



**Lightspeed**  
Australian Synchrotron News  
June 2009

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Australian Synchrotron

THE AUSTRALIAN SYNCHROTRON IS PROUD TO HOST

**SRI09** | 27 SEPTEMBER TO 2 OCTOBER 2009

THE 10<sup>th</sup> INTERNATIONAL CONFERENCE ON SYNCHROTRON RADIATION INSTRUMENTATION  
AT THE MELBOURNE CONVENTION AND EXHIBITION CENTRE

Australian Government  
Department of Innovation, Industry, Science and Research  
This conference is supported by the Commonwealth of Australia under the International Science Linkages program.

State Government  
**Victoria**  
AUSTRALIA

## FROM THE DIRECTOR: ONE STEP AT A TIME

*The recently announced \$51.7 million of Federal and Victorian Government funding for the Australian Synchrotron will support the second phase of the facility's development.*

The national biomedical community has secured \$13.2 million from the National Health and Medical Research Council to complete the 150-metre-long imaging and medical beamline (IMBL) and expand its capabilities. This proposal was coordinated by Prof Ian Smith from Monash University. Counting \$1.5 million of local funding for construction of additional support facilities for users and staff, and original foundation investor support, IMBL has now become a \$24.7 million installation.



Prof. Robert Lamb outside the Australian Synchrotron: watch this space!

Turning to the broader picture, the synchrotron's main building was designed for 122 staff but currently houses 125. With plans to engage half-a-dozen more staff over the next couple of months, things are starting to feel a bit cramped.

And while our users are mainly focused on their work, we have known for some time

that they would really benefit from more support than we can currently provide. In some cases it's a matter of not knowing what you need until you don't have it, such as somewhere to eat nearby at 6 pm or a place to rest when you finally complete your experiment at 3 am.

An Education Infrastructure Fund grant of \$37 million announced in the recent

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## UP TO SPEED

This month our short interview features Brad Mountford, the Australian Synchrotron's principal mechanical engineer.



Federal Budget means we can go ahead with construction of onsite accommodation for users, meeting and conference facilities for up to 400 people, a restaurant, a second user lounge, more office space for staff, a dedicated area for education programs and a new engineering wing. All within 100 metres of the ring – and all within the next two years.

As the pieces of what has become the most national of science and technology facilities really take shape, we can now begin to focus on the next step - future beamlines. Watch this space! Looks like a good meeting!



## SYNCHROTRON IMAGERY TRANSFORMS MINERAL PROCESSING

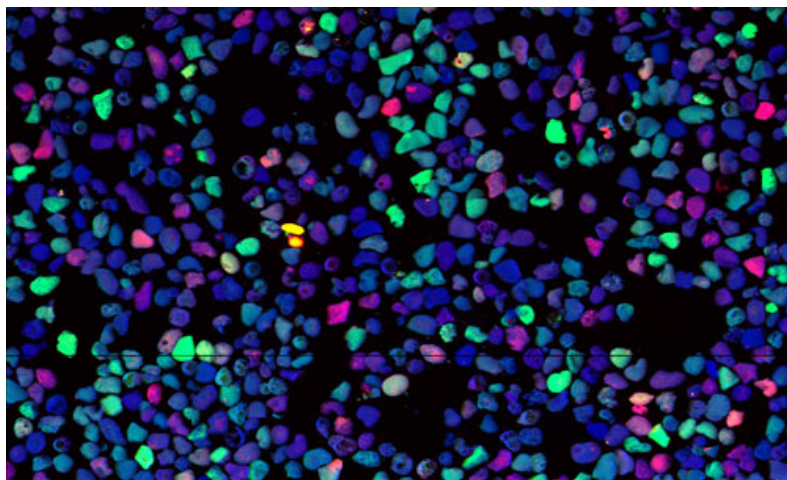
*The Australian Synchrotron is assisting the development of improved mineral processing methods by providing new information on the fine detail of mineral samples.*

Paints and sunscreens often contain titanium dioxide, a white pigment made from rutile. The titanium dioxide imparts a high brightness as well as helping to block out ultraviolet light.

Natural ilmenite, an important industrial source of synthetic rutile, typically contains small amounts of impurities such as manganese, aluminium and silicon. It can also contain traces of radioactive thorium. All these impurities must be removed when ilmenite is processed to make synthetic rutile.

La Trobe University researcher Peter Kappen is using the Australian Synchrotron's x-ray fluorescence microprobe beamline to examine the distribution of major and trace elements in ilmenite. Kappen and his colleagues also plan to use the synchrotron to investigate the detailed chemistry of these impurities. The work will ultimately help Australian industry to develop improved processes for producing high-quality synthetic rutile.

The x-ray fluorescence microprobe can resolve details as small as 0.1 micrometres (less than one-thousandth the diameter of a typical human hair) and detect much lower concentrations of elements than laboratory-based techniques such as proton-induced x-ray emission (PIXE).



The scan image shows the distribution of titanium (blue), niobium (green) and thorium (red) in ilmenite, an iron titanate ore.

Acknowledgments: The ilmenite sample shown in this scan image was provided by Peter Kappen and La Trobe University. The image was collected by the Australian Synchrotron XFM beamline team and CSIRO collaborators Chris Ryan, Robin Kirkham and Gareth Moorehead as part of testing and demonstrating the beamline's fast detector (Maia) capabilities.



### **Describe your job in 25 words or less.**

My job is to design the instruments the scientists require to carry out their experiments. I also look after the machine vacuum systems and front-ends.

### **What is the best aspect of your job?**

Everything is one-off and a good design is often more important than a cost-effective design ... most of the time ... according to the engineers anyway.

### **What is the worst aspect of your job?**

Why is it whenever I go for a coffee the coffee machine decides it needs a clean?

### **Apart from your work at the Australian Synchrotron, what is the coolest job you have ever had?**

My first job in Australia was to go looking for potholes in the roads for local councils. Is that cool?

### **What are the best things about living in Melbourne and why?**

Last night I saw Japan play Australia in a soccer world cup qualifier, this weekend I'm going to see the Wallabies play Italy and next weekend I'm going sailing. Always something to do.

### **What is your favourite overseas destination and why?**

During construction of the machine I spent a bit of time in Berlin. They make a good beer over there, also great city and friendly people.

### **Tell us a little-known fact about the Australian Synchrotron.**

All our storage ring magnets were made in New Zealand.



## BEAMTIME APPLICATIONS

Beamtime submissions for the 2009/3 round (September – December 2009) closed on 17 June 2009.

Key dates for beamtime submissions are listed at

[http://www.synchrotron.org.au/content.asp?Document\\_ID=5305](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.

## 1000 UNIQUE USERS

*In May 2009, Bo Zhu from the Institute for Sustainability and Innovation at Victoria University's Werribee Campus became the 1000th person to conduct experiments at the Australian Synchrotron.*

In a project led by Mikel Duke (Victoria University) and Anita Hill (CSIRO Materials Science and Engineering), Bo used synchrotron powder diffraction to investigate changes in the crystallinity of zeolite samples exposed to sea salts. He successfully tested zeolite powders on high-throughput sample stages designed by CSIRO scientists Danielle Kennedy and Matthew Hill that enabled over 600 samples to be analysed in 72 hours of beamtime.

The researchers are looking at how zeolite interactions with different seawater ions can influence structural rearrangement and ion exchange. The synchrotron experiments will enable a better understanding of how such changes affect the performance of zeolite membranes for desalinating seawater. Synchrotron powder diffraction results identified slight structural changes between the original zeolite and the same zeolite treated with a sea salt solution. These slight changes have major consequences in ion-selective desalination performance and will be further investigated. Combined with laboratory experiments, the synchrotron work will help guide the design of membrane materials with the potential to substantially reduce the energy required for desalination.

The experiments were supported by a collaborative ARC Discovery Project with CSIRO, the University of South Australia and Arizona State University in the USA.



The Australian Synchrotron's 1000th user, Bo Zhu (centre), is congratulated by synchrotron powder diffraction expert Kia Wallwork and David Cookson from the synchrotron's user office.



## REMOTE INTERACTION STRENGTHENS RELATIONSHIP

*Undergraduate physics students from La Trobe University recently enjoyed a real-life experience of using the PX1 beamline – without leaving their classroom in Bundoora.*

Ten students and staff from La Trobe University were connected to the PX1 (high-throughput protein crystallography) beamline at the Australian Synchrotron via the Virtual BeamLine project's video-conferencing links, work

For more information about applying for beamtime at the Australian Synchrotron, contact the User Office: [user.office@synchrotron.org.au](mailto:user.office@synchrotron.org.au)

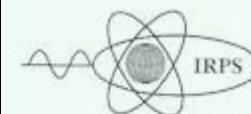
## EVENTS DIARY

### EVENTS IN AUSTRALIA

#### 11th International Symposium on Radiation Physics (ISRP-11)

21-25 September 2009

The University of Melbourne, Australia



ISRP-11 is organised by the International Radiation Physics Society (IRPS) and is supported by DEST, the Australian Synchrotron and the Victorian Government. The meeting is devoted to current trends in radiation physics research.

More: [mcmconferences.com/isrp11](http://mcmconferences.com/isrp11)

#### 10th International Conference on Synchrotron Radiation and Instrumentation 2009 (SRI 2009)

Melbourne Convention & Exhibition Centre

28 September – 2 October 2009



The world's largest and most important forum for synchrotron radiation science and technology communities, SRI is expected to attract 800 international and Australian delegates in 2009. The conference promotes international exchange and collaboration among scientists and engineers involved in developing new concepts, techniques and instruments related to the production and utilisation of synchrotron radiation. More details are available at [www.sri09.org/](http://www.sri09.org/)

area overview cameras, storage gateway, metadata viewer and PX1's NoMachine remote desktop software. In collaboration with three other La Trobe students at the beamline, powder samples were loaded for identification and analysis with the students at the La Trobe end remotely controlling the beamline operations via Blu-Ice on NoMachine. The outputs from the beamline were duly interpreted by the students, who inferred the nature of the various materials by assessing the powder diffraction patterns and conferring remotely with one another on the physical nature of the materials.

The class activities introduced some of tomorrow's scientists to the remote and onsite capabilities of the synchrotron in general and the PX1 beamline in particular, as well as forming part of the students' assessed coursework.

The collaboration was the brainchild of Paul Pigram and Peter Kappen (La Trobe University) and Anton Tadich (Australian Synchrotron soft x-ray spectroscopy team), together with Rachel Williamson (Australian Synchrotron protein crystallography team) and Chris Myers from the Victorian eResearch Strategic Initiative (VeRSI). Everyone involved in the class was delighted with the experience.

The Australian Synchrotron and La Trobe University look forward to further educational collaborations.



La Trobe University students in the classroom (shown on screen, with lecturers Paul Pigram on the right and David Hoxley third from left) and at the Australian Synchrotron (seated) recently conducted a series of synchrotron experiments with the help of Peter Kappen (RHS) and Anton Tadich (second from right).



## SUNRISE SCIENCE

*May 2009 saw the dawn of a new era in scanning microscopy at the Australian Synchrotron with successful resolution tests of the nanoprobe at the Microspectroscopy (XFM) beamline.*

The sunrise image (next page) shows a scan of a resolution test pattern and demonstrates the ability of the instrument to focus the x-ray beam to a sub-micron 150-nanometre probe. The image also demonstrates instrument's stability and accuracy. The scan took over 15 hours to accumulate, precisely positioning the sample in 50-nanometre steps without error.

### **BSR/MASR 2010 con-joint meetings Biology and Synchrotron Radiation Medical Applications of Synchrotron Radiation**

15-18 February 2010  
Melbourne Convention and Exhibition  
Centre

BSR 2010 session themes include protein structure and function, biomaterials, spectroscopic techniques and non-crystalline diffraction.

More: [www.bsr2010.org](http://www.bsr2010.org)

MASR 2010 session themes include x-ray imaging, radiology, dosimetry and radiation biology, oncology, and pathology and diagnostics.

More: [www.masr2010.org](http://www.masr2010.org)

Early bird and abstract deadline is 27 November 2009. Sponsored by Monash University Centre for Synchrotron Science and CSIRO.

### **EVENTS OUTSIDE AUSTRALIA**

For additional information and listings, see

[www.lightsources.org/cms/?pid=1000068](http://www.lightsources.org/cms/?pid=1000068)

#### **XAFS 14 Conference**

26-31 July 2009

University of Camerino, Italy

The 14th International Conference on X-ray Absorption Fine Structure will cover a wide range of topics, including EXAFS, NEXAFS, XANES, DAFS, SEXAFS, EELFS, XMCD and Auger spectroscopies, microspectroscopy and spectro-microscopy, resonant photoemission, resonant and non-resonant inelastic x-ray scattering, time-resolved XAFS and diffraction.

More: [www.xafs14.it/](http://www.xafs14.it/)

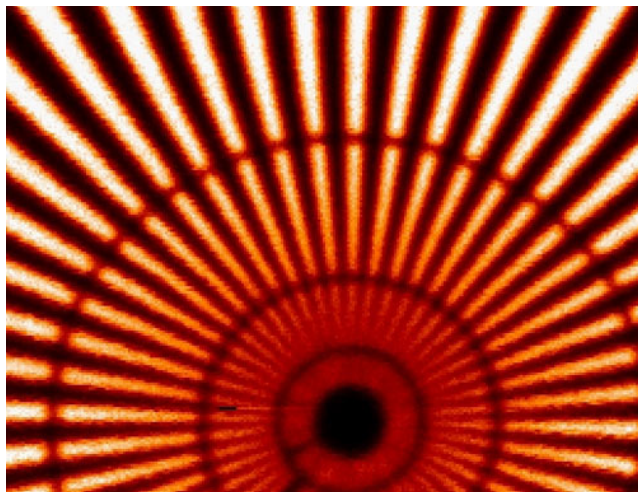
#### **X-RAY SCIENCE, GORDON RESEARCH CONFERENCE MEETING**

2-7 August 2009

Colby College, Waterville, Maine, USA

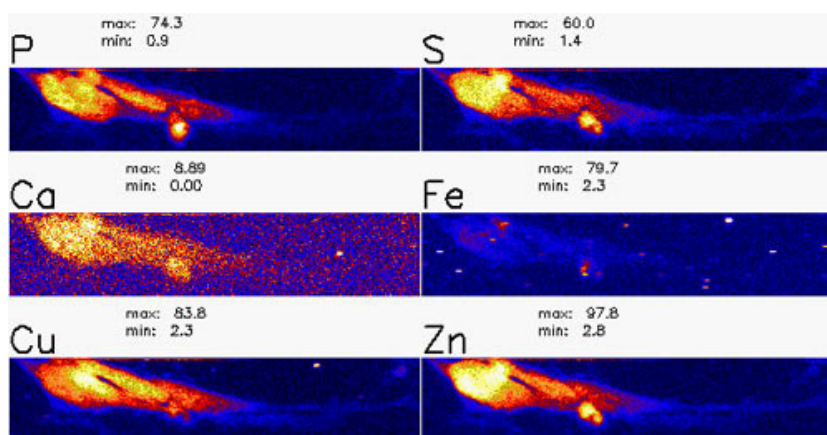
Conference participants will hear about x-ray-based science at 3rd generation light sources, and scientific plans and early results from 4th generation sources. Sessions include:

\* x-ray scattering / spectroscopy under



In this scan of a Siemens star resolution test pattern, the radial spokes of the second ring are 100 nanometres apart. The image demonstrates 150 nanometre spatial resolution, with the beam focussed by the nanoprobe to a spot of 150 nm size. The scan was 13 x 10 microns in size, 260 x 200 50-nm pixels with 0.8 second dwell per pixel.

Subcellular elemental mapping and imaging will be one of the major uses of the nanoprobe. The first experiments using the nanoprobe were conducted with neuron cells by researchers from The University of Melbourne's Department of Pathology and Mental Health Research Institute, who were investigating metal homeostasis in amyloid precursor protein-family knockout cells. The work is part of ongoing efforts to understand key aspects of Alzheimer's disease.



Distribution of key elements in neuron cells taken at 300 nm resolution. Each image is approximately 90 micrometres wide or about the width of a typical human hair. Image courtesy of Joe Ciccotosto, The University of Melbourne.



## NEW VISITORS CENTRE TO ENGAGE AND ENLIGHTEN

*In June 2009, 30 physics teachers from across Victoria attended a professional development day at the Australian Synchrotron.*

The teachers were treated to an extensive tour of the facility, including the booster and storage ring tunnels, which are usually off-limits to visitors. They were shown a range of practical activities to suit various year levels, particularly VCE physics, and took full advantage of opportunities to network with other teachers and synchrotron scientists.

Participants also heard presentations from Australian Synchrotron staff Eugene Tan (machine physicist), Don McGilvery (Group Leader, Accelerator Operators) and Greg LeBlanc (Head of Accelerator Science and Operations), and guest lecturers Kim Northmore (VCE physics teacher) and Dan O'Keeffe (Australian

- extreme conditions
- \* new techniques / optics, detectors and others
- \* x-rays in environment and nano science
- \* x-rays in biology and life science
- \* use of coherent x-rays for imaging and studies of dynamics.

Applications must be submitted by 12 July 2009.

More:

[www.grc.org/programs.aspx?year=2009&program=xray](http://www.grc.org/programs.aspx?year=2009&program=xray)

### WIRMS 2009

Banff, Alberta, Canada

13-17 September 2009

The 5th International Workshop on Infrared Microscopy and Spectroscopy with Accelerator Based Sources will bring scientists and synchrotron users together to discuss the latest developments and trends, future directions and promising applications. Experts will introduce young researchers and graduate students to this rapidly advancing field.

More: [www.lightsource.ca/wirms2009](http://www.lightsource.ca/wirms2009)

### SAS 2009

13-18 September 2009

Oxford, UK

The XIV International Conference on Small-Angle Scattering will enable scientists using SAS in the study of soft and hard condensed matter (with light, x-rays or neutrons) to discuss the latest scientific results and technological improvements.

More: [www.sas2009.org/](http://www.sas2009.org/)



## READER FEEDBACK

Lightspeed welcomes your comments and suggestions. Please send these to: [info@synchrotron.org.au](mailto:info@synchrotron.org.au) with 'Lightspeed comments' in the subject line.



Institute of Physics Education Committee).

The main aim of the PD day was to support teachers of the Synchrotron and its applications study unit in the VCE physics curriculum.



Synchrotron outreach officer Jonathan de Booy plans to organise more such events for a variety of science education areas, including primary science, secondary general science and VCE. When the new synchrotron website is launched, teachers will be able to keep track of all professional development activities on offer and apply online.

The Australian Synchrotron Student Lab is expected to open later this year. No bookings are being taken at this stage, but watch the website for updates.



## NEW WEBSITE

The Australian Synchrotron's new website is rapidly taking shape. The new website home page will look something like this.



To help ensure that the move to the new website does not inconvenience synchrotron users and other important audiences, the new website will provide a link to the old website for a transition period of approximately two months.



## CAREERS AT THE AUSTRALIAN SYNCHROTRON

The Australian Synchrotron offers a unique working environment for a wide range of specialists. More information on job postings.




## MORE INFORMATION

A list of Australian Synchrotron personnel can be found here: [http://www.synchrotron.org.au/content.asp?Document\\_ID=129](http://www.synchrotron.org.au/content.asp?Document_ID=129).


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