ANSTO User Meeting

Wednesday, Nov 24 **09:00 AM - 10:00 AM**

Welcome Address: Day 1

Update

Marta Krasowska
Associate Professor, Fii, UniSA

Michael Rose
Communications and STEM Manager, AINSE

Miles Apperley

Yun Liu
Professor, The Australian National University

Welcome to the opening session of AUM2021! Please take some time to familiarise yourself with the Pheedloop virtual event platform. The general chat and Q&A chat on the top right of your screen is specific to each session. Next to that, you can also see the other atendees that are with you in this virtual session.Enjoy AUM2021!

Wednesday, Nov 24 **10:00 AM - 10:30 AM**

Plenary: Prof. Despina Louca

Despina Louca
University of Virginia

Yun Liu
Professor, The Australian National University

Wednesday, Nov 24 **11:00 AM - 11:20 AM**

87 - The Death Kiss: understanding how the zombie protein, MLKL, is triggered to kill cells by necroptosis

Biomedicine, Life science & Food Science

Andrew Clulow
Dr, ANSTO Australian Synchrotron

James Murphy
Division head, Walter and Eliza Hall Institute of Medical Research

In 2012, Mixed lineage kinase domain-like (MLKL), a catalytically-dead ('zombie') cousin of conventional protein kinases, termed a pseudokinase, was implicated as the key effector in the programmed necrosis (or necroptosis) cell death pathway. This pathway has been implicated in innate immunity, the pathogenesis of inflammatory diseases, and tissue injury arising from ischemia-reperfusion. As a result, an improved fundamental knowledge of MLKL's activation mechanism is of enormous interest as we and others look to target the pathway therapeutically. Here, I will describe our recent work dissecting the chronology of events in this pathway using novel tools, biochemistry, microscopy, proteomics and structural …

Wednesday, Nov 24 **11:00 AM - 11:20 AM**

24 - Structural studies of solid-state ionic conductors at the limits of diffraction and beyond

Advanced Materials

Aaron Elbourne

Chris Ling
Prof, The University of Sydney

The structures of solid-state ionic conductors are a compromise between long-range (and hence long-term) lattice stability and short-range coordinative flexibility. To rationally design improved versions for applications such as fuel cells and batteries, we need to understand how this compromise is reached. Diffraction methods alone are inadequate whether using X-rays or neutrons, *ex situ* or *operando*, conventional crystallography or total scattering analysis because of their dynamic nature. The time-averaged structure is not the whole story. In this talk I will show how we use experimental X-ray and neutron spectroscopy, and computational structure and dynamics calculations, to supplement diffraction when studying …

Wednesday, Nov 24 **11:00 AM - 11:20 AM**

232 - The new external ion beam capability for testing of electronics suitable for harsh space radiation environments

Instruments & Techniques

Anna Sokolova
ANSTO

Stefania Peracchi
Dr, ANSTO

In 2019, the Australian Space Agency made its debut in the international scene of the space exploration. Securing the future of Australia's space sector is the core of the Advancing Space: Australian Civil space Strategy 2019-2028. This Government plan reminds that space-based technology and services not only interests space missions, but benefits all Australians daily as for weather forecasting, GPS, internet access, online banking, emergency response tracking bushfires, monitoring of farming crops, etc.To further increase capability, the Space Infrastructure Fund (SIF) investment was issued to target 7 space infrastructure projects that involve several industries, organisations, universities, laboratories, all around the …

Wednesday, Nov 24 **11:00 AM - 11:20 AM**

227 - From Niche to Mainstream: Ptychography Comes of Age.

Instruments & Techniques

Michael Jones
Dr, Queensland University of Technology

In the space of a few short years, ptychography has moved from a niche method1,2 to emerging as a mainstream technique for user science3,4. Until recently, ptychography required significant expert user experience to collect and reconstruct useable data, with a field of view often limited to a small area (such as a single cell)5 by data collection and reconstruction limitations6. Now however, ptychography data can be collected at high speed7 complementary to modern X-ray fluorescence fly-scanning8, with data-pipelines providing results within a few hours using GPU enabled reconstruction algorithms9. These advances allow ptychography to be applied to larger areas and …

Wednesday, Nov 24 **11:20 AM - 11:35 AM**

94 - Magnetoelastic coupling as a relaxation pathway for single ion magnets observed using inelastic neutron scattering.

Advanced Materials

Aaron Elbourne

Richard Mole
Dr, ANSTO

Single ion magnets (SIM's), are materials that show an energy barrier to spin reorientation without long range magnetic order. Such materials have been postulated to be useful as potential materials for high density data storage or to be used as Qubits. The origin of the effect lies in the crystal field splitting of the central lanthanoid ion. The determination of crystal field splitting has long been performed using INS and this has been readily extended to SIM's [1]. In recent years the operating temperature of these SIM's has increased dramatically with magnetic hysteresis observed above liquid nitrogen temperatures [2]. The …

Wednesday, Nov 24 **11:20 AM - 11:35 AM**

25 - Structures of biliary micelles during solubilisation of lipids mimicking the digestion products of human and bovine milk

Biomedicine, Life science & Food Science

Andrew Clulow
Dr, ANSTO Australian Synchrotron

Milk is our sole source of nutrition for the first six months of life and milk lipids carry fat-soluble nutrients through the gut as well as providing most of the energy we consume with milk. The digestion and absorption of lipids, predominantly triglycerides, and entrained nutrients is therefore important for survival and growth. Milk triglycerides are regarded amongst the most chemically complex mixtures, their composition is species-dependent and determines the mixture of fatty acids and monoglycerides that form during their digestion. Most lipid digestion takes place in the small intestines where bile salts mixed with phospholipids in the intestinal fluids …

Wednesday, Nov 24 **11:20 AM - 11:35 AM**

206 - How to take a perfect image with DINGO

Instruments & Techniques

Anna Sokolova
ANSTO

Vili Grigorova
Dr, Macquarie University

Neutron tomography is a powerful non-destructive technique used to study the internal structure of opaque objects. Neutron images are obtained by exposing an object to a uniform neutron beam. The transmitted neutrons interact with a phosphor which converts from neutrons to visible light, which is then demagnified on to a CCD camera. The modulation transfer function (MTF) is routinely used to determine the sharpness of an image, i.e. the ability of the imaging system to transfer information from an object to an image. The spatial frequency (SF) is the rate of transition between light and dark features in the image. …

Wednesday, Nov 24 **11:35 AM - 11:50 AM**

36 - Total scattering: science that's better than average

Advanced Materials

Aaron Elbourne

Frederick Marlton
Dr, University of Sydney

Local-scale defects and disorder are essential in the development of new advanced functional materials. However, such features are often difficult to characterize and understand without suitable probes. Powder diffraction is a powerful technique for understanding atomic structures, however, Bragg peaks alone are limited to information regarding the 'average' or long-range structure. The presence of local-scale disorder results in diffuse features that occur beneath and between the Bragg peaks. Hence, the chracterisation of nano-scale (0.1 - 3 nm) features in functional materials demands an alternative approach. Total scattering involves the collection of both Bragg and diffuse data over a wide Q-range. …

Wednesday, Nov 24 **11:35 AM - 11:50 AM**

216 - Hepatic lipid composition in dietary models of high iron NAFLD investigated with Synchrotron Infrared and X-Ray Fluorescence microscopy

Biomedicine, Life science & Food Science

Andrew Clulow
Dr, ANSTO Australian Synchrotron

Clinton Kidman
Mr, Curtin University

Hepatocytes are essential for maintaining homeostasis of mammalian iron and lipid metabolism. Serious health consequences have been linked to dysregulation of both areas. One such consequence is non-alcoholic fatty liver disease (NAFLD). Approximately 30% of individuals with NAFLD demonstrate a moderate increase in hepatic iron; however, the mechanism and metabolic consequences remain under-investigated. We assessed the metabolic consequences using mice fed either a control or high fat (HF) diet, with or without high iron. Attenuated Total Reflection Infrared Microscopy (Macro-ATR) at the Australian Synchrotron was used to investigate lipid composition and distribution, and X-Ray Fluorescence Microscopy (XRF) at the Diamond …

Wednesday, Nov 24 **11:35 AM - 11:50 AM**

213 - The Imaging and Medical Beamline is expanding

Instruments & Techniques

Anna Sokolova
ANSTO

Daniel Hausermann
Dr, ANSTO

Synchrotron radiation has many advantages, but it is also flawed. And its biggest flaw happens to be its fundamental intrinsic property! The radiation is emitted in the plane of the stored beam and we are stuck with the infamous 'letterbox door' beam profile. At least when not tinkering with focused undulator beams. In clinical imaging research, this beam shape is a serious disadvantage. In fact, when compared with the field of view of commercial medical imaging devices, it is often the showstopper when engaging with a clinician to discuss medical application of the IMBL. So how will we image human …

Wednesday, Nov 24 **11:50 AM - 12:05 PM**

146 - Quantifying the x-ray dark-field signal in single-grid imaging

Instruments & Techniques

Anna Sokolova
ANSTO

Ying Ying How
Miss, Monash University

X-ray imaging has progressed in recent decades to capture not only a conventional attenuation image, but also a
phase-contrast image that visualises those features that are difficult to see with attenuation. More recently, techniques have been developed to capture a
dark-field signal. The dark-field signal is generated by ultra-small-angle x-ray scattering from unresolved sample features, such as bubbles, powders or fibres, providing information about sample microstructure that is inaccessible using full-field conventional or phase-contrast x-ray imaging. Dark-field imaging can be useful in a range of fields, including medical diagnosis, materials science and airport screening. Single-grid imaging is an emerging x-ray …

Wednesday, Nov 24 **11:50 AM - 12:05 PM**

49 - Single-Crystal-to-Single-Crystal Transformations of Metal–Organic-Framework-Supported, Site-Isolated Trigonal-Planar Cu(I) Complexes with Labile Ligands

Advanced Materials

Aaron Elbourne

Ricardo Peralta
Dr, DGIST

Transition-metal complexes bearing labile ligands can be difficult to isolate and study in solution because of unwanted dinucleation or ligand substitution reactions. Metal–organic frameworks (MOFs) provide a unique matrix that allows site isolation and stabilization of well-defined transition-metal complexes that may be of importance as moieties for gas adsorption or catalysis. Herein we report the development of an in situ anion metathesis strategy that facilitates the postsynthetic modification of Cu(I) complexes appended to a porous, crystalline MOF. By exchange of coordinated chloride for weakly coordinating anions in the presence of carbon monoxide (CO) or ethylene, a series of labile MOF-appended …

Wednesday, Nov 24 **11:50 AM - 12:05 PM**

79 - Investigating the Therapeutic Benefit of Spermidine in a Pre-Clinical Model of Muscular Dystrophy

Biomedicine, Life science & Food Science

Andrew Clulow
Dr, ANSTO Australian Synchrotron

Lauryn Schaddee Van Dooren
Miss, University of Melbourne

Research into treatment for Duchenne Muscular Dystrophy (DMD) typically focuses on deterioration of muscle, however bone health is also severely compromised. Current treatment with corticosteroids exacerbate bone loss, so novel therapies targeting both muscle and bone are needed. Studies on bone health in a pre-clinical model, mdx mice, are limited and have conflicting results. Objective of study: To characterise aspects of bone health in mdx mice and investigate whether spermidine might attenuate disease symptoms and spare bone. Bone structure and function were assessed in 16-week-old mdx mice femurs by three-point bending, microarchitectural assessment using the Imaging and Medical Beamline (IMBL) …

Wednesday, Nov 24 **12:05 PM - 12:20 PM**

18 - Total Scattering Measurements at the Australian Synchrotron Powder Diffraction Beamline: Capabilities and Limitations

Instruments & Techniques

Anita D'Angelo
Dr, Australian Synchrotron (ANSTO)

Anna Sokolova
ANSTO

The PD beamline at the Australian Synchrotron (ANSTO) consistently receives requests to carry out total scattering experiments for various materials including battery electrodes, piezoelectrics and coordination frameworks. In this study we describe the capabilities and limitations of carrying out total scattering experiments on the Powder Diffraction beamline. A maximum instrument momentum transfer of 19 ⁄-1 can be achieved. Our results detail how the pair distribution function is affected by Qmax, absorption, and counting time duration at the PD beamline. We also trial a variable counting time strategy using the Mythen II detector. Refined structural parameters exemplify how the PDF is …

Wednesday, Nov 24 **12:05 PM - 12:20 PM**

168 - Deuteration of Rec1-Resilin and its hydrogel for biomedical applications

Advanced Materials

Aaron Elbourne

Nisal Wanasingha
Mr, RMIT University

Rec1-resilin is a highly hydrophilic protein that exudes a vast range of multi-responsiveness, well known for its superelasticity. Self-assembly of Rec1-resilin has been studied in vitro, however, it is difficult to understand the interaction and molecular organisation of the protein with varying biological environments due to the presence of complex systems. Therefore, it is critical to synthesise Rec1-resilin in deuterated form, which would enable a unique neutron scattering length density for neutron scattering experiments. With a view to understand the self-assembly and co-assembly of Rec1-resilin and tailor its responsiveness, we successfully synthesised deuterated Rec1-resilin using a modified protocol. Utilising this …

Wednesday, Nov 24 **12:05 PM - 12:20 PM**

123 - Structural insights into the ferroxidase and iron sequestration mechanisms of ferritin from Caenorhabditis elegans

Biomedicine, Life science & Food Science

Andrew Clulow
Dr, ANSTO Australian Synchrotron

Tess Malcolm
Postdoctoral Research Fellow, Bio21 Molecular Science and Biotechnology Institute, University of Melbourne

Iron is an essential trace element that, when in excess, becomes highly toxic [1]. Intracellular iron concentration must be strictly regulated by a network of interacting mechanisms [2]. Ferritin is a ubiquitous iron-storage protein that forms a highly conserved 24-subunit spherical cage-like structure. Ferritin catalyses the oxidation of iron (II) to iron (III) and sequesters the newly oxidised iron (III) as a mineral core to prevent cellular damage [3]. In this study, we use the model organism, Caenorhabditis elegans, to investigate iron uptake, oxidation, storage and release by ferritin. C. elegans expresses two ferritin proteins, FTN-1 and FTN-2, which both …

Wednesday, Nov 24 **12:20 PM - 12:35 PM**

99 - Update on Polarised Neutron Capabilities at the Australian Centre for Neutron Scattering

Instruments & Techniques

Andrew Manning
Dr, ANSTO

Anna Sokolova
ANSTO

The Australian Centre for Neutron Scattering offers neutron polarisation capabilities which are compatible with six different neutron scattering instruments, using a combination of polarising supermirrors and 3He cell spin filters. An overview of these capabilities will be given, followed by a description of some recent experiments which make use of a variety of these capabilities on instruments, including the cold triple-axis spectrometer Sika, and the small-angle neutron scattering instrument Quokka with a recently-commissioned 7 T compensated vertical magnet. Finally, current and future work to expand capabilities will be outlined, such as a new system for polarisation analysis experiments with magnetic …

Wednesday, Nov 24 **12:20 PM - 12:35 PM**

173 - Spectroscopic Analysis of Age-Related Changes in the Brain Lateral Ventricles During Ageing

Biomedicine, Life science & Food Science

Andrew Clulow
Dr, ANSTO Australian Synchrotron

Ashley Hollings
Curtin University

Alzheimer&#xfffd;s disease is the most common form of dementia and poses significant health and economic concerns. Currently, the disease has no cure, and it is expected that over 1 million people could be affected by 2058 in Australia alone. The content and distribution of metals such as Fe, Cu, Zn is known to change in the ageing brain and thus, increased understanding of the mechanistic role of metal dis-homeostasis may illuminate new therapeutic strategies. The brain lateral ventricles, which play a role in controlling metal and ion transport, have shown increasing levels of copper surrounding their walls with ageing. As …

Wednesday, Nov 24 **12:20 PM - 12:35 PM**

137 - Interfacial spin-structures in Pt/Tb3Fe5O12 bilayer films on Gd3Ga5O12 substrates

Advanced Materials

Aaron Elbourne

Roshni Yadav
National Chung Hsing University

The insulating ferrimagnets of rare-earth iron garnets (ReIG) are researched intensively owing to their strong magneto-electric responses. Proximity coupling between an insulating ReIG and a heavy metal, such as Pt has been shown to lead to an Anomalous Hall effect (AHE). Amongst the ReIG family, TbIG is less explored than the well-known YIG films. In this article, we report thin films (40 nm) of ferrimagnetic insulator Tb3Fe5O12 (TbIG) were grown on (111) oriented Gd3Ga5O12 (GGG) substrates by using pulsed laser deposition technique, some of which were capped by a thin Pt layer. Scanning transmission electron microscopy and X-ray diffraction show …

Wednesday, Nov 24 **12:35 PM - 12:50 PM**

162 - KOALA 2: Implications for magnetic structural and exotic studies

Instruments & Techniques

Anna Sokolova
ANSTO

Ross Piltz
Dr, ANSTO

The KOALA single-crystal diffractometer has now been operating for more than a decade and is now nearing retirement (mid-2022). The technical improvements of the new KOALA 2 diffractometer, and the implications for conventional chemical crystallography are described in separate presentations at this meeting. In this presentation we will present the implications for less conventional studies, such as: magnetic structures; incommensurate and other complex structures; very small samples; high-pressure experiments; studies over many temperatures; various preparatory studies of inelastic and diffuse scattering.

Wednesday, Nov 24 **12:35 PM - 12:50 PM**

155 - In-operando investigation of a lead-acid battery with the IMBL.

Advanced Materials

Aaron Elbourne

Chad Stone
Mr, Swinburne University of Technology

Lead-acid batteries play a key role in the energy storage marketplace. They are often cheaper, safer and more recyclable than alternative electrochemical energy storage systems. Under traditional energy storage applications such as starting, lighting and ignition batteries, they provide a great balance of affordability, lifespan and performance to the consumer. However, as the demands placed on energy storage systems have increased over recent decades, lead-acid batteries have been shown to have a markedly shortened lifespan. Investigations have found the cause of this failure is related to an uneven utilization of active material in the Pb electrode. Although, the process whereby …

Wednesday, Nov 24 **12:35 PM - 12:50 PM**

10 - Imaging Breast Microcalcifications Using Dark-Field Signal in Propagation-Based Phase-Contrast Tomography

Biomedicine, Life science & Food Science

Alaleh Aminzadeh
Dr, The University of Melbourne

Andrew Clulow
Dr, ANSTO Australian Synchrotron

Breast microcalcifications are an important primary radiological indicator of breast cancer. However, microcalcification classification and diagnosis can be still challenging for radiologists due to limitations of the standard 2D mammography technique, including spatial and contrast resolution. In this study, we propose an approach to improve the detection of microcalcifications in propagation-based phase-contrast X-ray tomography (PB-CT) of breast tissues. Five fresh mastectomies containing microcalcifications were scanned at the Imaging and Medical beamline of the Australian Synchrotron at different X-ray energies and radiation doses. Both bright-field and dark-field images were extracted from the same data sets using different image processing methods [1]. …

Wednesday, Nov 24 **01:20 PM - 02:00 PM**

Platform Updates: Australian Centre for Neutron Scattering | National Deuteration Facility

Jamie Schulz
Dr, ACNS, ANSTO

Tamim Darwish

Australian Centre for Neutron Scattering UpdateThe Australian Centre for Neutron Scattering (ACNS) utilises neutrons from Australia's multi-purpose research reactor, OPAL, to solve complex research and industrial problems for Australian and international users via merit-based access and user-pays programs. Neutron scattering techniques provide the research community and industry with unique tools to study the structure, dynamics and properties of a range of materials, helping scientists understand why materials have the properties they do, and helping tailor new materials. An update will be given on the OPAL reactor and its neutron beam facilities, the status of the neutron beam instruments and supporting …

Wednesday, Nov 24 **02:00 PM - 02:15 PM**

93 - Neutron Reflectometry Unravels Allergen-Lung Surfactant Monolayer Interactions in the Development of Pollen-Induced Thunderstorm Asthma

Biomedicine, Life science & Food Science

Arslan Siddique
Mr, UNSW Sydney

Keith Bambery
Dr, ANSTO Australian Synchrotron

Pollen-induced thunderstorm asthma outbreaks affect thousands of individuals globally. Australians in particular suffer from it every year. Pollens, the major culprit in thunderstorm asthma, are biological microparticles produced by flowering species of the plants. Pollens encounter stormy environments including lightning and humidity in thunderstorms, which results in liberation of associated allergen proteins and probable reactions with reactive oxygen nitrogen species (RONS) from the environment, before inhalation. Since allergen proteins are much smaller in size than whole pollen, they can travel deep down in the lower airways where they initially interact with the lung surfactant monolayer present within the lumen of …

Wednesday, Nov 24 **02:00 PM - 02:15 PM**

65 - In-situ X-ray diffaction for hydrogen sorption study of Mg-La alloys

Advanced Materials

Ceri Brenner
Dr, ANSTO Centre for Accelerator Science

Manjin Kim
Mr, The University of Queensland

Trace Na additions can enhance the reaction kinetics of Mg-5%La (wt.%) alloys, resulting in a potential hydrogen storage material. In this study, we used in-situ synchrotron Powder X-ray Diffraction (PXRD) to examine the hydrogen sorption behaviour of the Na-modified Mg-5%La. A setup equipped with a hydrogen gas flow cell and a hot air blower at the Powder Diffraction beamline of the Australian Synchrotron facility is used to allow for PXRD data collection during hydrogen sorption reactions to study the phase evolutions and the cyclability of the alloy. To shed light on the underlying processes during the reactions, in-situ desorption and …

Wednesday, Nov 24 **02:00 PM - 02:15 PM**

143 - Precision Measurement of the Complex Atomic Fine Structure at the Australian Synchrotron

Instruments & Techniques

Livia Salvati Manni
Dr, University of Sydney

Tony Kirk
Mr, La Trobe University

Current applications of X-ray Absorption Fine Structure (XAFS) to low absorbing samples such as ultra-thin films in semiconductor and nano-devices have been limited. This is expected to not be the case for the phase component of the fine structure as it is generally orders of magnitude larger than the absorption component in the x-ray regime. Here, we present details of precision measurements of both the phase and absorption components of the atomic fine structure across the K-edge of thin copper and iron foils. The experiments applied Fourier Transform Holography with an extended reference in spectroscopy mode and were conducted at …

Wednesday, Nov 24 **02:15 PM - 02:30 PM**

68 - X-ray dark-field imaging without optics

Instruments & Techniques

Livia Salvati Manni
Dr, University of Sydney

Thomas Leatham
Mr, Monash University

X-ray image contrast can be generated via three mechanisms: (i) attenuation, (ii) phase contrast and (iii) most recently, the dark-field signal, which arises due to the incoherent scattering of the incident x-ray wavefield by unresolved sub-pixel features (microstructure) present in the sample. These contrast mechanisms can be realised using emerging x-ray imaging techniques, such as analyser-based and grid-based imaging, each of which require the use of specialised optics and carefully aligned setups. In this work, we focus on a technique which has not been used to capture quantitative dark-field contrast propagation-based imaging. Propagation-based imaging requires no specialist optics and …

Wednesday, Nov 24 **02:15 PM - 02:30 PM**

59 - Investigating the role of Zn in glucose regulation using X-ray Fluorescence Microscopy and X-ray absorption near-edge structure spectroscopy

Biomedicine, Life science & Food Science

Gaewyn Ellison
Dr, Curtin University

Keith Bambery
Dr, ANSTO Australian Synchrotron

Zinc plays an important function in glucose regulation, particularly within pancreatic islets, the anatomical home of the glucose regulating hormones insulin and glucagon. Glucose dysregulation is a significant contributor to the epidemic of metabolic diseases, including diabetes, that affect an increasing number of people. Zn is found in very high (mM) concentrations in insulin-secreting ?-cells, where it facilitates insulin synthesis and storage, and is co-secreted with insulin, subsequently acting as a signalling molecule. Zn dysregulation is often coincident with impairment of insulin secretion, but little is known about the nature of the changes. Since a subset of the pool of …

Wednesday, Nov 24 **02:15 PM - 02:30 PM**

156 - Natural ageing behaviour in Al-Cu alloys containing Sc and Zr

Advanced Materials

Ceri Brenner
Dr, ANSTO Centre for Accelerator Science

Lu Jiang
Dr, Deakin University

The 2xxx series Al-Cu alloys have been extensively used as engineering structures and components of lightweight vehicles due to their excellent strength-to-weight ratio. Recent research has demonstrated that further substantial enhancement in the strength of Al-Cu alloys could be achieved by adding Sc and Zr by forming nano-sized Al3(Sc, Zr) dispersoids. However, further development and manufacturing of these new Sc and Zr-containing Al-Cu alloys are limited by a lack of basic understanding of the effect of Al3(Sc, Zr) dispersoids on the microstructural evolution during room temperature storage after quenching from solution treatment (called natural ageing). In this work, therefore, we …

Wednesday, Nov 24 **02:30 PM - 02:45 PM**

50 - Magnetic Nanochain Formation Studied by Small-Angle Scattering

Advanced Materials

Ceri Brenner
Dr, ANSTO Centre for Accelerator Science

Lester Barnsley
Dr, ANSTO

Self-assembly of magnetic nanoparticles is of interest due to the broad range of applications in material science and biomedical engineering. Parameters that affect self-assembly in nanoparticles include particle size, the applied magnetic field profile, concentration and synthesis routines. A range of different sizes of magnetic nanoparticles between 5 and 27 nm were investigated using polarized small-angle neutron scattering (SANS) at the KWS-1 instrument operated by the J�lich Centre for Neutron Science (JCNS) at Heinz Maier-Leibnitz Zentrum (MLZ) in Garching, Germany and the Quokka instrument operated by the Australian Centre for Neutron Scattering (ACNS) at ANSTO in Lucas Heights, Australia. Iron …

Wednesday, Nov 24 **02:30 PM - 02:45 PM**

22 - refnx - The Next Generation of Reflectometry Analysis Software

Instruments & Techniques

Andrew Nelson
Dr, ANSTO

Livia Salvati Manni
Dr, University of Sydney

refnx [1] is a next generation reflectometry analysis package, building on its predecessor, Motofit. It has undergone a large amount of collaborative development over the last five years, introducing innovative features that greatly aid the national and international neutron and X-ray reflectometry community: - a Bayesian statistics core with comprehensive uncertainty analyses and model selection ("how many layers can the data justify"). - quantitative introduction of prior information into the modelling system (information known from other sources) - modular construction of structural models, ranging from a basic Slab up to freeform SLD profiles and Lipid membrane leaflets. These components are …

Wednesday, Nov 24 **02:30 PM - 02:45 PM**

174 - Gd-TPP-DOTA reduces cell viability in cancer cells via synchrotron radiotherapy

Biomedicine, Life science & Food Science

Keith Bambery
Dr, ANSTO Australian Synchrotron

Ryan Middleton
Dr, ANSTO

High-Z elements have been proposed as radiosensitisers in X-ray photon radiotherapy due to their emission of multiple high-LET photo- and Auger electrons following X-ray irradiation. Gadolinium is a particularly attractive candidate radiosensitiser, since it can also be used as an MRI contrast agent. In this study, we report on the efficacy of Gd-triphenylphosphonium salt-DOTA (Gd(III)-TPP-DOTA) for synchrotron microbeam radiation therapy dose enhancement. The compound utilises the mitochondrial targeting moiety triphenylphosphonium (TPP) to accumulate Gd in the inner mitochondrial membrane. Experiments were conducted using the dynamic mode option at hutch 2B of the Imaging and Medical Beamline at the Australian Synchrotron. …

Wednesday, Nov 24 **02:45 PM - 03:00 PM**

112 - Micro-Computed Tomography (MCT) beamline at ANSTO/Australian Synchrotron: A progress report

Instruments & Techniques

Andrew Stevenson
Dr, ANSTO/Australian Synchrotron

Livia Salvati Manni
Dr, University of Sydney

The Micro-Computed Tomography (MCT) beamline is one of the first new beamlines to be constructed at the Australian Synchrotron as part of the BRIGHT program. MCT will complement the existing X-ray imaging/tomography capability provided by the Imaging and Medical Beamline (IMBL), and will target applications requiring higher (sub-micron) spatial resolution and involving smaller samples. MCT will be a bending-magnet beamline, operating in the 8 to 40 keV range, based on a double-multilayer monochromator. Filtered white and pink beams will also be available, the latter utilising a single-(vertical)bounce mirror. MCT will benefit from X-ray phase-contrast modalities (such as propagation-based, grating-based and …

Wednesday, Nov 24 **02:45 PM - 03:00 PM**

5 - Structural, Biochemical and Functional characterization of Salmonella BcfH: an unusual Dsb-like fimbrial protein

Biomedicine, Life science & Food Science

Keith Bambery
Dr, ANSTO Australian Synchrotron

Pramod Subedi
Dr, La Trobe Uni

Bacteria use folding enzymes to produce functional virulence factors. These foldases include the Dsb family of proteins, which catalyze a key step in the protein-folding pathway, the introduction of disulfide bonds. The Dsb oxidative system, which includes an oxidative DsbA/DsbB pathway and an isomerase DsbC/DsbD pathway, is present in numerous bacterial species. Conventionally, Dsb proteins have specific redox functions with monomeric and dimeric Dsbs exclusively catalyzing thiol oxidation and disulfide isomerization, respectively. This contrasts with the eukaryotic disulfide forming machinery where the modular thioredoxin protein PDI mediates thiol oxidation and disulfide reshuffling. In this study, we identified and structurally and ...

Wednesday, Nov 24 **03:30 PM - 03:50 PM**

54 - From deep time to the present: An exploration of Aboriginal connections to South Australia's Riverland region

Earth, Environment & Cultural Heritage

Amy Roberts
Prof, Flinders University

Tracy Rushmer
Professor, Macquarie University

This keynote address will explore a range of cultural heritage projects relating to collaborations between ANSTO, Flinders University and the River Murray and Mallee Aboriginal Corporation. From rare artefacts to earthen cooking mounds and ancient shell middens this presentation considers the contribution of radiocarbon dating within a broader research program that has investigated Aboriginal connections to Country from deep time to the present in South Australia's Riverland region.

Wednesday, Nov 24 **03:30 PM - 03:50 PM**

229 - Elucidating the Structures and Behaviour of Therapeutic Delivery Platforms with Non-interfering Techniques

Chemistry, Soft Matter & Crystallography

Anton Blencowe
Prof, UniSA

Karyn Jarvis
Dr., Swinburne University of Technology

Self-assembled polymeric delivery platforms based on colloidal aggregates have promise for the delivery of therapeutics and cells, and their morphology in solution strongly influences their behaviour in a biological context (e.g., cellular uptake). In turn, the composition and microstructure of the individual polymers play a defining role in their self-assembly and the morphology of the resulting colloidal aggregates. Observing the behaviour and precise morphology of these systems in solution using non-interfering techniques allows them to be studied in their native state. In this presentation, Anton will discuss the application of diffusion nuclear magnetic resonance spectroscopy and Synchrotron small-angle X-ray scattering ...

Wednesday, Nov 24 **03:30 PM - 03:50 PM**

187 - Good vibrations: phonons in topological thermoelectrics

Physics, Surface & Condensed Matter

David Cortie
University of Wollongong

Kirrily Rule
Dr, ACNS/ANSTO

Thermoelectric materials harness a temperature gradient to produce a voltage via the Seebeck effect, providing a way to harvest and recycle heat. Recently a new generation of thermoelectrics has been developed that offer unprecedented performance by leveraging topological physics. The key to their functionality is their robust high electronic conductivity in tandem with their low thermal conductivity. The latter can be engineered by controlling the lattice vibrations or “phonons”. Here I will discuss recent neutron spectroscopy experiments at the Australian Centre for Neutron Scattering, ANSTO, which offer unique insights into the differences between “good” optical and “bad” acoustic phonon vibrations …

Wednesday, Nov 24 **03:50 PM - 04:05 PM**

46 - The structure and spectroscopy of solid propanal: A potential mineral for planetary astrobiology

Earth, Environment & Cultural Heritage

Courtney Ennis
Dr, University of Otago

Tracy Rushmer
Professor, Macquarie University

Aldehydes are considered an important species toward astrobiology, acting as a primary reagent for the Strecker synthesis of amino acids in aqueous media. However, within the cold, icy surfaces of planetary bodies and interstellar dust particles, chemical reactions that lead to these biological-building blocks can still unfold. Here, "non-thermal equilibrium" chemistry is driven by harsh radiation environments, which produce populations of radicals and charged species in the icy matrix. It is these short-lived intermediates that then on-react with ammonia and cyanides to form of higher-order organics. For the possible detection of proteinogenic amino acids in space environments it is important …

Wednesday, Nov 24 **03:50 PM - 04:05 PM**

31 - Quantifying the robustness of neutron reflectometry for analysing polymer brush structure

Chemistry, Soft Matter & Crystallography

Andrew Nelson
Dr, ANSTO

Karyn Jarvis
Dr., Swinburne University of Technology

Surfaces covered with densely tethered polymer chains possess desirable properties and are ubiquitous in natural and human-made systems. These properties stem from the diffuse structure of these polymer brush interfaces; consequently, resolving their structure is key to designing systems with better performance. NR has been widely used for studying these systems as it is the only technique that can resolve the detailed structure of these films, the polymer volume fraction profile. However, the analysis of collected reflectometry data has significant challenges; inflexible models preclude viable structures and the uncertainty around accepted profiles (spread) is challenging to quantify. Furthermore, there is …

Wednesday, Nov 24 **03:50 PM - 04:05 PM**

166 - Characterization of MOSFET sensors for dosimetry in alpha particle therapy

Physics, Surface & Condensed Matter

Fang-Yi Su
Miss, Centre for Medical Radiation Physics, University of Wollongong

Kirrily Rule
Dr, ACNS/ANSTO

Alpha particle therapy, such as diffusing alpha-emitters radiation therapy (DaRT) and targeted alpha-particle therapy (TAT), exploits the short-range and high linear energy transfer (LET) of alpha particles to destroy cancer cells locally with minimal damage to surrounding healthy cells. Dosimetry for DaRT and TAT is challenging, as their radiation sources produce mixed radiation fields of ? particles, ? particles, and ? rays. There is currently no dosimeter for real-time in vivo dosimetry of DaRT or TAT. Metal-oxide-semiconductor field-effect transistors (MOSFETs) have features that are ideal for this scenario. Owing to their compactness, MOSFETs can fit into fine-gauge needle applicators, such …

Wednesday, Nov 24 **04:05 PM - 04:20 PM**

27 - Magnetic Ordering in Superconducting Sandwiches

Physics, Surface & Condensed Matter

Andrew Chan
Mr, The University of Auckland

Kirrily Rule
Dr, ACNS/ANSTO

Our cuprate-manganite 'superconducting sandwich' multilayers exhibit a highly unusual magnetic-field induced insulating-to-superconducting transition (IST), contrary to the commonly held understanding that magnetic fields are detrimental to superconductivity [1, 2]. This new behaviour is a result of the specific magnetic and electronic properties of the manganite coupling with the high-Tc cuprate ($YBa_2Cu_3O_{7-\delta}$, YBCO). Due to the specific manganite composition, $Nd_{0.65}(Ca_{0.7}Sr_{0.3})_{0.35}MnO_3$ (NCSMO), we hypothesize the behaviour to originate from CE-type antiferromagnetic ordering as well as charge and orbital ordering [3]. The magnetic data presented here will focus on polarized neutron reflectometry (PNR) and elastic neutron scattering on a YBCO-NCSMO trilayer and superlattice. …

Wednesday, Nov 24 **04:05 PM - 04:20 PM**

16 - Pioneer plant driven primary mineral weathering and secondary mineral formation in Fe ore tailings

Earth, Environment & Cultural Heritage

Songlin Wu
Dr, The University of Queensland

Tracy Rushmer
Professor, Macquarie University

Eco-engineering tailings into soil-like substrates is an emerging technology to rehabilitate the tailings landscapes. Pioneer plants play an important role in mineral weathering and secondary mineral formation, which are pre-requisites for aggregate formation and pedogenesis in the tailings. The present study aimed to characterise the direct role of pioneer plant roots in tailing mineral weathering and secondary mineral formation in a compartmented cultivation system [1]. It was found that root activities accelerated the weathering of Fe bearing primary minerals (e.g., biotite) via Fe(II) oxidation coupled with Fe(III) and Si dissolution. Numerous nanosized Fe-Si rich amorphous minerals and vermiculite were neo-formed …

Wednesday, Nov 24 **04:05 PM - 04:20 PM**

117 - Muti-Scale Dynamic Study on The Amphiphilic Nanostructure of Protic Ionic Liquids

Chemistry, Soft Matter & Crystallography

Karyn Jarvis
Dr., Swinburne University of Technology

Shurui Miao
Mr, The University of Sydney

Ionic liquids are a novel class of solvents with ultra-low vapour pressure and tunable liquid properties. Among them, protic ionic liquids (PILs) are particularly effective solvents for self-assembly of surfactants and lipids into micelles, vesicles, liquid crystals and microemulsions. This is exemplified by alkylammonium PILs, which are also cheap, easily prepared and can be readily deuterated. Over the past decade, much is learnt about the static structure of alkylammonium PILs, however, virtually nothing is known about their dynamics, both the single ion diffusion and the collective motion of clusters. This is due to the complex and disordered nature of liquid …

Wednesday, Nov 24 **04:20 PM - 04:35 PM**

71 - Neutron and synchrotron characterisation techniques for hydrogen fuel cell materials

Physics, Surface & Condensed Matter

Kirrily Rule
Dr, ACNS/ANSTO

Krystina Lamb
ANSTO

Hydrogen fuel cells and other renewable energy technologies have specific materials and functional needs which can be more fully understood using neutron and synchrotron characterisation techniques. In this presentation, a materials which has applications in proton exchange membranes is studied with a variety to techniques to develop a comprehensive understanding of the functional-structural relationship. The materials used here is phosphotungstic acid (HPWA) stabilised in an 'inert' mesoporous silica host material. This aim of this research is to develop an understanding of the interaction between the HPWA and the silica and whether different structures or surface chemistries have advantageous or detrimental …

Wednesday, Nov 24 **04:20 PM - 04:35 PM**

35 - Maximum flux: Using time-resolved neutron reflectometry to improve our understanding of surface-initiated polymerisation

Chemistry, Soft Matter & Crystallography

Isaac Gresham
Dr, The University of Sydney

Karyn Jarvis
Dr., Swinburne University of Technology

Polymer brushes are dense arrays of surface-tethered polymers that possess desirable qualities, such as lubricity and fouling resistance, provided that their structure and chemistry are correctly tuned [1]. Surface-initiated polymerisation (SIP) is the primary method for synthesising these brushes with the physicochemical properties required to imbue surfaces with the aforementioned qualities. However, previous work [2,3] indicates that polymers synthesised by SIP deviate from polymers produced via solution polymerisation, likely due to the proximity of initiators in the tethered case. This deviation is not well understood, which impedes the structural characterisation of the resulting brushes. As structure dictates behaviour [1], understanding …

Wednesday, Nov 24 **04:20 PM - 04:35 PM**

111 - Cuatros Amigos- the four stromatolites in a row. The first 3D image of the oldest evidence of life in the geologic record

Earth, Environment & Cultural Heritage

Michaela Dobson
Ms, The University of Auckland

Tracy Rushmer
Professor, Macquarie University

The 3.48 Ga Dresser Formation, Pilbara Craton, Western Australia provides the Earth's most convincing evidence of early life through a diverse array of biosignatures. However, identifying biosignatures in Archean rocks is difficult due to billions of years of erosion, deformation, and metamorphic alteration. Characterisation of community-accepted biosignatures also remains challenging, particularly the robustness of textural biosignatures as indicators of early life in Archean rocks. The textural biosignatures identified in the Dresser Formation are identified in surface outcrops that are weathered. Therefore, in May 2019, fresh Dresser deposits were drilled to aid in a better understanding of these ancient biosignatures and …

Wednesday, Nov 24 **04:35 PM - 04:50 PM**

57 - Towards fast dose calculations for novel radiotherapy treatments with generative adversarial networks

Physics, Surface & Condensed Matter

Florian Mentzel
Mr, TU Dortmund University

Kirrily Rule
Dr, ACNS/ANSTO

Existing approximations used in clinical treatment planning are either not fast or not accurate enough for some novel irradiation techniques like microbeam radiation therapy (MRT), which relies on arrays of sub-mm synchrotron-generated, polarized X-ray beams. We present studies using generative adversarial networks (GANs) to mimic full Monte Carlo simulations of radiation transport to achieve a compromise of fast and accurate dose computation for variable phantoms and irradiation scenarios. **Materials & Methods** To obtain a generalised model for the dose prediction a conditional GAN using a 3D-UNet architecture is developed. As proof of concept, we predict the simulated dose depositions of …

Wednesday, Nov 24 **04:35 PM - 04:50 PM**

199 - High-resolution high throughput thermal neutron tomographic imaging of fossiliferous cave breccias from Sumatra

Earth, Environment & Cultural Heritage

Holly Smith
Ms, Griffith University

Tracy Rushmer
Professor, Macquarie University

We employ high-throughput thermal-neutron tomographic imaging to visualise internal diagnostic features of dense fossiliferous breccia from three Pleistocene cave localities in Sumatra, Indonesia. We demonstrate that these seemingly homogeneous breccias are an excellent source of data to aid in determining taphonomic and depositional histories of complex depositional sites such as tropical caves. X-ray Computed Tomographic (CT) imaging is gaining importance amongst palaeontologists as a non-destructive approach to studying fossil remains. Traditional methods of fossil preparation risk damage to the specimen and may destroy contextual evidence in the surrounding matrix. CT imaging can reveal the internal composition and structure of fossils …

Wednesday, Nov 24 **04:50 PM - 05:05 PM**

160 - Characterisation of Ionic Liquids and Their Ability to Stabilise Proteins

Chemistry, Soft Matter & Crystallography

Karyn Jarvis
Dr., Swinburne University of Technology

Stuart Brown
Mr, RMIT

Proteins are an important part of biotechnology and can be utilised for a range of applications and industries1. But the stability and solubility of the protein is often a limiting factor, so ionic liquids (ILs) have been tested as an alternative solvent due to their wide scope and tailorable properties. They are reported to increase protein activity2, solubility, long term and thermal stability. However, the relationship between the structure of an IL and how it interacts with proteins in solution is unknown. In this study 52 ammonium based ILs and 14 common salts were prepared with HEWL and human lysozyme. …

Wednesday, Nov 24 **04:50 PM - 05:05 PM**

70 - Pressure-dependent changes in Zr coordination in silicate liquid: in vs. ex situ measurements

Earth, Environment & Cultural Heritage

Nicholas Farmer
Dr, Macquarie University/Australian Synchrotron

Tracy Rushmer
Professor, Macquarie University

Thursday, Nov 25 **09:00 AM - 10:15 AM**

Welcome Address: Day 2, UAC Research Award | Stephen Wilkins Medal

Update

Andrew Peele
Prof, ANSTO

Huanyu Jin
Dr. Mr., The University of Adelaide

Michael Jones
Dr, Queensland University of Technology

Thursday, Nov 25 **10:45 AM - 11:00 AM**

42 - Membrane permeabilisation is mediated by distinct epitopes in mouse and human orthologs of the necroptosis effector, MLKL

Biomedicine, Life science & Food Science

Chris Horne
Dr, WEHI

Nanette Schleich
Dr, University of Otago

Necroptosis is a lytic programmed cell death pathway with origins in innate immunity that is frequently dysregulated in inflammatory diseases. The terminal effector of the pathway, MLKL, is licensed to kill following phosphorylation of its pseudokinase domain by the upstream regulator, RIPK3 kinase. Phosphorylation provokes the unleashing of MLKL's N-terminal four-helix bundle (4HB or HeLo) domain, which binds and permeabilises the plasma membrane to cause cell death. The precise mechanism by which the 4HB domain permeabilises membranes, and how the mechanism differs between species, remains unclear. Here, we identify the membrane binding epitope of mouse MLKL using NMR spectroscopy. Using …

Thursday, Nov 25 **10:45 AM - 11:05 AM**

228 - Delivery of antimicrobials to bacteria by cubosome nanocarriers

Advanced Materials

Brendan Kennedy
Prof, The University of Sydney

Charlotte Conn
Dr, RMIT

Dyett, B.; Meikle, T.G.; Yu, H.; Strachan, J.B.; Lakic, B.; White, J.; Drummond, C.J. and Conn, C.E The increasing prevalence of antibiotic resistant bacteria, in part due to overuse and misuse of antibiotics over the past decades, is one of the key global health challenges. Some gram-negative strains have already been found to be resistant even to last resort antibiotics. This is partially due to their ability to hinder the transport of antimicrobials through their outer membrane structure. One proposed strategy to combat this issue is via the use of lipid nanocarriers as drug delivery vehicles. These nanocarriers are known …

Thursday, Nov 25 **10:45 AM - 11:00 AM**

131 - Small Angle Neutron Scattering Capability at ANSTO

Instruments & Techniques

Kathleen Wood
Dr, ANSTO

Norman Booth
Dr., ACNS

The ANSTO Lucas Heights campus is home to three world-class small angle neutron scattering (SANS) instruments: Bilby, a time-of-flight SANS instrument [1], Kookaburra, an Ultra-Small Angle Neutron scattering instrument [2] and Quokka, a monochromatic SANS instrument [3]. Together they cover the structure of materials from 1 nm to > 20 microns. As well as recent scientific highlights, we here outline the updates from the group since the last ANSTO user meeting, notably: - The replacement of our lab-based small angle X-ray instrument with a state-of-the-art instrument along with a range of dedicated sample environments, currently being procured and due for …

Thursday, Nov 25 **11:00 AM - 11:15 AM**

175 - New developments in neutron imaging at DINGO

Instruments & Techniques

Norman Booth
Dr., ACNS

Ulf Garbe
Dr, ACNS, Australian Nuclear Science and Technology

The neutron radiography / tomography / imaging instrument DINGO is operational since October 2014 to support research at ANSTO. DINGO provides a useful tool to give a different insight into objects. A major part of applications from research and industrial users was demanding high resolution setup and fast scans on DINGO. The neutron beam size can be adjusted to the sample size from 25 x 25 mm 2 to 200 x 200 mm 2 with a resulting pixel size from 12µm to ~100µm. Depending on the sample composition a full tomography has been taken in 10 minute – 36 hours. …

Thursday, Nov 25 **11:00 AM - 11:15 AM**

130 - Disulfide bond formation between T-cell receptor and peptide antigen lowers the threshold of T cell activation

Biomedicine, Life science & Food Science

Christopher Szeto
Dr, La Trobe University

Nanette Schleich
Dr, University of Otago

The immune system is vigilant in detecting foreign pathogens. Our cells present peptides (p), small fragments of proteins, atop Major Histocompatibility Complex (MHC) glycoproteins. These pMHC molecules are displayed on the cell's surface and monitored by T cells of the immune system that patrol the body. T cells use their specialized T cell receptors (TCRs) to recognize and bind to pMHCs, where the quality of binding influences T cell activation. Activated T cells are responsible for killing off infected cells and clearing infection. The contribution of individual parameters that dictate activation for this cell-to-cell TCR-pMHC interaction are unclear. However, a …

Thursday, Nov 25 **11:15 AM - 11:30 AM**

90 - A study of the intrinsic background from the Beryllium Filter Spectrometer on Taipan

Instruments & Techniques

Anton Stampfl
Dr, ANSTO

Norman Booth
Dr., ACNS

The Beryllium filter spectrometer on Taipan is a low-energy band-pass spectrometer that employs a number of materials to effectively scatter out neutrons of higher energies and transmit only neutrons in the energy range, ef=1.2±0.5 meV. Here in this study the spectrometer response is studied in order to understand and identify the inherent background from the spectrometer itself. Ambient air and nickel are used as scatterers in this study as the former gives a reasonable detection limit of the spectrometer and the latter gives enough scatter to observe the inelastic signal but not too much to swamp out the inherent signal …

Thursday, Nov 25 **11:15 AM - 11:30 AM**

58 - A Comparison of Different Approaches to Image Quality Assessment in Phase-Contrast Mammography

Biomedicine, Life science & Food Science

Jesse Reynolds
Mr, Canterbury University

Nanette Schleich
Dr, University of Otago

Propagation-based phase-contrast computed tomography (PB-CT) has the potential to improve breast cancer detection and characterisation compared to established mammography techniques. The aim of this work is to find a quantitative image quality metric which could accurately predict the subjective clinical image quality assessment of PB-CT images made by radiologists as described in Taba et al. [1]. The experimental data analysed in this study included PB-CT scans, which were obtained for 12 full intact mastectomy samples at Imaging and Medical beamline (IMBL) of the Australian Synchrotron at different monochromatic X-ray energies and clinically relevant radiation doses. Quantitative image quality metrics including …

Thursday, Nov 25 **11:20 AM - 11:35 AM**

8 - Shape of nanopores in track-etched polycarbonate membranes

Advanced Materials

Brendan Kennedy
Prof, The University of Sydney

Shankar Dutt
Mr, Australian National University

Small angle X-ray scattering (SAXS) has been used over the past decade for characterizing track etched nanopores in a variety of organic and inorganic materials. In the present study, synchrotron based SAXS was used to study the morphology and size variation of the nanopores in polycarbonate (PC) as a function of the etching time and ion fluence. The shape of the nanopores fabricated through track-etch technology was found to be consistent with cylindrical pores with ends tapering off towards the two polymer surfaces in the last ~1.6 ?m. The tapered structure of the nanopores in track-etched PC membranes was first …

Thursday, Nov 25 **11:30 AM - 11:45 AM**

29 - BioSAXS: The future of solution scattering at the Australian Synchrotron

Instruments & Techniques

Christina Kamma-Lorger
Dr, Australian Synchrotron ANSTO

Norman Booth
Dr., ACNS

BioSAXS is one of the new beamlines to be constructed at the Australian Synchrotron within the BRIGHT program. The beamline is currently under construction and it is scheduled to phase into user operations in mid-late 2022. BioSAXS will be a high-flux (~5 x 1014 ph/sec) small angle X-ray scattering beamline dedicated to all sorts of solution scattering including dispersions, gels and soft matter, covering a variety of disciplines from biology to chemistry and material sciences. The high flux of the beamline will provide enhanced data quality and kinetic resolution, allowing for time-resolved studies on the millisecond timescale, as well as …

Thursday, Nov 25 **11:30 AM - 11:45 AM**

176 - Human MLKL is maintained by RIPK3 in an inactive conformation prior to disengagement and cell death by necroptosis

Biomedicine, Life science & Food Science

Nanette Schleich
Dr, University of Otago

Yanxiang Meng
PhD student, Walter and Eliza Hall Institute for Medical Research

Necroptosis is a caspase-independent form of programmed cell death that results in the compromise of plasma membranes and release of inflammatory cellular contents. Dysregulated necroptosis has been shown to play a role in a range of different human pathologies, including ischemia-reperfusion injury, inflammatory diseases, and inflammatory bowel disease. Phosphorylation of MLKL by the RIPK3 kinase leads to MLKL oligomerization, translocation to, and permeabilization of, the plasma membrane to induce necroptotic cell death. The precise choreography of MLKL activation remains incompletely understood. Here, we used Monobodies, synthetic binding proteins, that bind the pseudokinase domain of MLKL to detect endogenous protein interactions …

Thursday, Nov 25 **11:35 AM - 11:50 AM**

185 - Application of Inelastic Neutron Scattering for Thermoelectric Materials Study

Advanced Materials

Brendan Kennedy
Prof, The University of Sydney

Dehong Yu
Dr, ANSTO

Research on thermoelectric (TE) materials have been an active field for the past decade as TE material can potentially be used in many niche areas such as to power space probe and convert waste-heat into electricity. Continuing developments are undergoing in the search for advanced TE materials that could play significant role in sustainable technology. One of the strategies in improving the performance of a thermoelectric material is to decrease the thermal conductivity, which is directly related to the lattice dynamics of the materials. Measurement of phonon density of states and phonon dispersion as a function of temperature can provide …

Thursday, Nov 25 **11:45 AM - 12:00 PM**

109 - ACNS SAMPLE ENVIRONMENT UPDATE

Instruments & Techniques

Norman Booth
Dr., ACNS

Rachel White
Dr, ANSTO

Since the last ANSTO User Meeting the sample environment group at ACNS has supported our facility users with a range of unique developments and set ups. We have had a change in structure with the laboratory group forming and working alongside us. We will report on the progress on our ongoing projects on Direct Laser Melting (DLM) deposition system co-funded by a NSW RAAP grant. Also underway are LIEF grants with equipment for use at ACNS, one includes a rheometer for use on ACNS beam instruments. This presentation will also cover our new equipment projects funded by the NCRIS RIIP …

Thursday, Nov 25 **11:45 AM - 12:00 PM**

163 - The silver bullet: using silver doped lanthanum manganite to selectively target deadly brain cancer

Biomedicine, Life science & Food Science

Abass Khochaiche
Mr, University of Wollongong

Nanette Schleich
Dr, University of Otago

Treatment of deadly cancers that are deep-seated within sensitive healthy tissue is limited to adequate targeting strategies. More specifically, brain and central nervous system cancers can be the most aggressive, have higher mortality rates and lower accessibility to chemotherapeutic drugs. This study introduces the first in-depth analysis doped lanthanum manganite (LAGMO) nanoparticles (NPs) as a brain cancer selective chemotherapeutic and radiation dose enhancer **Method** The magnetic, chemical and biological properties of LAGMO NPs at silver dopant levels of 0-10% were investigated. Magnetic and chemical phases of LAGMO NPs were analysed with neutron diffraction using the ECHIDNA High-Resolution Powder Diffractometer. Biocompatibility …

Thursday, Nov 25 **11:50 AM - 12:05 PM**

44 - Origin of vertical slab orientation in blade-coated layered hybrid perovskite films revealed with in-situ synchrotron X-ray scattering

Advanced Materials

Brendan Kennedy
Prof, The University of Sydney

Wen Liang Tan
Dr., MONASH UNIVERSITY

Controlling the vertical orientation of perovskite slabs in layered hybrid perovskite films is key for enabling further optimization of photovoltaic device performance. However, the mechanism explaining vertical orientation control in such films remains under debate. Here, we present an in-situ grazing-incidence wide-angle X-ray scattering (GIWAXS) study on the formation of BA2MAn-1Pbnl3n+1 perovskite films during blade-coating where BA, MA and n denote butylammonium, methylammonium and thickness of perovskite slabs. The evolution of grazing-incidence transmission wide-angle X-ray scattering (GTWAXS) signal is also monitored to reveal the specific vertically-oriented low-n phases formed in such films. We find that the blade-coating temperature greatly influences …

Thursday, Nov 25 **12:00 PM - 12:15 PM**

205 - Determining the role of protein aggregation in COVID-19

Biomedicine, Life science & Food Science

Nanette Schleich
Dr, University of Otago

Nick Reynolds
Dr, La Trobe University

COVID-19 is primarily known as a respiratory disease caused by the virus SARS-CoV-2. However, neurological symptoms such as memory loss, sensory confusion, cognitive and psychiatric issues, severe headaches, and even stroke are reported in as many as 30 % of cases and can persist even after the infection is over (so-called 'long COVID'). These neurological symptoms are thought to be caused by brain inflammation and toxicity, triggered by the virus infecting the central nervous system of COVID-19 patients, however we still don't understand the molecular mechanisms underpinning this neurotoxicity. The neurological effects of COVID-19 share many similarities to neurodegenerative diseases …

Thursday, Nov 25 **12:00 PM - 12:15 PM**

152 - High-Resolution Macro ATR-FTIR Chemical Imaging Capability at Australian Synchrotron Infrared Microspectroscopy (IRM) Beamline

Instruments & Techniques

Jitraporn (Pimm) Vongsvivut
Dr, ANSTO

Norman Booth
Dr., ACNS

This presentation aims to provide a summary on technical aspects and applications of our synchrotron macro ATR-FTIR microspectroscopy, unique to the Infrared Microspectroscopy (IRM) beamline at ANSTO–Australian Synchrotron.1 The device was developed by modifying the cantilever arm of a standard macro-ATR unit to accept Ge-ATR elements. Coupling synchrotron-IR beam to the Ge-ATR element (n=4), reduces the beam focus size by a factor of 4 (improving lateral resolution), and the mapping step size by 4 times relative to the stage step motion. As a result, the macro ATR-FTIR measurement at our IRM beamline can be performed at minimum projected aperture (sampling …

Thursday, Nov 25 **12:05 PM - 12:20 PM**

147 - **New Time**Chemical expansion and proton conductivity in vanadium-substituted variants of γ-Ba4Nb2O9

Advanced Materials

Alex Brown
Mr, The University of Sydney

Brendan Kennedy
Prof, The University of Sydney

Complex perovskite derived oxides are an important emerging class of ionic conducting materials with potential applications in energy technologies including fuel cells, batteries, and separation membranes. The high temperature phase γ-Ba4Nb2O9 is one such complex oxide which shows proton and oxide ionic conduction. Recently we have shown that two new compositional series with the previously unique γ-Ba4Nb2O9 type structure, γ-Ba4VxTa2-xO9 and γ-Ba4VxNb2-xO9 (x = 0-2/3),can form [1]. Undoped Ba4Ta2O9 forms a 6H-perovskite type phase, but with sufficient V doping the γ-type phase is thermodynamically preferred and possibly more stable than γ-Ba4Nb2O9, forming at a 200 °C lower synthesis temperature. This …

Thursday, Nov 25 **01:30 PM - 01:50 PM**

45 - Scattering or spectroscopy? Both!

Physics, Surface & Condensed Matter

Chris Mcneill
Prof, Monash University

Richard Mole
Dr, ANSTO

In this presentation I will discuss the development of resonant tender X-ray diffraction to study the molecular packing of semiconducting polymers. Semiconducting polymers are being developed for application in a wide range of optoelectronic devices including solar cells, LED and transistors. Being polymeric materials they offer advantages over traditional semiconductors including ease of processing and mechanical flexibility. Most semiconducting polymers are semicrystalline, with the way in which polymer chains pack strongly affecting their optoelectronic performance. Unlike small molecule crystals whose structure can be directly solved using crystallographic methods, semiconducting polymers are more disordered meaning that there are not enough diffraction …

Thursday, Nov 25 **01:30 PM - 01:50 PM**

28 - Use of high-resolution technologies to understand the broken past

Earth, Environment & Cultural Heritage

Emily Finch
Australian Synchrotron

Ingrid Ward
Dr, Uni of Western Australia

Our understanding of material culture and past environmental contexts have been utterly transformed over the last two decades by new and greatly improved scientific methods. Innovative investigations revolve around refinement of methods for chronological dating, characterization and provenancing, bioarchaeology, geoarchaeology and the emerging sub-discipline of cyber-archaeology. As ever, when dealing with the past, 'meaning' remains more difficult and we are always be limited by what little we can know. With the help of multi-scalar, high-resolution techniques, there at least exists potential for useful and even groundbreaking information to be retrieved from material culture, the absence of which might inhere a …

Thursday, Nov 25 **01:45 PM - 02:00 PM**

212 - Application of Synchotron XFM and IRM to Study Plant - Pathogen Interactions

Biomedicine, Life science & Food Science

Courtney Ennis
Dr, University of Otago

Mark John Hackett
Curtin Univeristy

Thursday, Nov 25 **01:50 PM - 02:05 PM**

7 - Wavefield Characterisation of MHz XFEL Pulse Trains

Physics, Surface & Condensed Matter

Richard Mole
Dr, ANSTO

Trey Guest
Mr, La Trobe University

X-ray Free Electron Laser (XFEL) light sources present new opportunities in the imaging of single particles and biomolecules. The interpretation and analysis of XFEL imaging data depends critically on a fundamental understanding of the characteristics of the inherently stochastic XFEL pulses delivered to the instrument. Exploiting the unique MHz repetition rate of the European XFEL to image single particles requires an improved understanding of both the inter- and intra-train fluctuations in pulse structure and beam pointing, which are frequently implicated in the loss of information in XFEL single particle imaging (SPI) and other classes of coherent diffraction experiment. Failure to …

Thursday, Nov 25 **01:50 PM - 02:05 PM**

125 - Leaving a mark on forensic science: Using synchrotron microscopy and spectroscopy to explore fingermark chemistry

Earth, Environment & Cultural Heritage

Emily Finch
Australian Synchrotron

Rhiannon Boseley
Miss, Curtin University

Fingermarks are an important tool in forensic investigations however, a large number are not successfully recovered and are never used as evidence.(1) A significant challenge in their detection is the chemical variability of fingermark deposits. This research aims to answer important questions in fingermark chemistry using synchrotron sourced analysis including x-ray fluorescence microscopy (XFM), infrared microspectroscopy (IRM) and THz-Far infrared (Far-IR) spectroscopy to deepen the understanding of fingermark residue and improve recovery methods. First, what is the chemical composition of a fingermark? We explored the distribution of inorganic material using XFM to discriminate between the endogenous and exogenous metals present …

Thursday, Nov 25 **02:00 PM - 02:15 PM**

60 - Jaws caught on the IMBL

Biomedicine, Life science & Food Science

Courtney Ennis
Dr, University of Otago

Daniel Hausermann
Dr, ANSTO

Maturational changes in feeding behaviour among sharks are associated with increased mineralisation of the teeth and jaws, but this relationship has only been demonstrated in a few species. Large, highly mobile shark species are rarely available for detailed anatomical study, despite their importance for ecological health and widespread interest among the general population. We examined the crania, jaws, and teeth of two great white sharks (Carcharodon carcharias), a 2.3 m juvenile and a 3.2 m young adult. The CT scans used a 230 keV (mean energy) polychromatic beam from the 4 Tesla wiggler, with a filtration of 6mmAl, 6mmCu, 3mmMo …

Thursday, Nov 25 **02:05 PM - 02:20 PM**

182 - Verification of L-alanine single-crystallinity for anisotropic synchrotron terahertz measurements

Physics, Surface & Condensed Matter

Jackson Allen
Mr, University of Wollongong/ANSTO

Richard Mole
Dr, ANSTO

One way to probe the molecular interactions of a material is by using terahertz (THz) spectroscopy, which has been used to study L-alanine in detail [1]. However, isotropic THz spectroscopy has limitations in identifying the origin of vibrational modes since the direction of the associated dipole moment is random in an isotropic THz measurement. Therefore, there is a benefit to performing anisotropic (polarised) THz measurements. This work represents the first anisotropic measurements performed on L-alanine, the simplest chiral amino acid, and one of the earliest amino acids fundamental to early life on Earth [2]. An appropriate sample for anisotropic measurements …

Thursday, Nov 25 **02:05 PM - 02:20 PM**

51 - Understanding the generation and evolution of reaction-induced porosity in the replacement of calcite by gypsum: A combined microscopy, X-ray micro-tomography, and USANS/SANS study

Earth, Environment & Cultural Heritage

Emily Finch
Australian Synchrotron

Muhammet Kartal
Mr, Murdoch University

Fluid-mediated mineral replacement reactions are common in natural systems and are essential for geological and engineering processes. In these reactions, a primary mineral is replaced by a product mineral via a mechanism called coupled dissolution-reprecipitation. This mechanism leads to the preservation of the shape of the primary mineral into the product mineral. The product mineral includes reaction-induced porosity contributing to enhanced permeability, which is crucial for the replacement reaction to progress from the surface to the core of the primary mineral grain. These reaction-induced pores are complex in size, shape and connectivity, and can evolve with time. However, the mechanisms …

Thursday, Nov 25 **02:50 PM - 05:30 PM**

ANBUG Award Presentations (Technical, Student, Neutron, Young Scientist, Career) & Poster Slam

Andrew Clulow
Dr, ANSTO Australian Synchrotron

Elliot Gilbert

Gemeng Liang

Leonie Van 'T Hag
Dr, Monash University

Norman Booth
Dr., ACNS

Trevor Finlayson
Dr, The University of Melbourne

Yun Liu
Professor, The Australian National University

Thursday, Nov 25 **05:30 PM - 08:30 PM**

Poster Session (Will be hosted in SpatialChat)

Friday, Nov 26 **09:00 AM - 10:15 AM**

Welcome Day 3 and Plenary: Accelerating Australia: Perspectives on future particle accelerators and their applications

Marta Krasowska
Associate Professor, Fii, UniSA

Suzie Sheehy
Dr, University of Melbourne

There are over 50,000 particle accelerators in the world used for everything from treating cancer to finding out the secrets of the Universe. Australia has a long history in this area and excels in accelerator-based science: nowhere is this clearer than in the science carried out at our world-class infrastructure. That said, we have barely scratched the surface of what might be possible with beams of ions or electrons. Potential uses of particle beams are growing every day – from mining to archaeology to high-tech factories – enabled by breakthroughs in accelerator science and technology. In light of this, a …

Friday, Nov 26 **10:45 AM - 11:00 AM**

211 - Synchrotron CT dosimetry at the IMBL for low wiggler magnetic field strength and spatial modulation with bow tie filters

Biomedicine, Life science & Food Science

Ryan Middleton
Dr, ANSTO

Stewart Midgley
Dr, canberra hospital

Synchrotron CT dose reduction was investigated for the IMBL wiggler source operated at lower magnetic field strength and for beam modulation with spatial filters placed upstream from the sample. Beam quality at 25-30 keV for 1.4-3.0 T was assessed using transmission measurements with copper to quantify the influence of third harmonic radiation. The low energy operational limit is 24-28 keV for 0.1-1% transmission by added filters, 2 mm path length through silicon and 25 m of air. The upper limit is near 80 keV for wiggler field 1.4 T, approximately 100 keV for 2.0 T and extend beyond 100 keV …

Friday, Nov 26 **10:45 AM - 11:05 AM**

186 - Molecular binding and exchange between model membranes and biologically relevant lipid assemblies

Chemistry, Soft Matter & Crystallography

Marite Cardenas
Prof, Malmo University and Nanyang Technological University

Tamim Darwish

Model cellular membranes are often used to understand the interactions with biomolecules and nanoparticles[1], but the effects of such interactions go beyond molecular binding and include processes such as biomembrane restructuring and molecular exchange that may lead to changes in the structure and composition of the interacting nanoparticles. Here I will present our most recent work aiming at increasing the understanding of the role of biomembrane structure and composition on the function of lipoproteins. Lipoproteins are nanoemulsion-like particles composed of fats and proteins (apolipoproteins).[2] The complexity of lipoproteins is great,with different amounts and types of fats and proteins. We use …

Friday, Nov 26 **11:00 AM - 11:15 AM**

177 - Magnetically-guided particle delivery to airway surfaces for cystic fibrosis gene therapy: Synchrotron-based visualisation and optimisation for improved in vivo lentiviral gene transfer

Biomedicine, Life science & Food Science

Martin Donnelley
Senior Research Fellow, University of Adelaide

Ryan Middleton
Dr, ANSTO

Gene vectors to treat cystic fibrosis lung disease should be targeted to the conducting airways, as peripheral lung transduction does not offer therapeutic benefit. Viral transduction efficiency is directly related to the vector residence time. However, delivered fluids such as gene vectors naturally spread to the alveoli during inspiration. Extending gene vector residence time within the conducting airways is important, but hard to achieve. Gene vector conjugated magnetic particles that can be guided to the conducting airway surfaces could improve targeting. Due to the challenges of in vivo visualisation, the behaviour of small magnetic particles on the airway surface in …

Friday, Nov 26 **11:05 AM - 11:20 AM**

76 - Tomographic X-ray phase and attenuation extraction for a sample composed of unknown materials

Instruments & Techniques

Andrew Nelson
Dr, ANSTO

Samantha Alloo
Miss, School of Physical and Chemical Sciences, University of Canterbury, Christchurch, New Zealand

Propagation-based phase-contrast X-ray imaging (PB-PCXI) is a technique suitable for imaging weakly-attenuating objects, e.g., biological samples, as it utilizes both attenuation and refraction effects. Such effects are material dependent, and described by the X-ray's complex refractive index $n=1-\delta+i\beta$, where β and δ describe attenuation, and refraction, respectively. Phase retrieval algorithms are typically applied to PB-PCXI images to recover lost phase information. A single-material reconstruction, based on the transport-of-intensity equation, has been published by Paganin et al. [1] and has proven useful in diverse fields. This approach has been extended to consider multi-material objects [2], and partially-coherent X-ray sources [3]. The …

Friday, Nov 26 **11:05 AM - 11:20 AM**

56 - High viscosity injector effects on the phase behaviour of lipidic cubic phase

Chemistry, Soft Matter & Crystallography

Daniel Wells
Dr, La Trobe University

Tamim Darwish

In serial crystallography of membrane protein crystals, high-viscosity flow injectors deliver micron-sized crystals to the x-ray beam. The protein crystals are often injected embedded in the lipidic cubic phase (LCP) media, monoolein (MO), in which they were grown. The self-assembled structure of this media is easily impacted by the performance of the injector, e.g. pressure and gas flow surround the sample injection. However, it is not yet well understood how the continuous injection impacts the phase of the monoolein and how this influences the sample stream stability. In the present work, we report on observations of the structure of MO/water …

Friday, Nov 26 **11:15 AM - 11:30 AM**

74 - Biochemical Interaction of Few Layer Black Phosphorus with Microbial Cells Using Synchrotron macro- ATR-FTIR

Biomedicine, Life science & Food Science

Ryan Middleton
Dr, ANSTO

Zo Shaw
Mx, RMIT University

In the fight against drug resistant pathogenic bacterial and fungal cells, low dimensional materials have been shown as a promising form of alternative treatment method. Specifically, few-layer black phosphorus (BP) has demonstrated its effectiveness against a wide range of pathogenic bacteria and fungal cells. In this work, the complex biochemical interaction of BP with a series of microbial cells is investigated to provide a greater understanding of the antimicrobial mechanism. Synchrotron macro-attenuated total reflection–Fourier transform infrared (ATR-FTIR) spectroscopy is used to elucidate the chemical changes occurring outside and within the cell of interested after exposure to BP nanoflakes. The ATR-FTIR …

Friday, Nov 26 **11:20 AM - 11:35 AM**

81 - Self-assembly of surfactants in protic ionic liquids

Chemistry, Soft Matter & Crystallography

Sachini Kadaoluwa Pathirannahalage
Ms, RMIT University

Tamim Darwish

Protic ionic liquids (PILs) are the largest known solvent class capable of promoting surfactant self-assembly. However, PILs are increasingly used as mixtures with molecular solvents, such as water, to reduce their cost, viscosity and melting point, and the self-assembly promoting properties of these mixtures are largely unknown. Here we investigated the critical micelle concentration (CMC) of ionic and non-ionic amphiphiles in two ionic liquids, ethylammonium nitrate (EAN) and ethanolammonium nitrate (EtAN), to gain insight into the role of solvent species, and effect of solvent ionicity on the self-assembly process. The amphiphiles used were the cationic cetyltrimethylammonium bromide (CTAB), anionic sodium …

Friday, Nov 26 **11:20 AM - 11:35 AM**

30 - High speed free-run ptychography at the Australian Synchrotron

Instruments & Techniques

Andrew Nelson
Dr, ANSTO

Cameron Kewish
Dr, ANSTO

The Australian Synchrotron X-ray Fluorescence Microscopy (XFM) beamline has recently implemented fast-scanning ptychography, a scanning X-ray diffraction microscopy method. Ptychography creates super-resolution images from transmitted microdiffraction patterns acquired as the sample is scanned through the beam. High-speed detectors and high-performance computers are required to iteratively reconstruct these complex images. The experimental methods and reconstruction algorithms have significantly evolved over the last decade and a half into a mature and user-friendly complementary imaging method to XFM. Here we present the implementation of high speed ptychography at the XFM beamline, which includes a free-run data collection mode where detector dead time is …

Friday, Nov 26 **11:30 AM - 11:45 AM**

37 - Using X-ray crystallography to understand bushfire-induced seed germination

Biomedicine, Life science & Food Science

Ryan Middleton
Dr, ANSTO

Sabrina Davies
Miss, The University of Western Australia

Passing the site of a bushfire a couple of weeks after it has burnt itself out, you may notice a mass seed germination event taking place, allowing the bush to completely come back to life. This fascinating phenomenon occurs due to compounds in bushfire smoke called karrikins, which act as triggers for seed germination. Although we know this process occurs, we don't understand how karrikins interact with seeds or seedlings, and what the little molecular machines – known as proteins – inside individual cells do to allow a seed to germinate. X-ray crystallography is a technique where the atomic structure …

Friday, Nov 26 **11:35 AM - 11:50 AM**

91 - Deuterated Phospholipids to Study the Structure, Function and Dynamics of Membrane Proteins Using Neutron Scattering

Chemistry, Soft Matter & Crystallography

Nageshwar Rao Yepuri
Dr, ANSTO

Tamim Darwish

Contrast matching and contrast variation in neutron scattering provide unparalleled power for understanding the structure, function, and dynamics of a selected component in a multicomponent system. A sophisticated contrast study often requires the availability of deuterated molecules in which deuterium atoms are introduced in a predictable and controlled fashion to replace protons. This can be achieved by direct deuteration of precursors followed by custom chemical synthesis, for which expertise and capabilities have been developed at facility (NDF), ANSTO. It this paper we will discuss recent high impact research output using deuterated phospholipids produced by NDF/ANSTO. We will describe the synthesis …

Friday, Nov 26 **11:35 AM - 11:50 AM**

110 - Medium Energy Spectroscopy (MEX) - Sample environments and supporting infrastructure

Instruments & Techniques

Andrew Nelson
Dr, ANSTO

Krystina Lamb
ANSTO

The Medium Energy Spectroscopy (MEX) beamline aims to facilitate a wide variety of ex- and in-situ experimental work from a variety of research areas. As such, we will provide a number of sample environments as standard set-up, in addition to ancillary equipment that can be used with custom or BYO sample environments. Sample environments will likely include; room temperature cell, electrochemical flow cell, micro-fluidic cell, flammable gas cell, furnace with gas environments,and a battery testing cell. In addition, supporting infrastructure and ancillary equipment will likely include; flammable and toxic gas handling (flow and pressure control), gas and vapor ventilation, electrochemical …

Friday, Nov 26 **11:45 AM - 12:00 PM**

154 - Regional lung volume measures in small animal models from single projection X-ray images

Biomedicine, Life science & Food Science

Dylan O'connell
Mr, Monash University

Ryan Middleton
Dr, ANSTO

Regional Lung volume is a key parameter in assessing lung function and health. Computed Tomography (CT) is considered the gold standard for measuring lung volume; however, it requires a relatively high radiation dose and typically has associated lower spatial and temporal resolution than X-ray projection imaging. In this work, we investigate whether regional lung volumes can be determined using 2D X-ray projections. The idea is that as the lung inflates with air, the attenuating tissue is displaced leading to a localised increase in X-ray intensity. We imaged 13 New Zealand white rabbit kittens using high-resolution X-ray imaging and CT at …

Friday, Nov 26 **11:50 AM - 12:05 PM**

34 - **New Time**Hot Commissioning and First User Experiments on the Spatz Neutron Reflectometer

Instruments & Techniques

Andrew Nelson
Dr, ANSTO

Anton Le Brun
Dr, ANSTO

The Spatz neutron beam instrument is the latest to be installed and commissioned in the Neutron Guide Hall at the 20 MW OPAL Research Reactor. Spatz is a time-of-flight neutron reflectometer used for studying nanoscale structures at surfaces and interfaces and utilises a vertical sample geometry / horizontal scattering geometry. The instrument is situated at the end position of the CG2B neutron guide and views the cold-neutron source (CNS). The disc chopper cascade that pulses the neutron beam to produce the time-of-flight is very configurable to provide a wavelength resolution between 1 to 12 %. The detector is a helium-3 …

Friday, Nov 26 **11:50 AM - 12:05 PM**

138 - Investigating the interactions of monoolein liquid crystals with human microbiomes

Chemistry, Soft Matter & Crystallography

Jonathan Caukwell
The University of Newcastle

Tamim Darwish

Lipid-based liquid-crystals are biocompatible nanomaterials offering selective and ‘smart’ drug-release properties which are an emerging technology in the research and development pipeline. Over the last decade, research on these nanomaterials has focused on their behaviour in response to physicochemical phenomena and after loading with pharmaceutical cargo. Over the next decade, research aims to address our lack of understanding about how these prospective drug-carriers are influenced by physiological environments. This study explored members of the human microbiome as a potential candidate. Bacterial species which inhabit popular sites of drug administration were mixed with monoolein cubosomes and bulk cubic phase gels. The …

Friday, Nov 26 **11:50 AM - 12:05 PM**

80 - Medium Energy Spectroscopy (MEX) - Opportunities for Microspectroscopy - CANCELLED

Instruments & Techniques

Simon James
Dr, ANSTO

Simon Pocock
ANSTO

The medium energy range offers unique opportunities for synchrotron-based X-ray absorption spectroscopy across the sciences. In particular, the K-absorption edges of alkali and alkali earth elements, e.g. K and Ca, s-group elements, e.g. S, P and Se, along with d-block elements, e.g. Mn, Fe, Cu all fall within this energy range. As do various L- and M-edges for heavier elements, e.g. Pb and U. The nascent Medium Energy X-ray Spectroscopy (MEX) beamlines will access these edges and offer unique opportunities to study the local structure, speciation, and chemistry of compounds and systems critical to biological, environmental, geological and industrial processes. …

Friday, Nov 26 **12:00 PM - 12:15 PM**

201 - Sub cellular scale mapping of deuterated compounds by nanoSIMS

Biomedicine, Life science & Food Science

Jeremy Bougoure
Dr, The University of Western Australia

Ryan Middleton
Dr, ANSTO

High resolution imaging mass spectrometry by nanoSIMS (nano scale secondary ion mass spectrometry) is a valuable method to observe deuterium accumulation in any number of sample types. NanoSIMS analysis is a high resolution isotope and elemental imaging technique for solid sample surfaces, allows for spatial resolution as low as 50nm and has high sensitivity which makes it an ideal method for observing deuterium accumulation in sub cellular features of any number of sample types. The nanoSIMS method allows for simultaneous analysis of up to seven ion species, meaning there is capacity to pair deuterium analysis with other elemental or isotopic …

Friday, Nov 26 **12:05 PM - 12:20 PM**

149 - How Do Ion Specific Effects Operate in Ionic Liquids?

Chemistry, Soft Matter & Crystallography

Joshua Marlow
Dr, The University of Sydney

Tamim Darwish

Recent work has found that the identity of a surfactant's counter-ion can affect the critical micelle concentration, and the size and shape of resultant micelles in ionic liquid (IL) and choline-based deep eutectic solvents.[1,2] This indicates the presence of ion specific effects for micellisation in these neoteric solvents despite their high ionic strength.[3] This project examines this phenomenon further, by investigating a range of choline salts (chloride, bromide, and nitrate) in different nitrate-based ILs (ethylammonium, propylammonium, and ethanolammonium nitrate) *via* measurements taken on the Small Angle Neutron Diffractometer for Amorphous and Liquid Samples (SANDALS) beamline at ISIS. These results bring …

Friday, Nov 26 **12:50 PM - 01:30 PM**

Platform Update: Centre for Accelerator Science | Australian Synchrotron

Ceri Brenner
Dr, ANSTO Centre for Accelerator Science

Michael James
Prof, ANSTO

Discovery and innovation tools at ANSTO Centre for Accelerator Science At the Centre for Accelerator Science (CAS) we support research and industry communities to explore the past, understand the present, and design for the future with our collection of ultra-sensitive analysis and precision irradiation beamlines. We use ion beam accelerators for a suite of isotope dating techniques, trace-element analysis and depth-profile mapping, dopant and defect surface engineering, and radiation exposure and damage. From environment modelling to space technology qualification, data and knowledge coming from CAS has an impact on many of the science and research priority areas.Our accelerator science instrumentation …

Friday, Nov 26 **01:30 PM - 01:50 PM**

230 - Scattering investigation and structure evolution of hydrogel-forming polymers for extrusion printing

Chemistry, Soft Matter & Crystallography

Kathleen Wood
Dr, ANSTO

Namita Roy Choudhury
Prof, RMIT University

Understanding the structure formation induced by specific fabrication method is crucial due to the complex interplay between their microstructure and the imposed deformation during fabrication. In this talk, we will focus on extrusion based printing, where 3D structures are created through continuously depositing material layer-upon-layer. Consequently, both polymer rheology and the gel formation mechanism are important; Temporal control of gelation is crucial to avoid premature gelation of the polymer solution while it is still in the printer. To investigate 3D printability, extensive steady shear and oscillatory rheology studies of polymer solutions have been reported earlier. However, simultaneous structure characterization under …

Friday, Nov 26 **01:30 PM - 01:50 PM**

47 - Studying Polysaccharides in Solution with SAXS and Molecular Dynamics

Biomedicine, Life science & Food Science

Liliana De Campo
Dr, ANSTO

Martin (Bill) Williams
Prof, Massey University

Polysaccharides are semi-flexible polymers composed of sugar residues with a myriad of important functions in-vivo, including structural support, energy storage and immunogenicity. The local conformation of such chains is a crucial factor governing their interactions. Traditionally this conformation has only been directly accessible in the solid-state, using crystallographic techniques such as fibre diffraction. However, improvements in the quality of synchrotron-based X-ray scattering data means that conformation-dependent features can now be measured in solution. In tandem, scattering predictions based on structures initiated from existing fibre x-ray diffraction data, and then re-animated using molecular dynamics, can now be performed. Our group has …

Friday, Nov 26 **01:30 PM - 01:45 PM**

132 - The recent progress of polarized neutron scattering techniques at SIKA

Instruments & Techniques

Dehong Yu
Dr, ANSTO

Shinichiro Yano
Dr, NSRRC

SIKA, the cold-neutron triple-axis spectrometer is on the CG4 beam port at the OPAL reactor, ACNS, ANSTO. We have reported the capabilities and status of SIKA in the last several user's meetings. In this meeting, we discuss the recent development of polarized neutron scattering experiments on SIKA. A 3He polarization analysis system is available for SIKA. We have performed several user experiments and commissioning experiments in the last two years. We would like to present some results by introducing the techniques we are trying to implement. In addition, we discuss our plan for the polarized neutron scattering experiment on the …

Friday, Nov 26 **01:45 PM - 02:00 PM**

106 - MyD88 TIR domain higher-order assembly interactions revealed by serial femtosecond crystallography

Instruments & Techniques

Connie Darmanin
Dr, La Trobe University

Dehong Yu
Dr, ANSTO

Serial Synchrotron Crystallography (SSX) is rapidly emerging as a promising technique for collecting data for time-resolved structural studies or for performing room temperature micro-crystallography measurements using micro-focused beamlines. When performed using ultra-bright X-ray Free Electron Laser (XFEL) sources serial crystallography typically involves a process known as ‘diffract-and-destroy’ where each crystal is measured just once before it is destroyed by the intense XFEL pulse. It’s the small and intense beam focus of XFELs that make it possible to determine structures from nanocrystals where conventional crystallography techniques fail. Only through thorough synchrotron investigation, can we achieve successful XFEL beamtime proposals. Here we …

Friday, Nov 26 **01:50 PM - 02:05 PM**

128 - SPACE RADIATION AND INDIVIDUAL RADIOSENSITIVITY- ANSTO CAS & HUMAN HEALTH IN AIR BEAM EXPERIMENTS

Biomedicine, Life science & Food Science

Liliana De Campo
Dr, ANSTO

Melanie Ferlazzo
Dr, ANSTO

Radiation exposure is a major limiting factor for long duration manned space flights. Radiation protection standards are based on the assumption that individuals are equally resistant to ionizing radiation. However, for over a century, there is evidence that humans do not respond equally to radiation. Particularly, the studies of secondary effects post-radiotherapy have shown a great variability among individuals. More specifically, large discrepancies among astronauts after the same flight were observed. Recently, from a collection of hundreds of fibroblast cell lines derived from patients suffering from genetic disease or post-radiotherapy radiosensitivity, we have shown that the delay in the nucleoshuttling …

Friday, Nov 26 **01:50 PM - 02:05 PM**

12 - Inelastic Neutron Scattering Study of K3[Mn(Cn)6] in an applied field

Chemistry, Soft Matter & Crystallography

John Stride
Dr, University of New South Wales

Kathleen Wood
Dr, ANSTO

A polycrystalline sample of the Mn(III) complex K3[Mn(CN)6] was measured on the cold neutron time-of-flight spectrometer Pelican at ACNS in October 2020, under a range of applied magnetic fields of $0 \leq B \leq 7$ T. The spectra obtained in zero-field clearly show a pair of magnetic excitations centered at ca. 9.5 meV, in accord with previous measurements on IN4 at ILL and MARS at PSI. In externally applied magnetic fields, these excitations were found to be significantly modified, consistent with a Zeeman split pair of spin doublets that move apart as a function of field. This behaviour is believed …

Friday, Nov 26 **02:00 PM - 02:15 PM**

184 - The High Performance Macromolecular Crystallography (MX3) Beamline

Instruments & Techniques

Daniel Eriksson
Australian Synchrotron

Dehong Yu
Dr, ANSTO

The MX3 beamline will extend the capabilities of the existing suite of MX beamlines at the Australian Synchrotron. It will allow collection on crystals that are too small or weakly diffracting for the current beamlines. A high level of automation will transform membrane protein micro crystal collection and high throughput projects such as drug and fragment screening. Sample positioning will be provided via an MD3-UP goniometer and an ISARA robot will allow 6 second sample exchange. Serial crystallography capability will be provided using in-tray screening and collection and fixed target silicon chip scanning stages. A dedicated cluster will provide real-time …

Friday, Nov 26 **02:05 PM - 02:20 PM**

179 - Antimicrobial and Anti-Inflammatory Gallium Implanted ‘Trojan Horse’ Surfaces for Implantable Devices

Biomedicine, Life science & Food Science

Liliana De Campo
Dr, ANSTO

Shiva Kamini Divakarla
Miss, The University of Sydney

A rapidly aging population, high incidence of osteoporosis and trauma-related fractures, and better health care access explain rapid surge in utilisation of orthopedic implantable devices. Unfortunately, many implants fail without strategies that synergistically prevent infections and enhance the implant’s integration with host tissues. Here, we propose a solution that builds on our pioneering work on gallium (Ga)-enhanced biomaterials, which show exceptional antimicrobial activity, and combined it with defensin (De, hBD-1), which has potent anti-microbial activity in vivo as part of the innate immune system. Our aim was to simultaneously impart antimicrobial activity and anti-inflammatory properties to polymer-based implantable devices through …

Friday, Nov 26 **02:05 PM - 02:20 PM**

102 - SAXS Investigation of Solvent Effect on Globular Proteins

Chemistry, Soft Matter & Crystallography

Hank Han
Dr, RMIT University

Kathleen Wood
Dr, ANSTO

Ionic liquids (ILs) are liquids that are comprised entirely of ions. IL solutions have been widely studied for biochemical applications in recent decades, where their ions interact with proteins and can profoundly regulate their properties and functionalities. However, it is challenging to gain an in-depth understanding on the solvent effect on proteins and specific ion-protein interactions at the molecular level. Here, we employ small angle X-ray scattering (SAXS) to investigate the effect of a range of IL systems on various globular proteins including lysozyme, green fluorescent protein, β-lactoglobulin, myoglobin and trypsin. The protein functionalities such as size, shape, conformational changes, …

Friday, Nov 26 **02:15 PM - 02:30 PM**

134 - KOALA - a single-crystal Laue neutron diffractometer: potential for advanced chemical crystallography realised.

Instruments & Techniques

Alison Edwards
Dr, ACNS ANSTO

Dehong Yu
Dr, ANSTO

Our chemistry community participated generously in the workshops which led to the commissioning of the first suite of neutron beam instruments at ANSTO's OPAL reactor. That community has now become a core group of users of the KOALA diffractometer which has resulted in studies which have underpinned superb publications. Whether it is the careful systematic work required to validate the new methodologies of quantum crystallography (a recent search of the Cambridge data base reveals that a single KOALA user has published 10% of all the original single-crystal neutron diffraction studies reported across the life of KOALA) or the one-off determinations …

Friday, Nov 26 **02:20 PM - 02:35 PM**

48 - Structural insights into the unique modes of relaxin-binding and tethered-agonist mediated activation of RXFP1 and RXFP2

Biomedicine, Life science & Food Science

Ashish Sethi
Dr, The University of Melbourne

Liliana De Campo
Dr, ANSTO

Our poor understanding of the mechanism by which the peptide-hormone H2 relaxin activates its G protein-coupled receptor, RXFP1 and the related receptor RXFP2, has hindered progress in its therapeutic development. Both receptors possess unique ectodomains that comprise of an N-terminal LDLa module joined by a linker to a Leucine Rich Repeat (LRR) domain. Truncation of the N-terminal LDLa module abolishes signalling for both receptors suggesting that the LDLa module is essential for activation and is postulated as a tethered agonist, induced to undergo a conformational change upon H2 relaxin binding. Here, we use Small Angle X-ray Scattering (SAXS), NMR spectroscopy, …

Friday, Nov 26 **02:20 PM - 02:35 PM**

4 - Development of a new powder-bed arc additive manufacturing approach for producing high entropy alloys

Manufacturing & Engineering

Bosheng Dong
University of Wollongong

Chris Wensrich

Friday, Nov 26 **02:35 PM - 02:50 PM**

170 - Synchrotron infrared characterisation of SARS-CoV-2 virions for a new COVID-19 saliva test

Biomedicine, Life science & Food Science

Bayden Wood
Prof, Monash University

Liliana De Campo
Dr, ANSTO

In response to the COVID-19 pandemic the Biospectroscopy group within the Monash School of Chemistry have become part of a research working group headed by Prof. Dale Godfrey and Prof. Damian Purcell at the Doherty Institute to develop a new IR diagnostic for the detection of COVID-19. An infrared-based test would be reagent-less, able to test hundreds of thousands using the same instrument, be highly sensitive and inexpensive, producing results in minutes. This is cogent especially given the worldwide shortage of conventional testing kits and the long delays in getting results that in the case of virulent variants such as …

Friday, Nov 26 **02:35 PM - 02:50 PM**

220 - How neutron scattering can improve advanced manufacturing industry?

Manufacturing & Engineering

Anna Paradowska
Industry Engagement Manager, ANSTO

Chris Wensrich

The Australian Centre for Neutron Scattering at ANSTO has several instruments available for materials science and engineering applications. The instruments have a unique non-destructive ability to determine critical imperfections assist performance of engineering apparatus via radiography and tomography, measure internal residual stresses and textures in crystalline materials, such as metals, alloys, ceramics, and composites. These measurements can be carried out on real engineering components, mock-ups, or test samples with minimal preparation. The results directly impact into optimisation of modern manufacturing processes, improved product reliability, enhanced design performance, reduced production cost, and extended life prediction on significant engineering assets. The versatile …

Friday, Nov 26 **03:20 PM - 05:10 PM**

Special Session: Soft X-ray (SXR) - Updates and Developments

Anton Tadich
Dr, ANSTO

Bruce Cowie
Dr, ANSTO

Lars Thomsen
Dr, ANSTO

Friday, Nov 26 **03:20 PM - 03:40 PM**

231 - New insight in corrosion mechanisms of nuclear fuel cladding using synchrotron x-rays

Manufacturing & Engineering

Jisheng Ma
Monash University

Michael Preuss
Prof, Monash University

In water-cooled nuclear reactors zirconium alloys have been the material of choice to encapsulate the fuel due to a combination of low neutron cross-section, excellent corrosion performance and good mechanical properties. However, fuel cladding performance, or our ability to predict its performance, remains the limiting factor in an effort to push for increased fuel burnup, i.e. the energy extracted from a fuel assembly before it is removed from the core. Aqueous corrosion, and the associated hydrogen pick up, remains one of the limiting factors to take nuclear fuel assemblies to higher fuel burnup. Even slight variation in alloy chemistry is …

Friday, Nov 26 **03:20 PM - 03:35 PM**

113 - SAXS investigation of protic ionic liquid-water mixtures, and in their application to protein crystallisation

Chemistry, Soft Matter & Crystallography

Richard Mole
Dr, ANSTO

Tamar Greaves
Dr, RMIT Unviersity

Protic ionic liquids (PILs) are cost efficient “designer” solvents which can be tailored to have properties suitable for a broad range of applications. PILs are also being combined with molecular solvents to enable more control over the solvent environment, driven by a need to reduce their cost and viscosity. This also leads to greater biocompatability.In this presentation I will discuss our ongoing work into designing PIL solvents for proteins, with a focus on lysozyme as a model protein 1. We have recently been using SAXS to explore the effect of PILs on lysozyme from dilute to neat IL concentrations in …

Friday, Nov 26 **03:35 PM - 03:50 PM**

89 - Stimuli Responsive Switchable Chemical Sensors

Chemistry, Soft Matter & Crystallography

Carol Hua
Dr, Deakin University

Richard Mole
Dr, ANSTO

The development of real-time, highly sensitive chemical sensors for the detection of very low analyte concentrations is of significant interest and importance for monitoring levels of harmful chemicals in the environment. The unique properties of the rare-earth metals enables sharp and narrow luminescent signals to be obtained. The incorporation of rare-earth ions into sensor systems offers significant advantages for enhancing the sensor response, allowing greater discrimination between chemical analytes. Coordination polymers (CPs) and Metal-Organic Frameworks (MOFs) are crystalline materials containing inorganic nodes bridged by multidentate ligands. The high porosity and tunability of CPs enable the systematic modification of pore chemistry …

Friday, Nov 26 **03:40 PM - 03:55 PM**

200 - Thermal evolution in metals as revealed by in-situ neutron diffraction

Manufacturing & Engineering

Jisheng Ma
Monash University

Klaus-Dieter Liss
Prof, Gunagngdong Technion - Israel Institute of Technology

The thermal evolution in metals plays an utmost important role in thermo-mechanical processing. Lattice expansion not only reveals conventional thermal expansion but moreover gives insight to order parameters, change of chemical composition and pressure. Peak widths reveal microstructural changes, as well as texture evolution, while primary extinction can be used to study defect mechanisms. Quantifying anisotropic and phase related expansion mismatch allows to design alloys with better mechanical properties. Here I give an overview with selected examples on bulk zirconium alloys, aluminium alloys. Focus will be given on materials after severe plastic deformation, in which different states of thermal stress …

Friday, Nov 26 **03:50 PM - 04:05 PM**

140 - Influencing lipid hydrolysis by minute molecular changes

Chemistry, Soft Matter & Crystallography

Livia Salvati Manni
Dr, University of Sydney

Richard Mole
Dr, ANSTO

Designer lipid colloids are being increasingly studied for the delivery of drugs and nutrients. These nanoparticles can have different internal nanostructures and different lipidic composition. Cyclopropanated derivatives of commonly used monoacylglycerols show substantial differences in self-assembled structures, and formations of nanostructured nanoparticles. Most remarkably, small differences in the hydrophobic tail affect the packing of the lipids, sufficient to alter the availability of the lipid headgroups to be hydrolysed by interfacial enzymes. We employed small angle X-ray scattering and acid/base titration at the Australian Synchrotron SAXS/WAXS beamline to monitor the nanostructural changes during hydrolysis and the digestion rate. These fundamental characteristics …

Friday, Nov 26 **03:55 PM - 04:10 PM**

67 - In-situ X-ray imaging of transient liquid phase (TLP) bonding in solder joints

Manufacturing & Engineering

Jisheng Ma
Monash University

NURUL RAZLIANA ABDUL RAZAK
Ms, The University of Queensland

The demand for Pb-free solder interconnections that can operate reliably at high service temperatures has motivated the development of transient liquid phase (TLP) bonding as an alternative soldering method. The capability of TLP bonding to be processed at a lower temperature while creating a joint composed of high melting temperature intermetallic compounds (IMCs) makes it a promising method. Sn/Cu-based systems are commonly used in electronic packaging due to their low melting point and cost benefits. However, the slow kinetics of the IMC growth and uncontrolled formation of porosity in Sn/Cu-based systems remain challenging issues in practical applications. The addition of …

Friday, Nov 26 **04:05 PM - 04:20 PM**

83 - Insight into the Variations of ABO4 Structures: Combined Experimental and Computational Studies

Chemistry, Soft Matter & Crystallography

Bryce Mullens
Mr, The University of Sydney

Richard Mole
Dr, ANSTO

The development of carbon-neutral energy-generation is critical to combatting climate change. One such technology is the development of next-generation ion conductors for solid-oxide fuel cells (SOFCs). SOFCs offer a more efficient method of extracting energy from hydrogen or hydrocarbon fuels than current combustion engines due to their one-step chemical process. However, a bottleneck to the large-scale uptake of SOFCs is the poor performance of the conducting electrolytes that separate the anode from the cathode. Various ABO4 structures have recently been proposed as solid electrolyte candidates in SOFCs, with increased high-temperature ionic conductivity being measured in chemically doped LaNbO4. However, the …

Friday, Nov 26 **04:10 PM - 04:25 PM**

23 - The use of variable temperature synchrotron XRD to characterise the behaviour of low temperature solder alloys

Manufacturing & Engineering

Jisheng Ma
Monash University

Qichao Hao
Mr, The University of Queensland

During the soldering process and the daily operation of the electronic devices, solder alloys experience temperature variation frequently. The mismatch in volume expansion of the solder alloys and the interconnected components can result in stresses which lead to failure. In a solder alloy system with high solubility of one element in another, the effects of thermal expansion and temperature dependent solubility limits are both important contributing factors to the thermally induced volume changes. In this study, Sn-57wt%Bi and Sn-37wt%Bi alloys which are promising materials for low-temperature solders were investigated by in-situ heating synchrotron powder X-ray diffraction (PXRD) to reveal the …

Friday, Nov 26 **04:20 PM - 04:35 PM**

82 - Understanding Order and Correlation in Liquid Crystals by Fluctuation Scattering

Chemistry, Soft Matter & Crystallography

Jack Binns
Dr, RMIT University

Richard Mole
Dr, ANSTO

Characterising the supramolecular organisation of macromolecules in the presence of varying degrees of disorder remains one of the challenges of macromolecular research. Discotic liquid crystals (DLCs) are an ideal model system for understanding the role of disorder on multiple length scales. Consisting of rigid aromatic cores with flexible alkyl fringes, they can be considered as one-dimensional fluids along the stacking direction and they have attracted attention as molecular wires in organic electronic components and photovoltaic devices. With its roots in single-particle imaging, fluctuation x-ray scattering (FXS) is a method that breaks free of the requirement for periodic order. However, the …

Friday, Nov 26 **04:25 PM - 04:40 PM**

167 - Radiation test of Rad-Hard ICs for space applications

Manufacturing & Engineering

Jafar Shojaii
Swinburne University

Jisheng Ma
Monash University

Conventional Integrated Circuits (IC) are highly sensitive to radiation effects and can operate only in environments with a very low level of radiation. High radiation environments such as space need custom-designed ICs with dedicated radiation-hardened architectures. Our research is focused on the development and test of radiation-hardened ICs in nanoscale and ultra-low-power semiconductor technologies for high radiation environments such as in space and particle physics experiments. The University of Melbourne and Ansto developed a strategic collaboration to enable the ANSTO's heavy ion microprobe beamline for radiation test of custom-designed ICs for space applications. In our presentation, we provide an overview …

Friday, Nov 26 **04:35 PM - 04:50 PM**

101 - Automation of liquid crystal phase analysis for SAXS

Chemistry, Soft Matter & Crystallography

Richard Mole
Dr, ANSTO

Stefan Paporakis
Mr, Rmit

Lyotropic liquid crystal phases (LCPs) are widely studied for diverse applications, including protein crystallization and drug delivery. The structure and properties of LCPs vary widely depending on composition, temperature and pressure. Therefore, high-throughput structural characterisation, such as small-angle x-ray scattering (SAXS), is important to cover meaningfully large compositional spaces. Currently there are well established methods for high-throughput LCP synthesis using automated methods, and for high throughput SAXS data collection with synchrotron sources. However, high-throughput LCP phase analysis for SAXS data is currently lacking, particularly for patterns containing multiple phases. Using SAXS data, we have developed a high throughput LCP phase …

Friday, Nov 26 **04:40 PM - 04:55 PM**

223 - One layer at a time: Unlocking Novel Materials and Structures for Neutron Radiation Environments through Additive Manufacturing

Manufacturing & Engineering

Jisheng Ma
Monash University

Jonathan Knott
Dr, University of Wollongong

The UOW-ANSTO Seed Funding program is an initiative aimed at encouraging new collaborations between researchers at the University of Wollongong and ANSTO - bringing together teams with diverse and complementary skillsets to tackle questions that require multi-disciplinary approaches. In 2019, a team of researchers from ANSTO's Australian Centre for Neutron Scattering (ACNS), UOW's Australian Institute for Innovative Materials (AIIM) and the Translational Research Initiative for Cell Engineering and Printing (TRICEP) came together to tackle the question “Can the structures and materials made possible by additive manufacturing enable novel solutions for neutron radiation environments?” To explore this question, we undertook activities …

Friday, Nov 26 **04:55 PM - 05:10 PM**

141 - Large bandgap quantum anomalous hall insulator in a designer ferromagnet-topological insulator-ferromagnet heterostructure

Kelly Cubbin
Marketing & Event Co-ordinator, ANSTO (AUM2021 Admin)

Qile Li
Mr, Monash University

Ferromagnetic insulator (FMI)/Topological insulator (TI) heterostructure is an advantageous platform for realizing Quantum Anomalous Hall effect (QAHE) and Topological Magnetoelectric effect (TME) via magnetic proximity effect. The time reversal symmetry breaking, a key ingredient for realising QAHE, is achieved by the magnetization from the FMI layer in the proximity of a TI, which opens up an exchange gap in the surface state (SS). Recently, 1 septuple layer (SL) MnBi2Te4 (MBT) has been reported to be a van der waals FMI with robust out-of-plane long-range Ferromagnetic order and is an ideal FMI for engineering such heterostructures. Combining Bi2Te3 (BT) with 1SL …

Friday, Nov 26 **04:55 PM - 05:10 PM**

98 - **New Time**Elucidation of the electronic structure in lanthanoid-radical systems by inelastic neutron scattering

Chemistry, Soft Matter & Crystallography

Maja Dunstan
Ms, The University of Melbourne

Richard Mole
Dr, ANSTO

Single-molecule magnets (SMMs) are metal organic compounds which exhibit magnetic hysteresis and slow magnetic relaxation at low temperature. They have potential applications in high density data storage, quantum computing, and molecular spintronics. Coordination complexes of the trivalent lanthanoid (Ln(III)) ions are the current best performing SMMs, with examples showing hysteresis above liquid nitrogen temperature.[1] The magnetic properties of Ln(III) ions stems from the crystal field (CF) splitting of the ground Russel-Saunders state. These CF states give rise to the energy barrier to reversal of magnetisation, and can be tuned by modification of the ligand environment around the Ln(III) centre. Slow …

Friday, Nov 26 **04:55 PM - 05:10 PM**

221 - Microstructure and residual stress interactions in metal additive manufacturing: post-build assessment and new in-situ methods

Manufacturing & Engineering

Halsey Ostergaard
University of Sydney

Jisheng Ma
Monash University

Layer-wise addition of metal to directly form components or add coatings via laser powder bed fusion (LPBF) or laser directed energy deposition (DED) can generate very high levels of residual stress which affect component durability if not adequately addressed. These techniques also result in novel, non-equilibrium microstructures, sometimes with desirable features, that interact with traditional residual stress relief and microstructure manipulation heat treatments. In LPBF nickel superalloy 718, neutron diffraction was used to demonstrate that a complex residual stress state can persist through a non-recrystallising heat treatment at 960 ºC plus subsequent ageing. The same treatment has been previously shown …

Friday, Nov 26 **05:15 PM - 05:30 PM**

Closing & Prizes

Marta Krasowska
Associate Professor, Fii, UniSA

Yun Liu
Professor, The Australian National University

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