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Australian Government | ANSTO Science. Ingenuity. Sustainability.

ACNS Newsletter

From the Director's desk

Welcome to the first Australian Centre for Neutron Scattering newsletter. It's been a while since we published the last *Bragg Peaks* from the Bragg Institute and we believe that this is an important medium to communicate with our users and supporters.

2018 was a significant year for ACNS with the achievement of 10 years of neutron beam operations and 1000 Scientific Research Papers containing data obtained using the neutron scattering instruments at the OPAL reactor. Such milestones are testament to the quality of our world-class instruments, hardworking staff and superb user community.

In June we officially opened the Spatz neutron reflectometer which was generously donated to ANSTO by the Helmholtz Zentrum Berlin from the BER-II reactor in Berlin. We are now eagerly looking forward to the first external users on Spatz in early 2020.

We look forward to seeing you at the biannual ANSTO Users Meeting in December or the next time you are at ANSTO.

-Dr Jamie Schulz

What's in a name?

For long-time ACNS users and supporters, you will remember our previous newsletter as *Bragg Peaks*. A lot has changed in the last ten years, the Bragg Institute became ACNS and it is time the newsletter had a shimmering new name to take it into the next decade of research at ANSTO.

And who better to name it than you, our wonderful community of users and supporters! If you have a way with words or a penchant for puns, get out your notebook and get writing.

Entries close on Friday 29th November send submissions to kathleen.wood@ansto.gov.au. The winning title will be announced the following week at the ANSTO User Meeting and its author given a $100 gift card.

Around the instruments

Diffraction

'Tour de force' of chemistry

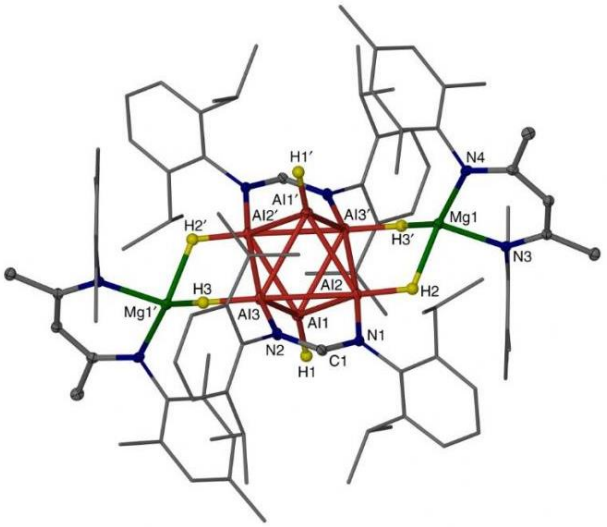
Low resolution Laue diffraction data from the Koala instrument was used to determine that a crystal was the first example of an elusive class of compounds that some chemists had hypothesised

could exist and had been searching for over decades.

Dr Alison Edwards said that although the crystal gave one of the ugliest diffraction patterns she had ever collected, the information it contained was sufficient to confirm an important development in chemistry—the synthesis of aluminium hydride cluster.

The research was led by Prof Cameron Jones with Dr Simon Bonhady (a student at the time), at Monash University and was published in *Nature Communications* in 2018.

The unusual electronic state and shape of the magnesium +1 compound developed by Cameron's group gave rise to a way to create this novel compound with a cluster of six aluminium atoms and six hydrides at its core and to isolate it for chemical study.



"It was a great privilege to contribute to this tour de force of chemistry," said Edwards, who had collaborated previously with Jones and Bonyhady to verify the first stable magnesium +1 compound which the Jones group had published in *Science* in 2007.

You can access the original ANSTO article here or read the full article in *Nature Communications* here.

Engineering & imaging

Neutrons for additive manufacturing

Neutron diffraction strain scanning measurements at ANSTO have validated a new theoretical model that successfully predicts the residual stresses and critical deposition heights for laser additive manufacturing.

The model, which was developed by Prof Ramesh Singh's group from Indian Institute of Technology Bombay in association with Prof Wenyi Yan from Monash University, accounts for both thermomechanical behaviour and metallurgical transformation that takes place by direct energy deposition techniques, such as laser cladding.

"To collaborate with ANSTO and use the world-class facilities there can definitely enhance our research quality. This work, just published in *Scientific Reports*, is just one good example," said Yan.

"Understanding the stresses and being able to predict them is very important for additive manufacturing industry." said Prof. Paradowska.

You can read the full article published on the ANSTO website here or read the article in *Scientific Reports* here.

Inelastic

Refrigeration of the future

ANSTO has contributed to a large research collaboration led by Prof Bing Li at the Chinese Academy of Sciences investigating a new class of materials with the potential to be used as an advanced, high-performing, environmentally friendly, and economical form of refrigeration.

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"This is an excellent example of how an understanding of lattice dynamics at a fundamental level can lead to an application in the real world, such as a better form of refrigeration," said Mole.

What to know more? Access the ABC news feature here or read the full article in *Nature* here.

Reflectivity

Sparrow Migration

The BioRef neutron reflectometer was generously donated by the Helmholtz Zentrum Berlin from the BER-II reactor in Berlin to ANSTO in February 2017 and renamed Spatz which is the German translation of sparrow.

Spatz was dismantled by a team of ANSTO and HZB staff in September 2016 and the 257 parts shipped to Australia in January 2017. To date over 30 ANSTO & HZB staff from numerous ANSTO business units have contributed in excess of 22,000 hours on the project.

Spatz will alleviate the present high demand for neutron reflectometry on the existing Platypus neutron reflectometer as well as providing new capability to Australian researchers to perform simultaneous infrared spectroscopy and wide-angle neutron diffraction, which is ideally suited to research studies in biomedicine, energy and materials science.

Small Angle

Nanoplastics and you

Collaborative research at ANSTO led by Mr Shinji Kihara and A/Prof. Duncan McGillivray of The MacDiarmid Institute, New Zealand with ANSTO's Dr Jitendra Mata and Dr Andrew Whitten, scientists from the University of Auckland and A/Prof Ingo Köper from Flinders University, SA, is contributing to a better understanding of how nanoplastics interact with blood plasma proteins and other biological molecules within the body.

The motivation for this study, which was recently published in *Bioconjugate Chemistry*, arose from concerns regarding the increasing quantities of plastic waste in the environment.

Studies on the toxicology of engineered nanoparticles have suggested that these particles gain easy access and mobility within the body, often side-stepping important biological barriers and defence mechanisms against foreign bodies. Unlike the engineered nanoparticles used in biomedical applications, however, the potential effects and interactions of these nanoplastics are not well-understood.

"Our facilities are quite unique in that we can explore the interaction between protein and nanoparticle at length scales from one nanometre to 10 microns, which is very difficult to do with other techniques." said Dr Jitendra Mata, co-author on the paper.

You can read the full article published on the ANSTO website here or read the article in Bioconigate Chemistry here.

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Operations

In July 2019 three enthusiastic French engineering interns joined the ACNS team under the supervision ACNS staff.

Paul Cassarino and Baptiste Caillaud from École Nationale Supérieur d'Arts & Métiers, and Jordan Darnige from Arts et Métiers Paristech, spent three months supporting the operations team working on maintenance and upgrade planning.

Achievements

Scattering neutrons on the road

The Australian Institute of Physics (AIP) selected, Dr Helen Maynard-Casely, an instrument scientist at ACNS, as the 2019 'Women in Physics Lecturer.'

For the award, Maynard-Casely presented a national series of public and schools lecturers on neutron scattering in every state and ACT.

"It is also a great opportunity to further clarify the misconception that women don't like physics," said Maynard-Casely.

Maynard-Casely, who has a PhD in high pressure physics from the University of Edinburgh, is the recipient of numerous awards and invitations, including speaking at the Science Academy's public lecture series, and two previous state tours of school talks.

The API is dedicated to promoting the role of physics in research, education, industry, and the community.

You can read the full article published on the ANSTO website here, read Dr Maynard-Casely's reflection on the tour here, or find more information about the award can be found online.

Event Report

ACNS Clip Day

In the style of the 3MT competition, 25 ACNS PhD candidates and post-docs from 22 universities, across four countries, took on the challenge to present their research at the inaugural ACNS Neutron Clip Day.

Congratulations to the winners of the oral and poster presentation competitions!

Oral presentations:

1st prize: Yunxin (Cindy) Xiao, Monash University - *Engineering Elongated Polymeric Nanocapsules for Prolonged Circulation and Improved Controlled Release*.

2nd prize: Emily Cheung, UNSW - *Diffusion in Modified Solid Ionic Conductors for Energy Applications: Structure and Dynamics.*

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Poster presentations:

1st prize: Katherine Davies, The Walter and Eliza Hall Institute of Medical Research - *Using neutron reflectometry to understand MLKL's membrane permeabilisation mod.*

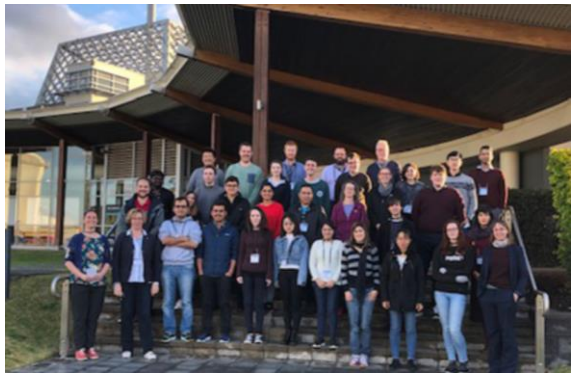
2nd prize: Edwin Johnson, University of Newcastle - *Non-monotonic structure of pH and temperature responsive copolymer brushes as determined by neutron reflectometry.*

Thank you to the Clip Day organisers: Dr Mark Reid. Dr Samila McDonald and Dr Stephen Holt and Heidi Welton for all their work behind the scenes.

HZB-ANSTO Neutron School 2019

The first joint Helmholtz Zentrum Berlin-ANSTO neutron school took place from 23 to 28 June 2019 at ANSTO. HZB experts Prof Bella Lake and Prof Susan Schorr gave several lectures. The interest in the neutron school was high, with 24 participants selected from 60 applications.

"We were inspired by the all-encompassing nature of the Berlin school - our plan going forward is to run a 'general' neutron school every two years and a more specific school in between," said Dr. Helen Maynard-Casely, one of the organisers at ANSTO.



The HZB-ANSTO neutron school will take place every two years.

AONSA Neutron School 2018

From 11th – 16th November 2018, ANSTO played host to the 10th AONSA Neutron School. A great success with 34 participants from 11 countries made possible by the whole team at ACNS.

ANSTO staff and invited lecturers presented a comprehensive introduction to neutron scattering techniques and case studies. Practical sessions using the neutron scattering instruments at the ACNS included spectroscopy, diffraction, reflectometry and small-angle scattering.

Thank you to the organising committee: Dr Anna Sokolova (chair), Dr Garry McIntrye, Dr Helen Maynard-Casely, Dr David Cortie, and Kelly Cubbin.

You can read more about this program in the AONSA Newsletter available online here.

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Upcoming Events

ANSTO User Meeting 2019

Hosted in the MUSE building at Macquarie University NSW on the 2nd & 3rd December 2019, the meeting will showcase the achievements of scientists who have accessed ANSTO's landmark infrastructure and capabilities in the last year.

It is also an opportunity for prospective users to hear about the unique capabilities of ANSTO's scientific infrastructure, which comprises a suite of neutron beam instruments in Sydney and synchrotron beamline in Melbourne. "The real power of accessing ANSTO is the possibility of using complementary instruments in a single investigation within one organisation", said Dr Miles Apperley, Head of Research Infrastructure.

The event will coincide with the combined annual meetings of the Australian Neutron Beam Users Group (ANBUG) and the Australian Synchrotron Users Advisory Committee (UAC).

To view the program or register head online.

AOCNS 2019

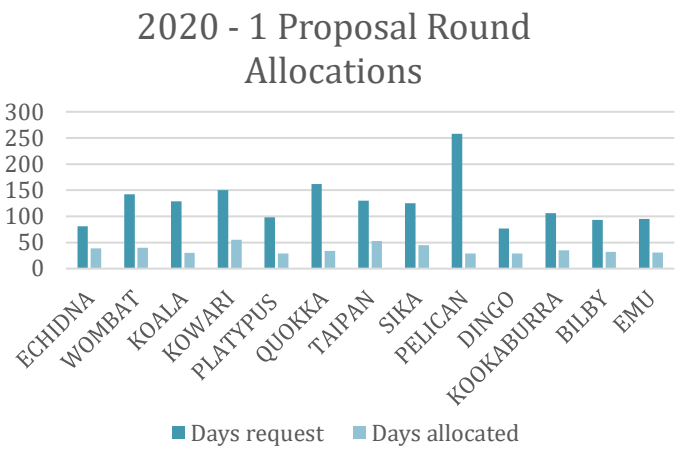
The Asia-Oceania Conference for Neutron Scattering (AOCNS) is a platform for scientists in the Asia Oceania region to share their latest results and discoveries in neutron scattering science across multiple fields such as physics, chemistry, biology, material science, engineering materials engineering, neutron sources and instrumentations.

This year's conference is being held from 16th – 21st November in Kenting, Taiwan. To view the program or register head online.

Applications

Results from last proposal round

The 2020-1 Proposal Round saw an average subscription request rate across all instruments of 280%.



Application Deadlines

Applications for beam time for the second half of 2020 are now open. The call for proposal will close on Monday 16th March 2020 at 11:59pm (AEST).

For submission advice see the website or contact the Sydney User Office team on:
T: +612 9717 9111
E: user.office.nsw@ansto.gov.au

New Publications

Between 2007 and 2019, there have been 1214 publications with neutron data collected at ACNS by users and staff, which includes 119 in 2019.

You can access a full list of ACNS publications from 2007 online, here.

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Recent Grants

ACNS scientists are currently involved and actively participating in nearly 20 successful Australian and international grants. The most recent successes are:

2018

ARC Training Centre - ***Surface Engineering for Advanced Materials.*** Vladimir Luzin (ACNS) and Swinburne University of Technology (Lead). Partners: multiple both domestic and international.

ARC Training Centre - ***ARC Training Centre for Multiscale 3D Imaging, Modelling and Manufacturing.*** Ulf Garbe (ACNS) and Australian national University (Lead). Partners: multiple both domestic and international.

ARC Discovery Grant - ***From liquids to semiconductors: understanding the formation of solution-processed electronic materials.*** Liliana de Campo (ACNS) and Macquarie University (Lead). Partners: ANSTO and university of Queensland.

ARC LIEF Grant- ***Surface/interface and thermal properties of functional materials***. Vanessa Peterson (ACNS) and University of Wollongong (Lead). Partners: ANSTO, Deakin University, UTS and UNSW.

ARC Linkage Grant - ***Laser cleaning processes for Roads and Maritime Services bridges***. Anna Paradowska (ACNS) and Australian National University (Lead). Partners: ANU, University of Sydney, University of Canberra and NSW RMS.

2019

Discovery – ***Bioactive Polymer Platelets.*** Chris Garvey (ACNS) and University of New South Wales (Lead). Partners: UNSW, Forschungszentrum Jülich.

Discovery - ***Magnetic Skyrmion Materials for Next Generation Spintronic-based Devices.*** Elliot Gilbert (ACNS) and University of Wollongong (Lead). Partners: University of Wollongong, Chinese Academy of Science.

Meet the team

With all of the projects going on at ACNS there are always new faces joining the team and others heading off on new adventures. Here we will try to keep you to up to date with team developments.

Arrivals

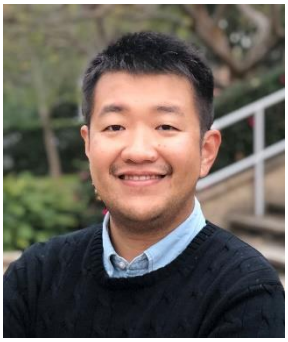
Mr Chris Baldwin

Sample Environment Professional Officer

Chris has joined the Sample Environment team after a PhD at Macquarie University. His background is in optics, and his PhD project focussed on UV laser nanomachining of diamond.

Dr Tzu-Ye (Ian) Huang

Neutron Reflectometry Instrument Scientist



Tzu-Yen (Ian) is also a research scientist at National Synchrotron Radiation Research Center (NSRRC), Taiwan. His research interests focus on organic semiconductor materials.

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Dr Amy Shumack

Sample Environment Professional Officer

Amy completed her PhD in plasma physics in the Netherlands and has since worked as responsible officer for an X-Ray spectrometer at the nuclear fusion experiment JET (Joint European Torus), in the UK.

Our students

ACNS has hosted over 25 students in 2019. From undergraduates to PhD candidates, both local and international. While we cannot detail their individual projects and supervisors, we would like to acknowledge their collective contribution to the research conducted at ANSTO this year.

Undergraduate placement students:

- Neil Anderson (Macquarie University)
- Nicholas Ashelford (Macquarie University)
- Baptiste Caillaud (École Nationale Supérieur d'Arts & Métiers)
- Paul Cassarino (École Nationale Supérieur d'Arts & Métiers)
- Elizabeth Clarkson (Macquarie University)
- Jordan Darnige (Arts et Métiers Paristech)
- Jerrisa Jadson (Macquarie University)
- Philipp Khondeir (Macquarie University)
- Juhyeong Lee (KONICOF)
- Bernard Sayegh (Macquarie University)
- Dean Tare (UNSW)

ACNS Post graduate Students:

- Lisi Li (Sun Yat Sen University)
- Jean Goder (Ecole Normale Supérieure / SAAFE RMIT)
- Zuzana Pietras (Linköping University)
- Olivia Pabois (Kings College London)

AINSE Post Graduate Research Award:

- Emily Chung (UNSW)
- Oliver Paull (UNSW)

ACNS funded/co-funded PhD candidates:

- Olivia Kendall (Monash)
- Sarath Kumara (Macquarie University)
- Giulia Novelli (University of Edinburgh)
- George Sackman (University of Oxford)
- Jennifer Standsby (UNSW)
- Hang Su (Monash)
- Qingbo Xia (University of Sydney)
- Ji Zhang (UNSW)
- Chengbo Zhu (RMIT)

Editor

Each edition of the ACNS Newsletter will be brought to you by a different editor/s from the ACNS team. Our first editor is:

Elizabeth Clarkson

Lizzy is an undergraduate PACE student from Macquarie University, completing a science communications placement at ACNS as part of her studies.

Contact us

Do you have a story you would like to share with the ACNS user community? Contact the ACNS team via:

E: kathleen.wood@ansto.gov.au

E: anna.paradowska@ansto.gov.au