

Nuclear Science and Technology

Supports

Sustainable Development Goals in the South Pacific



Lecture series

7–16 NOVEMBER 2022

Presented by

The University of the South Pacific



Nuclear Science and Technology (NST) is playing a key role in supporting the **United Nations** (UN) **Sustainable Development Goals** (SDG) including in key areas of interest to communities in the Pacific Island Countries.

Under the **Sub-regional Approach to the Pacific Islands** (SAPI), NST is likely to have a significant development impact in the short and medium term on key focus areas in this region, including:



The University of the South Pacific (USP), **International Atomic Energy Agency** (IAEA) and **Australian Nuclear Science and Technology Organisation** (ANSTO) would like to invite University teaching staff from the faculties of Science and related fields, Post Graduate research students and others from the South Pacific to attend a series of free information lectures.

The lectures will cover key areas of research being undertaken to help achieve these important goals and priority areas and learn more about Nuclear Science and Technology in the region.

About IAEA

The International Atomic Energy Agency (IAEA) is the world's central intergovernmental forum for scientific and technical co-operation in the nuclear field. It works for the safe, secure and peaceful uses of nuclear science and technology, contributing to international peace and security and the United Nations' Sustainable Development Goals.

www.iaea.org

About ANSTO

ANSTO is the home of Australia's nuclear science and technology expertise. ANSTO leverages great science to deliver big outcomes. We partner with scientists and engineers and apply new technologies to provide real-world benefits. Our work improves human health, saves lives, builds our industries and protects the environment. ANSTO is the home of Australia's most significant landmark and national infrastructure for research. Thousands of scientists from industry and academia benefit from gaining access to state-of-the-art instruments every year.

www.ansto.gov.au

About USP

The University of the South Pacific (USP) is the premier institution of higher learning for the Pacific, uniquely placed in a region of extraordinary physical, social and economic diversity and challenges to serve the region's need for high quality tertiary education, research and policy. Apart from being a tertiary institution, it also serves as an organisation of regional cooperation and integration.

We are jointly owned and governed by twelve (12) Member Countries: Cook Islands, Fiji, Kiribati, Marshall Islands, Nauru, Niue, Samoa, Solomon Islands, Tokelau, Tonga, Tuvalu and Vanuatu. The University has campuses in all Member Countries, with Fiji having three (3) Campuses.

For over fifty years, USP has been leading the Pacific by making distinctive contributions in research, innovation, learning, teaching and community engagement.

www.usp.ac.fj

Nuclear Science and Technology
supports

Sustainable Development Goals

This inaugural lecture series will provide information on nuclear science and technology applications, and how these applications are helping to achieve the UN Sustainable Development Goals to benefit humankind.

The lectures will focus on the areas of most interest to the communities in the Pacific Island Countries being addressed via the SAPI program.



Lecture series Program



1	DAY ONE Monday, 7 November 2022 5.00pm - 5.15pm	15 min duration		
	Official welcome			
2	DAY ONE Monday, 7 November 2022 5.15pm - 6.45pm	90 min duration		
	TOPIC Understanding climate change through isotopic tracing in earth systems	PRESENTER Dr Karina Meredith ANSTO		Page 8
3	DAY TWO Tuesday, 8 November 2022 5.00pm - 6.30pm	90 min duration		
	TOPIC Nuclear techniques for effective and sustainable implementation of integrated water resources management projects	PRESENTER Dr Oliver Kracht Department of Nuclear Applications, IAEA		Page 10
4	DAY THREE Wednesday, 9 November 2022 1.00pm - 2.30pm	90 min duration		
	TOPIC Nuclear analysis techniques for sustainable aquaculture and provenance for food security	PRESENTER Dr Debashish Mazumder ANSTO		Page 12
5	DAY FOUR Thursday, 10 November 2022 5.00pm - 6.30pm	90 min duration		
	TOPIC Improving the resilience of crops to climate change through mutation breeding	PRESENTER Dr Cinthya Zorrilla Cisneros Department of Nuclear Applications, IAEA		Page 14
6	DAY FIVE Friday, 11 November 2022 1.00pm - 2.30pm	90 min duration		
	TOPIC Sustaining aquaculture industries for the South Pacific: the social and economic benefit of aquaculture	PRESENTER Assoc Prof Jesmond Sammut University of New South Wales		Page 16
7	DAY SIX Monday, 14 November 2022 1.00pm - 2.30pm	90 min duration		
	TOPIC Improving health outcomes through nuclear science: Production and health benefits of medical radioisotopes	PRESENTER Dr Mitra Safavi-Naeini ANSTO		Page 18
8	DAY SEVEN Tuesday, 15 November 2022 5.00pm - 6.30pm	90 min duration		
	TOPIC Developing sustainable, high quality and safe medical diagnostics imaging and radiotherapy services	PRESENTER Enrique Estrada-Lobato MD Department of Nuclear Applications, IAEA		Page 20
	DAY EIGHT Wednesday, 16 November 2022 5.00pm - 6.30pm	90 min duration		
	TOPIC Supporting the improvement of nutrition programmes using stable isotope and complementary techniques	PRESENTER Dr Alexia J. Alford Department of Nuclear Applications, IAEA		Page 22

All times shown are Fiji local time (FJT)



Monday, 7 November
Day one

5.15pm - 6.45pm (FJT)
Duration- 90 min

Understanding climate change through isotopic tracing in earth systems

SYNOPSIS

Nuclear research techniques pioneered by ANSTO can be used to trace or track any element in an earth system – indeed the power of nuclear research techniques lies in this ability. It is enabling scientists to pin-point any element through any system on Earth, such as in the air and water or in the ground. This cannot be achieved using other types of research methods

This capability enables scientists to measure minute changes in atmospheric gases or negligible levels of contaminants in soil. The instruments at ANSTO in Sydney are sensitive enough to count individual atoms.

Climate reconstructions enabled by nuclear science and technology is providing valuable insights into past climate and environmental changes that are crucial in informing and helping to be better prepared for the challenges our planet faces today

ANSTO has world-leading expertise in the study of water resources, responding to environmental change and determining the impact of contaminants on our environment.

PRESENTER

Dr Karina Meredith
ANSTO



Dr Karina Meredith is a Principal research scientist with expertise in hydrochemistry, hydrogeology and environmental site investigations and currently leads the [Environment Research Theme at ANSTO](#). She is an isotope hydrogeologist that has been involved in applying a variety of chemical and isotopic tracers in water to investigate water resource sustainability and water quality in a variety of natural and contaminated environments. She is a technical expert in [radiocarbon hydrochemistry and age calculations](#).

Over the past 20 years, she has led and contributed to a variety of research and commercial water projects throughout Australia (including the Sub-Antarctic) and internationally, including Sri Lanka and [Antarctica](#). She is involved in major partnerships and collaborations with domestic and international universities, government departments and the International Atomic Energy Agency.

Recent research projects include [understanding the role of groundwater in contributing to kidney disease in the rural areas of Sri Lanka](#), providing expertise for [state-wide groundwater investigations](#) using isotopes to discovering the hydrochemical secrets of Antarctic lakes and how these unique environments are changing.



Tuesday, 8 November
Day two

5.00pm - 6.30pm (FJT)
Duration- 90 min

Nuclear techniques for effective and sustainable implementation of integrated water resources management projects

SYNOPSIS

The IAEA's Water Resources Programme promotes and transfers know-how on the use of isotope hydrology as an effective tool for water resources assessment and sustainable water management.

It maintains and operates several global isotope data networks for hydrology and climate studies, including the IAEA Global Network of Isotopes in Precipitation and the Global Network of Isotope Rivers. These unique networks provide Member States access to global and regional data sets on water isotopes (oxygen-18, deuterium and tritium). These widely used data sets are extremely useful tools for hydrological, climatological and environmental studies.

Through the IAEA's technical cooperation programme, bilateral cooperation and collaboration with other international organizations, the IAEA support countries improving the availability and sustainability of freshwater resources through science-based, comprehensive water resources assessments. It also promotes the use of isotope techniques for assessing water resources and managing surface and groundwater on local and national scales, as well as in the case of shared transboundary water resources.

[More information and videos](#) (IAEA) 



PRESENTER

Dr Oliver Kracht

Isotope Hydrologist,
Division of Physical and Chemical Sciences,
Department of Nuclear Applications,
IAEA



Oliver Kracht holds a Diploma in Geology from the University of Bochum (Germany) and a PhD in Environmental Engineering from the ETH Zurich (Switzerland).

He is currently working as a Technical Officer (Isotope Hydrologist) at the International Atomic Energy Agency (IAEA) in Vienna, with project responsibilities related to the geospatial analysis of environmental isotopes the hydrosphere and atmosphere, and to provide technical advice IAEA member states in the design, implementation and appraisal of projects aimed at nuclear techniques in water resources management.

He has by now been responsible Technical Officer in the design and implementation of more than 30 IAEA Technical Cooperation projects in Africa, Oceania and Europe.

Prior to this, he has worked as a researcher at the University of Lausanne (UNIL), the Swiss Federal Institute of Aquatic Science and Technology (EAWAG), the University of Bern (UNIBE), the Geological Survey of Norway (NGU), and the European Commission - Joint Research Centre (JRC) in Ispra.



Wednesday, 9 November
Day three

1.00pm - 2.30pm (FJT)
Duration- 90 min

Nuclear analysis techniques for sustainable aquaculture and provenance for food security

SYNOPSIS

Aquaculture is one of the fastest-growing food production sectors in the world contributing to 47% of seafood production. Asian countries play a significant role in aquaculture production which is fundamental to regional economic growth. ANSTO's expertise on nuclear analysis techniques helps sustainable management of food and water resources. Bring precision in aquaculture practice, and optimise waste production from underutilised feed and nutrients, thus reducing the environmental footprint of aquaculture. This talk will describe how isotopic techniques can be used to increase profitability, food and nutrition security.

Asian countries play a significant role in the global food production and are fundamental to economic growth. Asia exports and imports food and agriculture products. The import and export of food through complex market supply chains can and does lead to fraudulent activities which will affect the profitability and sustainable development. This talk will demonstrate ANSTO's expertise and capabilities in nuclear techniques to determining source and origin of food to mitigate fraud in the supply chain for the sustainability of the food industry as it is linked to the livelihood of millions of people.

PRESENTER

Dr Debashish Mazumder
ANSTO



Dr Debashish Mazumder is a Principal Research Scientist in the Australian Nuclear Science and Technology Organisation (ANSTO).

His area of expertise includes application of isotopic (stable C, N, S isotopes and carbon 14 isotope) and nuclear techniques (elemental profiling through X-ray fluorescence (XRF) using Itrax, Ion Beam and Neutron Activation Analysis) to advance fisheries, aquaculture, and aquatic environmental research to provide solutions to the industries.

He leads Food Provenance research at ANSTO and uses nuclear techniques to provide food industries with accurate tools to authenticate the origin of food to ensure transparency in the supply chains.

He holds adjunct academic positions at Universities in Australia. He has been collaborating with the International Atomic Energy Agency (IAEA), Universities, Government organisations and Industries on food provenance, environment and aquaculture projects in Australia and the Asia-Pacific.

He was part of the 'Blue Carbon Horizons Team' who won the Eureka Award in 2019 for Environmental Research and his Seafood Provenance team has received the Sydney Fish Market Seafood Excellency Award 2022 for the development of a novel seafood provenance technology for the seafood industry.



Thursday, 10 November
Day four

5.00pm - 6.30pm (FJT)
Duration- 90 min

Improving the resilience of crops to climate change through mutation breeding

SYNOPSIS

The Joint FAO/IAEA Centre of Nuclear Techniques for Food and Agriculture advances and supports the safe and appropriate use by FAO and IAEA Member States of nuclear and related technologies in food and agriculture, aiming to contribute to global food security and sustainable agricultural development worldwide.

It does so through adaptive research and development at its own laboratories in Seibersdorf as well as through annual support and coordination of more than 25 coordinated research projects involving some 400 research institutions and experimental stations; capacity-building and technology transfer to over 200 national and regional technical cooperation projects; and technical and policy advice to policymakers.

The central work is to assist Member States in the design and implementation of innovative and effective plant breeding programmes to enhance food security and sustainable crop production systems worldwide. Through its laboratories in Seibersdorf, Austria, protocols and guidelines to enhance the efficiency of crop mutation breeding are developed. It provides training in all areas of plant mutation breeding, including the use of efficiency-enhancing technologies such as in vitro plant tissue culture and genomics technologies. It also provides services for mutation induction to FAO and IAEA Member States.

More information and videos (IAEA) 



PRESENTER

Dr Cinthya Zorrilla Cisneros

Plant Breeder/Geneticist ,
Joint FAO/IAEA Centre of Nuclear
Techniques in Food and Agriculture,
Department of Nuclear Applications,
IAEA



Cinthya Zorrilla is a Plant Breeder and Geneticist at the Plant Breeding and Genetics Subprogramme (PBG) of the Joint FAO/IAEA Centre of Nuclear Techniques for Food and Agriculture.

She provides support as technical officer to projects that use nuclear techniques for plant breeding in Europe, Latin America, Africa, and Asia. Induced genetic diversity using nuclear techniques has been a successful approach to generate new improved varieties that can withstand biotic and abiotic stresses, as well as making available nutritious and health promoting crops. In addition to mutation induction, researchers at PBG develop and apply biotechnological tools, rapid cycling, high throughput phenotyping and in vitro techniques for accelerated breeding based on the request of our Member States.

Cinthya is starting a Coordinated Research Project (CRP) that will develop banana varieties resistant to Fusarium wilt (Foc TR4) using mutation induction and functional genomic tools, as well as biocontrol methods using beneficial microbes.



Friday, 11 November
Day five

1.00pm - 2.30pm (FJT)
Duration- 90 min

Sustaining aquaculture industries for the South Pacific: the social and economic benefit of aquaculture

SYNOPSIS

The main focus of the four year project, which is funded by the Australian Centre for International Agricultural Research (ACIAR) and the National Fisheries Authority of PNG, is to resolve constraints on the growth and sustainability of the aquaculture industry in an effort to improve food and income security as well as increase the social benefits from aquaculture in rural areas in PNG.

The ANSTO activities under the project are led by Dr Debashish Mazumder, Senior Research Scientist, who specialises in the use of isotopic techniques on environmental and aquaculture research.

The approach will help to identify feed ingredients that are not important and can be excluded from the production systems—saving money and reducing the production of waste. In particular, Joshua's research focuses on optimising the growth and quality of fish fingerlings. Keeping the cost of farming down and optimising growth are challenges facing aquaculture globally.

[More information and video](#) 



PRESENTER

Assoc Prof Jesmond Sammut
University of New South Wales



Jes Sammut leads the UNSW Aquaculture Research Group and is the Deputy Director of the Centre for Ecosystem Science and the Centre for Marine Science and Innovation. He is also an Honorary Research Fellow at ANSTO where he is a chief investigator on an innovative collaborative project using nuclear tools to determine seafood provenance and production methods.

Jes works across the biological, physical and social sciences, and leads multidisciplinary teams in the Asia-Pacific that research solutions for aquaculture production problems. Jes and his teams research inland and coastal aquaculture systems, fish nutrition, aquaculture planning and development, sustainable livelihoods, seafood provenance, oyster nutrition, environmental impact assessment, gender in aquaculture development, social impact assessment and rice-shrimp farming systems.

He currently conducts research in Australia, Vietnam and Papua New Guinea, and has previously worked in Indonesia, India, Thailand and the Philippines.

Monday, 14 November
Day six

1.00pm - 2.30pm (FJT)
Duration- 90 min

Improving health outcomes through nuclear science: Production and health benefits of medical radioisotopes

SYNOPSIS

Nuclear medicine offers the potential to identify disease at early stages, often before symptoms occur or before abnormalities can be detected with other diagnostic tests. When used in diagnostics, small amounts of radioactive material, called radiotracers, are introduced into the body, typically via an injection, inhalation or ingestion.

The radiotracer, which is designed to preferentially concentrate in the chosen target (e.g. cancer), emits radiation in the form of gamma rays, which are detected electronically outside the body and processed to produce a 3D image. These images show the concentration and distribution of the radiotracer within the body, allowing the physician or researcher to “see” a target such as a cancerous lesion – not anatomically but physiologically – and quantitatively assess it. Delivery of nuclear medicine therapy works in a similar fashion; the radioisotope is chosen to emit shorter-range radiation and the dose is increased to therapeutic levels.

Nuclear medicine has applications in neurology, cardiology, oncology, orthopaedics and many other areas. Australia is one of the very few nations in the world to produce the radioisotopes needed for nuclear medicine procedures. ANSTO researchers are working with both Australian and international companies to optimise the translation of emerging diagnostic and therapeutic techniques and develop the next generation of both accelerator and reactor-based nuclear medicines for the treatment cancers and other serious illnesses.

PRESENTER

Assoc Prof Mitra Safavi-Naeini
ANSTO

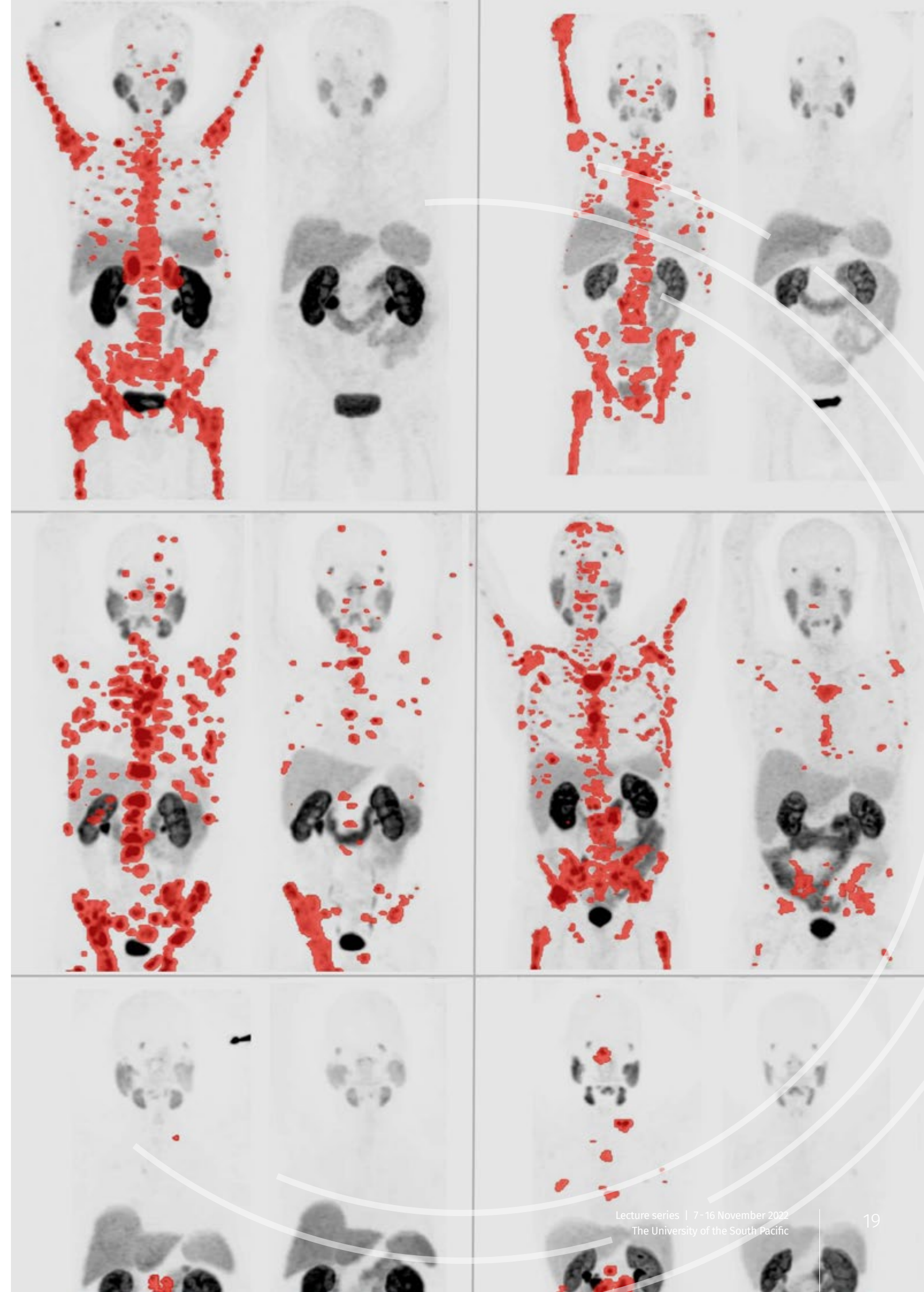


Assoc Prof Mitra Safavi-Naeini is a Principal Physicist and Research Leader in Human Health at ANSTO. Mitra is a prolific researcher in the field of particle physics and medical radiation physics.

Her two main research areas are: radiotherapy (proton and heavy ion therapy and flash photon therapy) - particularly in relation to treatment methods for cancers with poor prognoses - and image quantification (with a specific focus on positron emission tomography and its application to particle therapy). Mitra is one of the co-inventors of neutron capture enhanced particle therapy (NCEPT).

Pictured:

A series of patient scans before (left) and after (right) treatment with Lutetium-177. Image courtesy the Peter MacCallum Cancer Centre.



Tuesday, 15 November
Day seven

5.00pm - 6.30pm (FJT)
Duration- 90 min

Developing sustainable, high quality and safe medical diagnostics imaging and radiotherapy services

SYNOPSIS

A key objective of the IAEA is to support Member States’ fight against cancer, cardiovascular diseases and malnutrition and other diseases using nuclear and nuclear-related techniques. This is accomplished through support of cancer radiotherapy treatment and diagnostic imaging projects, and human resource development. Additional activities include the development of guidelines; databases; providing a quality assurance framework and review missions; providing technical, advisory and dosimetry laboratory services; as well as educational and research initiatives.

The IAEA has six decades of experience in helping countries fight cancer, and it has been doing so in cooperation with the World Health Organization (WHO). The assistance provided by the IAEA has enabled many countries to establish and/or strengthen safe, secure and effective radiation medicine (radiotherapy, radiology and nuclear medicine) capabilities.

More information and videos (IAEA) 



IAEA Rays of Hope initiative 



PRESENTER

Enrique Estrada-Lobato MD

Nuclear Medicine Physician and
Programme Officer from the
IAEA

Senior Professor at the
National Autonomous University of Mexico

Head of the Nuclear Medicine Department
at the Nacional Cancer Institute in Mexico
(2000 – 2014)



Dr. Estrada graduated in Medicine at the Autonomous University of Guadalajara (Mexico) and got his Postgraduate Nuclear Medicine Master Degree from the National Autonomous University of Mexico. In 1994 he got the Board Certification in Nuclear Medicine and in 2000 the Nuclear Oncology and Radionuclide Therapy Post Graduate Degree.

Dr Estrada has been President of the Mexican Society of Nuclear Medicine, The Mexican College of Nuclear Medicine Physicians, the Latin American Association of Societies of Biology and Nuclear Medicine and the World Federation of Nuclear Medicine and Biology.

Research field of interest: Nuclear Oncology, Breast Cancer, Radioguided Surgery.



Wednesday, 16 November
Day eight

5.00pm - 6.30pm (FJT)
Duration- 90 min

Supporting the improvement of nutrition programmes using stable isotope and complementary techniques

SYNOPSIS

Proper nutrition is fundamental to health. The world is facing a double burden of malnutrition – undernutrition and obesity coexist, contributing to non-communicable diseases. Using nuclear techniques, nutrition and health professionals can develop and evaluate nutrition actions to combat all forms of malnutrition.

[More information and videos \(IAEA\)](#)



PRESENTER

Dr Alexia J. Alford

Nutrition Specialist,
Division of Human Health,
Department of Nuclear Applications



Dr Alford is responsible for providing technical nutrition expertise to the IAEA Member States to help them combat malnutrition in all its forms and use nuclear techniques to assess body composition and energy expenditure in the programming and evaluation of their nutrition goals.

The current projects she is involved in includes developing body composition reference curves for infants, assessing body composition in pregnancy, examining obesity levels in adolescents and understanding the nutritional health of children with cancer.

Dr Alford is the coordinator of the IAEA Doubly Labelled Water Database which contains data on over 8000 subjects and the output of this database is changing what we know about metabolism and energy expenditure. Dr Alford collaborates with researchers across 30 countries, mainly in Asia Pacific, and Latin American and the Caribbean.



Register your interests to

Join the ANSTO Study Tour in 2023



ANSTO
AUSTRALIA



STUDY TOUR 2023

ANSTO is an IAEA collaborating centre and can accommodate **a group from USP on a week-long study tour.**

The study tour will connect representatives from USP with ANSTO's researchers working in key areas covered in the lecture series and learn more about the applications of nuclear science and technology and the basics of radiation safety.



It's proposed the tour will be conducted in the first quarter of 2023.
Tour dates yet to be confirmed.



The University of the South Pacific teaching staff and students who have **attended at least 4 lectures** within this series are eligible to apply

Register your interest

Entries close on 30 November 2022.
Don't miss your opportunity to participate.



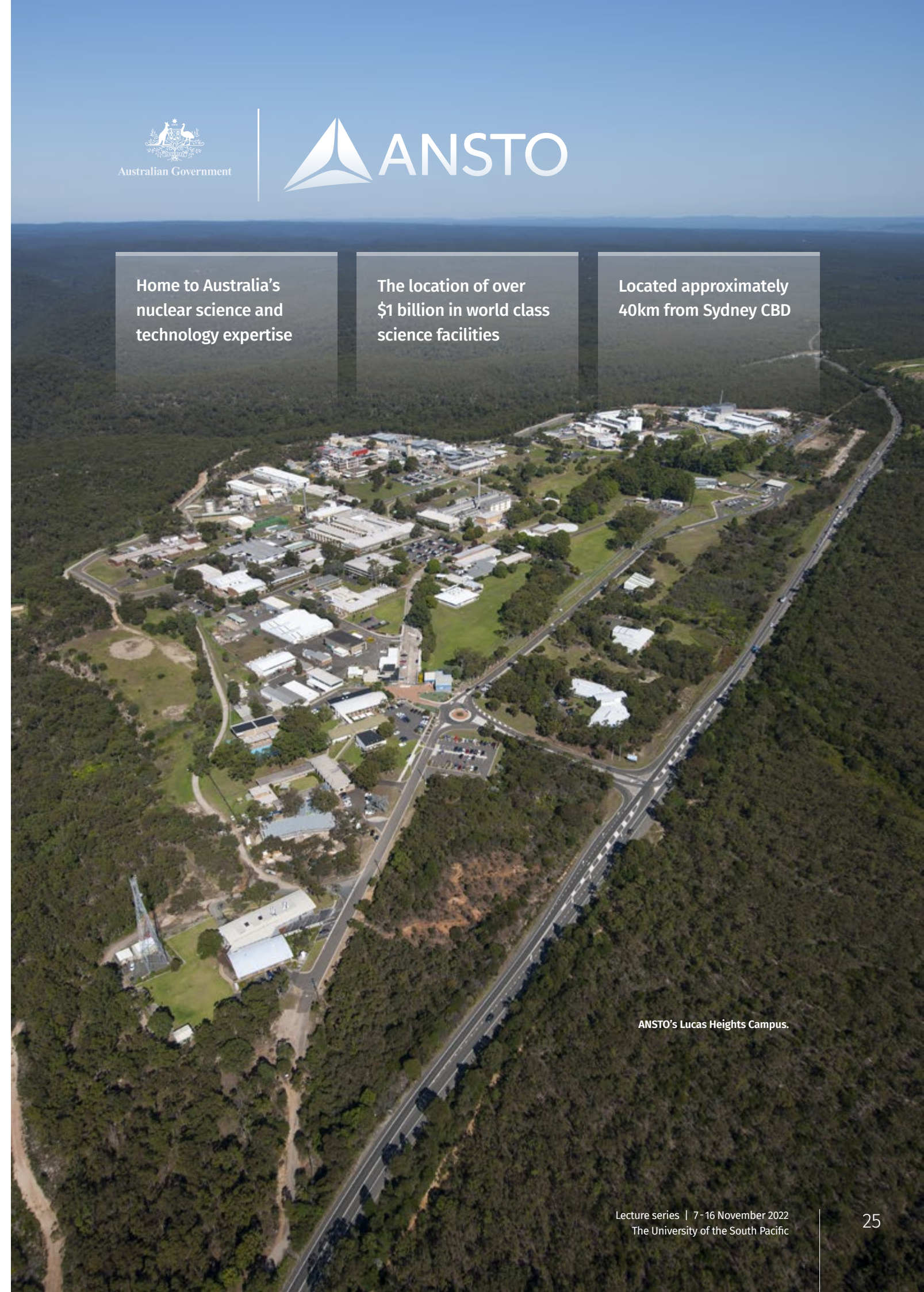
Program



Home to Australia's nuclear science and technology expertise

The location of over \$1 billion in world class science facilities

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ANSTO's Lucas Heights Campus.

Lecture series | 7-16 November 2022
The University of the South Pacific

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