectors.

Additional features include a site tour of the Australian Synchrotron, poster & oral presentations and a workshop dinner.

More: www.coecxs.org/workshop2008

Western Australian X-Ray Users Conference and Schools

X-rays from industry to academia

The Australian X-ray Analytical Association WA and the Royal Australian Chemical Institute (RACI) Analytical Chemistry Group have announced the dates for the Western Australian X-Ray Users Conference and Schools.

X-ray Diffraction School: Friday 10 October 2008

X-ray Users Conference: Saturday 11 and Sunday 12 October 2008

X-Ray Fluorescence School: Monday 13 October 2008.

The conference will be held at the Event Centre at Technology Park. The schools will be held at Curtin University and/or the University of Western Australia.

A call for abstracts and additional information will be circulated at the end of May.

More information is available from Geoffrey Carter at Curtin University of Technology
g.carter@exchange.curtin.edu.au

EVENTS OUTSIDE AUSTRALIA

For additional information and listings, see:

<http://www.lightsources.org/cms/?pid=1000068>

8th World Biomaterials Congress—2008

28 May–1 June 2008, Amsterdam, The Netherlands

<http://www.wbc2008.com/>

Crossing Frontiers in Biomaterials and Regenerative Medicine



More: <http://www.wbc2008.com>

6th International Conference on Synchrotron Radiation in Materials Science (SRMS-6)

20-23 July 2008, Campinas, Brazil

<http://www.srms-6.com.br>

The conference's main topics are archaeological materials, catalysts and clusters, complex oxides, data-storage and engineering materials, films, surfaces and interfaces, geo-physical and electronic materials, glasses and ceramics, liquids, magnetism, materials under extreme conditions (high pressure, etc.), metals and alloys, metamaterials, molecular electronics, multiferroics, nanostructured materials and self-assembly, polymers and biomaterials, photo materials, nanofocus techniques, strongly correlated materials, superconducting materials, industrial use of SR, and instrumentation/recent developments. Students and post-doctoral fellows may be able to apply for registration waivers.

9th International Conference on X-Ray Microscopy (XRM 2008)

21-25 July 2008, Zürich, Switzerland

<http://xrm2008.web.psi.ch/>



Topics to be addressed at this conference include x-ray microscopy applications, methods and novel approaches, and instrumentation. XRM2008 will also feature non x-ray based microscopy techniques with the aim of stimulating collaborations and further progress in the field. The conference is organised by the Paul Scherrer Institut, Switzerland's largest research institute.

2008 APS XAFS School

5-8 August 2008, APS, Chicago, USA

The XAFS School at the Advanced Photon Source is open to registered APS users who are interested in learning about all aspects of XAFS (x-ray absorption fine structure) and how to incorporate XAFS into their own research program. Applications close 16 June 2008.

<http://www.xafs.org/Workshops/APS2008>

Australia-India Collaboration Meeting

The Bragg Institute at ANSTO, in collaboration with the Australian Synchrotron, is organising a two-day meeting on "Indo-Australian Collaboration in Neutron and Synchrotron Science" to be held on 23-24 August at the Tata Institute of Fundamental Research in Mumbai, India.

CAREERS AT THE AUSTRALIAN SYNCHROTRON

The Australian Synchrotron offers a unique working environment for a wide range of specialists. For information on job postings, go to:

http://www.synchrotron.vic.gov.au/content.asp?Document_ID=14.

WE NEED A HEAD OF SCIENCE

Do you have what it takes to be the Head of Science at the Australian Synchrotron? We are currently seeking applicants for this important new position.

The Head of Science will be responsible for the science operations of the Australian Synchrotron. In partnership with the Head of Beamline Development and External Relations, you will be accountable for development of research programs, user management, beamline operations and development, and external relations.

You will use your skills to lead others within their areas of academic research, foster and develop effective scientific collaborations, manage and motivate yourself and others, and have a strategic and innovative vision aligned with the Australian Synchrotron Company Ltd. As a member of the synchrotron's senior management group, you will report to the Director, Robert Lamb. You will have a close association with a university.

This pivotal role would suit a person with:

- a track record in scientific excellence
- experience in leading and managing diverse and highly skilled teams
- excellent skills in networking and marketing / communication management
- experience in managing a research team within the tertiary sector
- demonstrated success in securing grant support at a national level

This position was advertised in *The Australian* newspaper on 14 May 2008.

Confidential enquiries can be directed to Prof. Robert Lamb 03 8540 4297 or robert.lamb@synchrotron.org.au

Applications for this position close 30 May 2008 and should be addressed to Head of Human Resources, Australian Synchrotron anne.ridgway@synchrotron.org.au

MORE INFORMATION

A list of Australian Synchrotron personnel can be found at http://www.synchrotron.org.au/content.asp?Document_ID=129

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[Please note that the facility is not open to the public]