



In this issue:

1. From the Director: A Day in the Light
 2. Phar Lap Mystery Revealed
 3. Synchrotron Tours
 4. Safety First
 5. A synchrotron by any other name
 6. Thin polymer plasma films
 7. Beamline Focus
 8. Shanghai-Australian Synchrotron Bilateral Workshop
 9. Visit by Eminent Protein Crystallographer
 10. The Graduate
 11. Beamtime Proposals
 12. Transfer of ASRP Operations to Aust. Synchrotron
 13. Events Diary
- Careers at the Australian Synchrotron

1. FROM THE DIRECTOR: A DAY IN THE LIGHT

The sun's rays disappear shortly after 5 pm here in late June, but our job is to ensure that the synchrotron beams shine 24 hours a day.



Prof. Rob Lamb

In the middle of a Melbourne winter, staff on early shift at the Australian Synchrotron can see the sun's first rays coming up over the horizon. We can track the sun's progress through the big windows around the perimeter of the synchrotron building until it sets.

Outside, the contractors working on the new imaging and medical therapy centre are on the job from first light, which is around 7:30 a.m. this time of

year, till the shadows lengthen in the late afternoon. But inside the building, in the heart of the synchrotron, the light never fades.

Less than two years after the synchrotron's own first light, we are now achieving very close to 100 per cent beam

availability. This is a world record for such a young facility and is thanks to the efforts of people like Greg LeBlanc and his machine operations group together with the engineering team. Apart from regular maintenance periods, the team is taking less than an hour to fix any problems that require the beam to be shut down.

On a typical day in the office, if there is such a thing as a typical day, I usually arrive at work around 8 a.m., but I'm not the first to arrive. Particularly when we have users onsite, synchrotron staff work around the clock and the beamlines are in constant use, day and night, with three eight-hour shifts each day for five days of the week. That's when 'working your own hours' acquires a whole new meaning.

2. PHAR LAP MYSTERY REVEALED

The latest synchrotron studies by researchers from Museum Victoria and the University of South Australia have confirmed preliminary findings that Phar Lap's untimely demise was due to arsenic poisoning.

Dr Ivan Kempson from the University of South Australia and Dermot Henry from Museum Victoria used microprobes at the Advanced Photon Source in Chicago to validate their earlier findings.



Ivan Kempson reflects on his close encounter with Phar Lap

The synchrotron techniques enabled Ivan and Dermot to differentiate between arsenic that had entered the hair cells by ingestion via the blood stream and arsenic introduced by the taxidermy process. The results showed that Phar Lap had ingested a large dose of arsenic in the last 30 to 40 hours of his life.

http://www.synchrotron.org.au/content.asp?document_id=5399

The work was supported by the Australian Synchrotron Research Program (ASRP), which has funded Australian researchers to gain access to overseas synchrotrons for more than a decade. From 1 July 2008, the Australian Synchrotron will take over this important role.

The Australian Synchrotron microspectroscopy beamline will enable similar studies 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

HAPPY FIRST ANNIVERSARY! EXACTLY 12 MONTHS SINCE OUR FIRST USER, ON THE PROTEIN CRYSTALLOGRAPHY BEAMLINE.

3. SYNCHROTRON TOURS

A group of high school students recently visited the Australian Synchrotron as part of the facility's new on-site tours program.

Senior physics and chemistry students from Luther College, Croydon Hills, were treated to a guided tour in June 2008 as part of their careers day.



Luther College pupils recently visited the synchrotron

The students met technical staff during their 90-minute site visit, starting with mechanical engineer Brad Mountford, who gave an outstanding CAD (computer-aided design) and FEA (finite element analysis) software demonstration. Beamline scientists Mark Tobin (infrared spectroscopy)

and Anton Tadich (soft x-ray spectroscopy) enthusiastically described how they came to work at the Australian Synchrotron and presented case studies of how their beamlines benefit cutting-edge Australian and New Zealand scientific research.

Amanda Kirby, the synchrotron's recently-appointed tours coordinator, explained how the synchrotron machine creates synchrotron light, which is then harnessed by each of the beamlines and used by visiting research scientists to carry out experiments.

The Australian Synchrotron's waiting list for on-site tours extends into late 2008. If you teach VCE physics or chemistry, or belong to a technical or community group that would like to tour the synchrotron, please email amanda.kirby@synchrotron.org.au to secure a tour date.

4. SAFETY FIRST

The Australian Synchrotron has won a national award for the PSS (personnel safety system) installed in each beamline enclosure.

The 'Safety scheme of the year' award is a *Manufacturers Monthly Endeavour Award*.

The PSS electronic access control system is designed to ensure that a 'search and secure' procedure has been completed and everyone has left the beamline enclosure before synchrotron radiation is allowed into the enclosure. If any of the safety system locks is forced, the synchrotron immediately shuts down and the area is rendered safe within about 20 milliseconds. Because the system uses 'intelligent' safety-rated components, it cannot be defeated either accidentally or deliberately.



Australian Synchrotron principal controls engineer Bryce Karnaghan accepts the 'Safety scheme of the year' award in Sydney

5. A SYNCHROTRON BY ANY OTHER NAME

We are looking for a new name. Not to replace 'Australian Synchrotron', which will remain our official name, but to use as a nickname or pet name.

Many synchrotrons around the world have short names derived from light source terminology. For example, the Berliner Elektronenspeicherring-Gesellschaft für Synchrotronstrahlung in Germany is known simply as BESSY. The French national synchrotron facility is Soleil. The Sincrotrone Trieste in Italy is Elettra. Japan's 8 GeV synchrotron photon ring is SPring-8.

For the Australian Synchrotron, we would like a pet name that is quintessentially Australian in character, easy to remember and not too long.

We invite all members of the synchrotron community and interested onlookers to submit their suggestions by email to info@synchrotron.org.au by 31 October 2008. The entries will be peer-reviewed and a short list of suitable names will be selected and submitted to the Australian Synchrotron Board to make a final decision. The chosen name will be announced at the 2008 User Meeting in Melbourne in early December 2008.

6. THIN POLYMER PLASMA FILMS

The performance of many biomedical, drug delivery, biosensor and micro-fluidic devices depends on how well they can resist protein build-up on their surfaces.

Polyethylene glycol (PEG) coatings are widely used to prevent or reduce protein adsorption, but the mechanism of their protein-repellent properties is not well understood.

Donna Menzies, a joint CSIRO/Monash University PhD student, is using surface-sensitive techniques such as FTIR (Fourier Transform infrared), NEXAFS (near-edge x-ray absorption fine structure) and XPS (x-ray photoelectron spectroscopy) to analyse a range of complex plasma PEG polymer films with varying chemical composition.



PhD student Donna Menzies is using the IR microscope to examine thin polymer films

Donna and her colleagues (Thomas Gengenbach, Celesta Fong, John Forsythe and Ben Muir) are using the IR microscope at the Australian Synchrotron to correlate chemical functionality with film deposition conditions and ultimately protein resistance. The spatial resolution of the grazing angle objective on the IR microscope enables the researchers to quickly and accurately map large numbers of the polymer films.

7. BEAMLINE FOCUS

Powder Diffraction Beamline

The powder diffraction beamline is being put through its paces with a wide variety of experiments taking advantage of the MYTHEN microstrip detector, from in situ minerals processing to protein crystallography.

An exciting first for this beamline is macromolecular crystallography research. Matthew Wilce and Nathan Cowieson from Monash University have collected diffraction data from lysozyme in a preliminary study examining the feasibility of macromolecular crystallography from poly-crystalline samples.

According to Matthew and Nathan, "A major stumbling block in the determination of crystal structures in macromolecular crystallography is the production of 'good' single crystals. Often it is possible to produce microcrystalline precipitate yet even after extensive optimisation of crystallisation conditions single crystals cannot be grown".

The researchers are seeking to take advantage of recent developments in structure analysis of protein molecules from powder diffraction data. In this pilot study, it took around 15 minutes to obtain data to resolution of 2.8 Å of sufficient quality for indexing and structure refinement.

This experiment shows that the powder diffraction beamline is capable of accommodating a diverse range of experiments, and doing it well. The diffraction data obtained by Matthew and Nathan demonstrate the excellent angular resolution that can be achieved on the beamline. Additionally, data collection is rapid (compared to crystal analyser detector systems), which substantially reduces the risk of samples becoming radiation-damaged.

Kia Wallwork, Principal Scientist, Powder Diffraction

Imaging and Medical Therapy Beamline

Construction of the long beamline is progressing at a steady pace despite the occasional winter shower and bogged-down truck. June has seen the beginning of the erection of the pre-cast concrete panels of the 75cm thick measurement bunker walls, the construction of the casting for the 44cm thick optics enclosure and, most recently, the concrete pour for the transfer tunnel floor. Installation of the tunnel culverts is scheduled to begin in late July.



View from the main synchrotron building: the transfer tunnel concrete pour begins in front of the satellite building optics enclosure and measurement bunker. In the background is the Telstra-8 building, currently being refurbished to house the biomedical imaging consortium.

On the instrument side, the first design reports are coming in from the main supplier, Instrument Design Technology (Manchester, UK), and manufacturing of the first components is scheduled to begin in July.

Daniel Häusermann, Principal Scientist, Imaging and Medical Therapy

Infrared Beamline

Infrared microscope

The grazing incidence objective is now available on the infrared microscope for studying thin films on metallic surfaces. CSIRO and Monash University researchers have successfully used the grazing angle objective to chemically characterise protein-resistant plasma polymer thin films.



New grazing angle objective for the IR microscope

A wider band MCT detector operating down to 550 cm⁻¹ is now available on request. However, this detector has

reduced sensitivity across its broader range when compared with the narrow band MCT currently installed.

For the next period (2008/3) the ATR objective will only be available to users who have previously used this device on the IR beamline.

More information on the IR microscope is available from liljana.puskar@synchrotron.org.au

Mark Tobin, Principal Scientist, IR Spectroscopy

Protein Crystallography Beamlines

The PXII beamline is nearing the end of its construction phase. The radiation enclosure, utilities and optics are in place, the endstation is being installed and the ADSC Q315 detector has been delivered. Cold commissioning with FMB-Oxford began in mid-June and hot commissioning is scheduled for July.

The PXI beamline is proving very popular with users. Robotic loading is now available, and remote access will be operational in August 2008. The beamline's multiple anomalous dispersion (MAD) capability will be available in run 3 (September-December) 2008 and automated crystal screening will be tested during run 3.

Julian Adams, Principal Scientist, Protein Crystallography

Microspectroscopy Beamline

The installation of beamline optics is progressing well and testing of the beamline equipment protection systems has been completed. Final design review has been completed for the nanoprobe instrument, which is now being constructed by Xradia. The x-ray nanoprobe will be capable of focusing the x-ray beam down to a 60 nm spot and then fast scanning of samples with nanometre precision. Other endstation instrumentation requirements, including a segmented detector for differential phase contrast, are in the final stages of procurement.



Daryl Howard has joined the microspectroscopy team

David Paterson, Principal Scientist, Microspectroscopy

SAXS/WAXS Beamline

The construction of the SAXS/WAXS beamline continues to progress well with the initial hardware installation nearing completion. The equipment protection system and the personnel safety system are currently being put in

place. Cold commissioning activities will commence in June, and commissioning with photon beam will be conducted during August. Installation of the main endstation will commence in July.



The silicon-111 crystals in the SAXS/WAXS monochromator, which select the required wavelength and help steer the beam

Nigel Kirby, Principal Scientist, SAXS/WAXS

8. SHANGHAI-AUSTRALIAN BILATERAL WORKSHOP

A bilateral workshop in May 2008 has strengthened ties between the Australian Synchrotron and its counterpart in Shanghai.

The workshop followed an invited visit to Shanghai earlier this year by two Australian Synchrotron accelerator physicists, who participated in the commissioning of the Shanghai Synchrotron accelerator. This valuable experience enabled the Australians to observe the operations of a larger facility and to provide advice and assistance on software as well as measurements of beam parameters.

For the May workshop, three Shanghai Synchrotron scientists, including Director Hongjie Xu, visited the Australian Synchrotron to discuss special interests and potential areas for collaboration, especially in the field of instrumentation. The on-site workshop was also attended by representatives from La Trobe, Melbourne and Monash universities and CSIRO.

The Shanghai delegation was particularly interested in Australian developments in imaging and therapy. Daniel Hausermann from the imaging and medical therapy beamline and David Paterson from the microspectroscopy beamline gave presentations on their respective fields.

Commenting on the success of the workshop, Daniel said "our institutions are similar in age and performance so we should find areas of collaboration which will benefit both

our research facilities and, in turn, the whole synchrotron community in the Asia-Pacific region".

To consolidate these discussions, a group of Australian scientists will visit the Shanghai Synchrotron later in 2008 to further explore challenging design issues in biomedical imaging beamlines as well as the supply of accelerator machine components, and identify further opportunities for collaboration.

9. VISIT BY EMINENT PROTEIN CRYSTALLOGRAPHER

Dr Rajan Sankaranarayanan from the Centre for Cellular and Molecular Biology (CCMB) in Hyderabad, India, visited the Australian Synchrotron in June 2008.

Dr Sankaranarayanan is a Wellcome Trust International Senior Research Fellow and Group Leader of the CCMB Structural Biology Laboratory. The CCMB is one of India's top four research institutes for protein crystallography.

Currently on sabbatical at the University of Queensland, Dr Sankaranarayanan is in Australia to foster links between Indian and Australian research institutes. He visited the Australian Synchrotron to meet with the synchrotron director and the protein crystallography group.

10. THE GRADUATE

Beamline control systems engineer Terry Cornall recently completed his PhD in the Department of Electrical and Computer Systems Engineering at Monash University.

Terry's PhD studies were supervised by Prof. Greg Egan and Dr Khee Pang and were aided greatly by Dr Andrew Price, Ray Cooper, Stewart Jenvey and many others at the department. His thesis dealt with the problem of using onboard vision processing to detect and measure the angle of the horizon on miniature unmanned aircraft and developing a control system that used the information to stabilise flight.



Self-portrait of Terry Cornall at his May 2008 Monash University graduation ceremony

Terry's vision processing experience can be applied to areas such as beam and sample location techniques using small stand-alone microprocessor or FPGA based processing units. The experience with real-time control systems could be applied to a range of synchrotron-related challenges.

11. BEAMTIME PROPOSALS

The third round of submissions for 2008 beamtime at the Australian Synchrotron closed on 1 July 2008. This call was for beamtime between September and December 2008 on the protein crystallography, infrared microscope and high resolution far-IR, powder diffraction and soft x-ray spectroscopy beamlines.

Key dates for the next round (2009/1) are listed at: http://www.synchrotron.org.au/content.asp?Document_ID=5305.

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

For more information about applying for beamtime at the Australian Synchrotron, contact the User Office: 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

12. TRANSFER OF ASRP OPERATIONS TO AUSTRALIAN SYNCHROTRON

Responsibility for coordination of access to international synchrotrons by Australian researchers will transfer from the Australian Synchrotron Research Program (ASRP) to the Australian Synchrotron on 1 July this year.

From 1 July 2008, all international synchrotron access and associated travel funding for Australian users will be handled through the Australian Synchrotron User Office rather than ASRP. International access funding provided prior to 1 July will need to be acquitted through the ASRP office at ANSTO as usual.

The Australian Synchrotron's international access program for Australian researchers 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.

13. EVENTS DIARY

EVENTS IN AUSTRALIA

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>

TEACHING SYNCHROTRON PHYSICS 2008 In-service course for VCE teachers

NOTE NEW DATE AND VENUE
8 August 2008, Australian Synchrotron

This half-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

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.

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>

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.

MORE INFORMATION

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

Email: info@synchrotron.org.au

Facility office

800 Blackburn Road, Clayton, Vic 3168

Within Australia: 03 8540 4100

International +61 3 8540 4100