MACQUARIE University

FACULTY OF SCIENCE AND ENGINEERING

July 2018

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From the Dean

NEWSLETTER | JULY ISSUE

Dear Suzannah

As well as welcoming staff from the AAO, there's been a lot more happening in the Faculty over the past month. In research we've shown why bluetongue lizards' tongues are blue, that polar ice is melting faster than we thought and sharks turn right in warming oceans.

Faculty spin out 'Modular Photonics' was recognised at the recent Australian Information Industry Association NSW iAwards. Our resident whale snot whisperer, Vanessa Pirotta, came runner-up at the international FameLab competition. Laura Fernandez was part of the team who won an award at the 2018 Plant Biosecurity CRC Awards. And Zhenxu Bai and Thomas Gretzinger were both awarded scholarships by SPIE, the international society for optics and photonics.

Our Astronomy Open Night was a huge success with the biggest turnout we've ever had, over 2,500 people, showing the enduring popularity of events like this. And did I mention we were the top identifier at the recent University bioQuest competition? In May, I visited Thailand and Indonesia to formalise agreements with many of our partners in the region. I also visited the UK to look at how buildings can support innovative approaches to learning and teaching. You can see photos of some of the places I visited on Twitter.

In funding news, Andrew Lee and his team from our Photonics Research Centre were awarded a $350K ARC Linkage Grant last month to fund their research into using terahertz lasers to detect illicit substances. And Dali Kaafar and Hassan Asghar have secured $163K as part of the NSW Cyber Security Network for a 12-month project looking at privacy-preserving distributed data analytics. Congratulations to you all.

I'd also like to thank all those members of staff who write for *The Conversation*. It's vital that we communicate our research to a broader public audience and that website is a very effective way of doing so. In the last month and a half there have been six articles

in *The Conversation* authored or co-authored by members of our Faculty, on topics ranging from volcanoes to bees to single-use plastics and climate change.

If you want to know more about what's happening across the Faculty, follow our Faculty Twitter account @MQSciEng and my personal account @BarbaraMesserle. If you've got news to share, please tweet about it and include our Faculty handle so we can see it and retweet. If you're not on Twitter, then email us at fse.execdean@mq.edu.au and we'll share the news.

Regards,

Barbara

In this bulletin

Why bluetongue lizards' tongues are blue

Bluetongue lizards use their tongues as a last-ditch effort to avoid being eaten, according to the latest research from Biology's Lizard Lab.

The base of their tongue is particularly bright under UV light – which birds can see clearly. The lizard relies on camouflage to avoid hawks and other predators.

When that fails, the lizards poke out their tongues as far as possible distracting the birds with a flash of bright blue and ultraviolet tongue. And yes, you would see the bright tongue under disco lights.

"Bluetongue lizards have a highly conspicuous tongue, but unlike many other kinds of lizards, it's a big tongue—the surface area is large. When blue tongues do a 'full tongue' display, the mouth is opened widely, and the tongue is flattened and expanded," says study co-author Martin Whiting.

"At the same time, they may hiss and puff-up their body for maximum effect. This behaviour, in combination with a highly conspicuous tongue, can be quite intimidating for anyone that has got too close to a wild bluey."

The researchers placed blue tongues in a large outdoor enclosure where they tested their behavioural responses to model, or fake, predators. The lizards were presented with a model snake, bird, fox, goanna, and a control element (a piece of wood).

"Blueys did not respond much to the piece of wood, while they showed a strong response to the model predators that would normally represent the greatest threat," says Arnaud Badiane, a PhD student on the research team.

"By delaying their display until the predator was very close, and exposing the rear of the tongue, which has the most UV and which is the brightest, blueys maximise their chance of intimidating a predator and surviving another day."

The study was published last month in *Behavioral Ecology and Sociobiology*.

Find out more

Watch a video of a bluey in action

Photo by Shane Black.

Polar ice melting faster than we thought

Sea levels may rise six to eight metres as polar ice-sheets melt—and geological records from the last interglacial period are helping researchers uncover what rising seas mean for global coasts.

Environmental Sciences' Ian Goodwin is working with other researchers at Curtin and Harvard universities to track geological evidence of high sea levels across the southern hemisphere during the last interglacial period to look at how these varied geographically.

Already, their research suggests that the Intergovernmental Panel on Climate Change estimate of sea level rise of one metre by 2100 due to ice sheet melt is far too conservative.

Over the past two decades, spatial data from satellite coverage of ice sheets in Greenland and Antarctica has delivered overwhelming evidence that melting and ice discharge of some outer sections of the ice sheets is speeding up.

"Disintegrating ice shelves in some locations suggests we're witnessing the beginning of a faster rate of sea level rise, as the amount of ice discharge in the ocean is rapidly increasing," he says.

But we can't make longer-term climate predictions based on the short record of instrumental observations of ice sheet variability. That's where geological records come in.

Ian's latest work involves connecting the dots between these modern data sets and geological records stretching back hundreds of thousands of years.

"By understanding spatial patterns of sea level change through time, we can try to project into the future based on the empirical evidence from the past," he explains.

Ian presented his findings at the Polar 18 conference in Switzerland last month.

Read the full story on *The Lighthouse*

Faster data in old fibre networks

A device that increases data transmission rates and reach in legacy optical fibre networks has won the Consumer Markets Award at the recent 2018 Australian Information Industry Association (AIIA) NSW iAwards.

Manufactured by Faculty spin out Modular Photonics, the plug-and-play Mode Multiplexer can enable a hundred-fold increase in data transfer speed at a tenth of the cost and time it would take to recable an underground network.

“Data is transmitted through optical fibre as pulses of light. In binary a 1 is the presence of a light pulse, a 0 is the absence,” explains Physics and Astronomy’s Mick Withford, who is also one of the co-founders of Modular Photonics.

“Twenty years ago the predominant type of fibre deployed was multimode fibre. A shortcoming of this fibre is that a light pulse spreads out as a function of distance.

“If allowed to travel a sufficiently long distance, the stretched pulse will start to overlap with other pulses at which point we can now longer discriminate a data train into individual 1’s and 0’s,” he says.

This stretching effect occurs because a conventional light pulse may consist of hundreds of modes, or particular intensity patterns or shapes. Each of these modes travels at a slightly different speed, causing the light pulse to stretch.

“Our multiplexers are capable of triggering just one mode so we remove the data rate limitation of that old fibre,” says Mick.

The team will represent New South Wales at AIIA’s National iAwards, held in Melbourne in late August.

Whale snot whisperer is FameLab international runner-up

Congratulations to Biology's Vanessa Pirotta who was named runner-up at the FameLab international grand final last month.

FameLab is a worldwide science communication competition, and scientists from 27 countries took part this year.

Participants had just three minutes to win over the judges and audience with a scientific talk that excelled for its content, clarity and charisma.

Vanessa spoke about her research using drones to collect whale snot in order to non-invasively monitor the mammals' health, and was overwhelmed by the award.

"Representing Australia at FameLab was a great experience, and allowed me to share my research with the world," she says.

"Meeting the other 26 scientists was a highlight, and the overall experience (and coming second in the world) gives me the perfect platform for my career as I near the end of my PhD. Thank you to everyone who supported me along the way!"

Vanessa, we're very proud of everything you've achieved representing the Faculty on the international stage.

Building partnerships in Thailand and Indonesia

May was an exciting month for formalising agreements with some of our key institutional partners in the region.

Associate Dean for Global Engagement Richard de Grijs, Matt Monkhouse (Macquarie University Regional Director South East Asia) and I spent a week in Thailand and Indonesia visiting some of the organisations we work with.

In Jakarta we visited the Indonesian Institute of Sciences (LIPI), the Indonesian equivalent of CSIRO. We're partnering with them to deliver more joint PhD programs, in particular cotutelle PhD programs in association with supervisors drawn from some of the top universities in Indonesia. LIPI are keen to upskill their staff members to PhD level.

We signed a MOU for our Chiropractic program with the Binawan Institute of Health Science in Jakarta, and were excited to be joined by a member of Parliament for the signing ceremony. We look forward to their students joining us at Macquarie University, with two students commencing with us next year.

We're working with the King Mongkut University of Technology Thonburi (KMUTT) in Bangkok to build our engagement in STEM through student exchanges, and research and industry collaborations.

And we visited Mahidol University, one of the top universities in Thailand, to discuss how we're planning to collaborate in research and teaching. Both KMUTT and Mahidol University offer exciting opportunities for industrial internships. Exciting times are ahead!

I also visited the UK for a week with the Faculty's General Manager Emma Bowen and Associate Dean of Learning & Teaching James Downes, to look at science and engineering buildings and teaching spaces. We were keen to learn about innovative approaches to learning and teaching, and how buildings can support this.

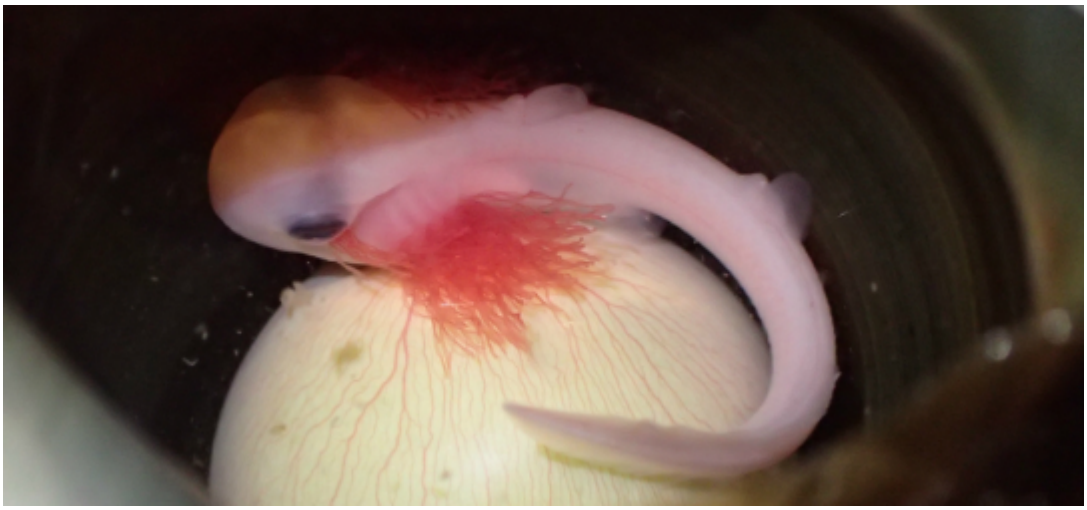
Highlights included:

- Visiting the University of Sheffield's Diamond Building.
- Being shown around the Materials and Engineering Research Institute at Sheffield Hallam University, and seeing how their art school turned an old post

office into a teaching building complete with maker spaces.
- Seeing and learning about the very significant building program for Engineering happening at the University of Manchester, next to the impressive Graphene Institute.
- Hearing about the University of Glasgow's plans for a new engineering and innovation precinct at an old hospital site.

Thanks to everyone who was so generous with their time, and happy to share their engagement and design processes with us.

Sharks turn right in warming oceans



Increasing water temperature by just three degrees alters the behaviour of hatchling sharks, according to a new study from Biology's Fish Lab.

Published in *Symmetry* in May, the research showed that baby sharks incubated at temperatures predicted by the end of the century had very different turn preferences compared to sharks reared in present day water temperatures.

They were much more likely to turn right to detour around a barrier.

The researchers believe this is due to differences in their brains.

"Shark brains are very similar to ours in that they have two hemispheres, each specialised in analysing specific information," says lead author Catarina Vila-Pouca.

When specialised brain functions are predominantly controlled by one hemisphere over the other, this is called cerebral lateralisation.

Cerebral lateralisation is often overtly displayed as behavioural side preferences such as turn or hand preferences, and these side biases are known as laterality.

"Strong lateralisation is associated with enhanced intelligence and is often manifested in behaviour, for example in left- or right-handedness or preference to turn left or right

when detouring a barrier," says Catarina.

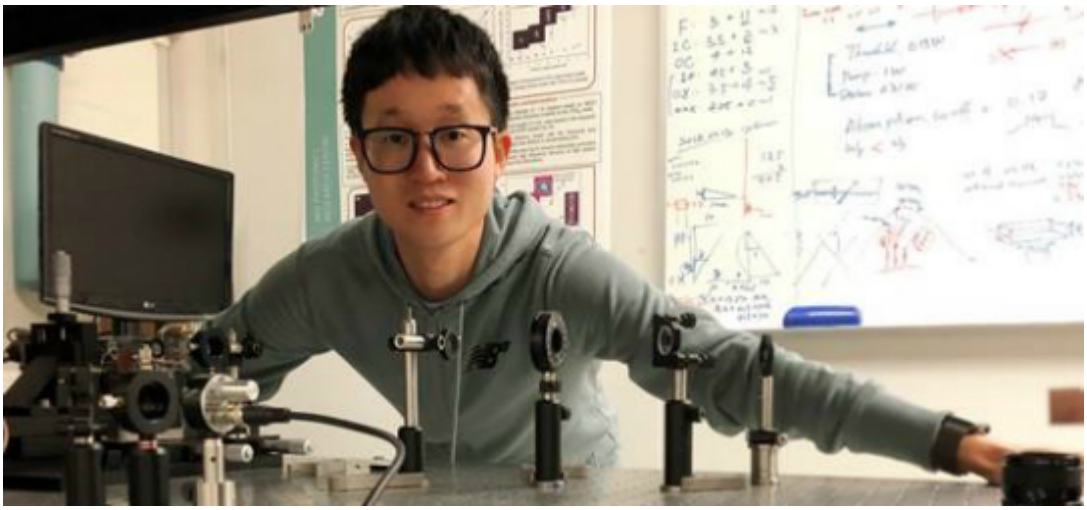
Culum Brown, the leader of The Fish Lab, says many of the shark embryos died when exposed to high temperatures, but those that survived had stronger laterality, suggesting enhanced cognitive abilities.

"They are likely compensating for poor growth due to high temperatures. It is very likely that such changes will affect the way sharks navigate, learn about their environment, and interact with each other," he says.

"This has important implications for survival because it could impact on them finding food, mates and avoiding predators."

Find out more

Scholarship for diamond laser researcher



Congratulations to Physics and Astronomy's Zhenxu Bai who has been awarded the 2018 Teddi Laurin Scholarship by SPIE, the international society for optics and photonics.

Zhenxu is a cotutelle PhD candidate at Macquarie and Harbin Institute of Technology in China under the co-supervision of Rich Mildren and Zhiwei Lu. His research focuses on Raman and Brillouin lasers in diamond.

"The distinctive properties of diamond make it a promising approach in developing compact high efficiency and high brightness lasers," says Zhenxu.

"My future work will focus on power-scaling of diamond lasers and development of on-chip diamond devices for microwave-photonic applications."

Congratulations to Thomas Gretzinger, also from Physics and Astronomy, who has been awarded a SPIE Optics and Photonics Education Scholarship.

Fungus fighters win plant biosecurity award

A collaborative research team working to protect iconic Australian trees from a deadly fungus, has received the Chairman's Award at the 2018 Plant Biosecurity CRC Awards in May.

The Myrtle Rust team—Geoff Pegg and Fiona Giblin from the Queensland Department of Agriculture and Fisheries, NSW Department of Primary Industries' Angus Carnegie, plant taxonomist Bob Makinson, the University of Queensland's Emily Lancaster and Biology's own Laura Fernandez—were recognised for their "outstanding contributions to Australian plant biosecurity science".

Myrtle rust is an invasive pathogen that infects the Myrtaceae plant family—which includes our iconic eucalyptus, paperbark and bottlebrush species—leading to deformed leaves, reduced fertility, stunted growth, and in some cases the death of the plant.

The team has looked at the impact the fungus is having on these native plant communities, as well as its impact on commercial plantations, like lemon myrtle.

There are more than 2,200 Myrtaceae species in Australia. While less than a fifth have been tested to see if they are susceptible to the pathogen, over 90 per cent of the species tested so far are.

Addressing the threat of myrtle rust is critical to protecting and conserving Australian native plant communities, and the wildlife which depend on these iconic species.

Astronomy outreach encourages thousands to look at the stars

It was a cold Saturday night at the onset of winter, but that didn't deter the crowds from lining up to attend our Astronomy Open Night, a 'star-studded' evening presented by the Department of Physics and Astronomy and Macquarie University's Association for Astronomy.

Established 25 years ago, Astronomy Open Night has led the way in astronomy outreach, bringing stargazing to the public.

As astronomy enthusiasts, students, families, and guests of all ages and levels of astronomy experience arrived, a slight breeze pushed the smaller clouds away allowing for almost perfect conditions for viewing the brighter planets in our night sky.

Our planetariums ran jam-packed sessions throughout the event, with guests filling up almost every section of the domes and children excitedly calling out the planets and moons they could see. Jupiter's prominent band structure and its many moons proved particularly popular.

Telescopes were available for guests to view a range of deep sky objects, with staff and volunteers giving detailed explanations in a hands-on experience of observational astronomy.

Inside, members of the public could meet astronomers, attend short talks, try other interactive experiences involving lasers and robotics, and learn more about the 'magic' of physics.

In total the event attracted over 2,500 people, making it the largest Astronomy Open Night ever. My congratulations to everyone involved.

And days later they did it again, with the Association for Astronomy hosting a stargazing party as part of the ABC's Stargazing Live world record attempt. Observers at Macquarie's observatory contributed to a new world record for the most people (over 40,000) stargazing at once.

Find out more about the Department of Physics and Astronomy's outreach activities.

Macquarie top identifier at University bioQuest

Macquarie University has taken out the Top Team trophy for Correct Identifications during the recent University bioQuest challenge.

University bioQuest is an international competition where universities compete against each other to find the most diverse range of plants and animals on and around their campuses.

The award means we were the university team with the highest combined score from all members for correct identifications.

In addition to coming first for species identifications we placed fourth for total submissions, with a score of 49,387.

Congratulations also to Biology's Jenny Donald who scored the top sighting with 975 points for the Eastern Bristlebird, which is listed as endangered under State and Commonwealth legislation.

There were 27 members of the Macquarie University team.

My thanks to all who contributed, with special mentions of our top players: Banksia (Jenny Donald), Josie Kirkwood, Aimee Death, Jaygeems (Josephine Morton) and Kawsar (Kawsar Khan).

Photo of Eastern Bristlebird by Jenny Donald.

Research in tweets

We've been sharing snippets of our recently published research and Faculty members being mentioned in the media on Twitter.

Here are some recent highlights from @MQSciEng.

RT @Beaumontlj: Our article in The Conversation is now out: Ecosystems across Australia are collapsing under climate change via @ConversationEDU @MQBiology Read the article

Congratulations to two @MQPhysAstro members, @tallstarman & @OrsolaDeMarco on this achievement. Good luck on what will be a fantastic opportunity for you to share your skills with the rest of the #astronomy community! QT @tallstarman: I'm pleased to have been elected as Vice-President of the International Astronomical Union's Division C (Education, Outreach and Heritage) — a strong showing by @MQPhysAstro with @OrsolaDeMarco1 having been elected VP of Commission H3 (Planetary Nebulae)! Read the announcement

Using lasers in the fight against drugs: Congratulations to Andrew Lee & his team from @mqphotonics who have been awarded an @arc_gov_au Linkage Grant to fund their research into using terahertz lasers to detect illicit substances Find out more

"These are… over-privileged apps & unfortunately there are too many of them," says @computing_mq's Dali Kaafar speaking to @crikey_news about smartphone apps which access users' location data to share it with 3rd parties for advertising Read the story (paywall)

"For the rest of us who need to kick our single-use plastic addiction, you can start today (if you haven't already) by saying no to plastic straws and taking a reusable cup to your favourite coffee cart." Thanks for the handy tips about #singleuse plastic @DocPJHarvey! QT@DocPJHarvey: This week I was challenged to consider some 'legitimate' uses of single-use plastics following a Senate Inquiry to ban single-use plastics by 2023. Here's my piece in @ConversationEDU @MQsustain @EnvScMQ @MQSciEng @Macquarie_Uni @MqEPS

Bees get stressed at work too (& it might be causing colony collapse), says @MQBiology's Andrew Barron writing for @ConversationEDU Read the article

How nanoparticles can help us both diagnose & treat cancer, using molecular 'glue' technology from @sunnalab @Dr_Andrew_Care. It's an exciting collaboration between @MQMolSci @MQPhysAstro @CNBPscience @phystech_en, Russian Academy of Sciences, @NRNUMEPhI & @SechenovUni QT @phystech_en: Biophysicists have come up with a new way of attaching biomolecules to nanoparticles, which could make it easier to selectively target cancer cells in the body Read the story

RT @MqEPS: Is there life on Mars? Dr Abigail Allwood will be the first woman and Australian to lead a NASA team searching for signs of life on Mars on NASA's next mission scheduled for 2020! @AbigailAllwood #WomenInScience #WomenInSTEM #NASA Find out more

RT @computing_mq: Congrats to Prof. Dali Kaafar & Dr. Hassan Asghar for the successful project application "The Data Ring: Privacy-Preserving Distributed Data

Analytics", securing $163K in funds awarded as a part of the NSW Cyber Security Network with @datarepublicans & @Optus. #DataRing

Parent or publish? @MqEPS's @VMRG_MQ talks about the challenges facing academics with young children Read the story

Suffer from low back pain? @MacUniChiro and @SCUonline have come up with some handy tips

Congratulations to Nathan Daczko and Sandra Piazolo from @MqEPS, along with Timothy Chapman and Geoffrey Clarke from @Sydney_Uni's @sydneyunigeo Their #earth science paper was about evaluating the importance of metamorphism in the collapsing of layers in the earth's crust. QT @MqEPS: The Nature Scientific Reports article co-authored by our very own Nathan Daczko was in the Top 100 Earth science papers for Scientific Reports in 2017 #science #scientificreport #continentalcrust Read the paper

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Faculty bulletin

New staff | Current vacancies | NYSF's Next Step visit | Transient astronomy public lecture | Into the unknown public lecture | Space, STEM and your future workshops

Welcome to new Faculty staff

A warm welcome to all the new staff who have joined the Faculty within the past month.

Please join me in welcoming **Binesh Puthen Veettil** who has joined Engineering as a postdoctoral research fellow from Silanna Semiconductors.

Lifei Xu is a research fellow in Computing from Hubei University.

Ning Dong is a postdoctoral research fellow with Biology, joining us from the University of Reading.

Molecular Sciences have two new appointments.

Christie Foster is a research officer, previously at the University of Sydney.

Max Roemer is a research fellow and joins Macquarie from the University of Western Australia.

And as I mentioned in my special newsletter last week we're pleased to welcome **over 40 AAO staff** to our Faculty. In the short term they will be based at their current offices on Delhi Road, but are now all part of the Macquarie family.

Current vacancies

We're looking for suitably qualified and experienced academic to lead corporate outreach for the Faculty as Associate Dean, Industry and Corporate Engagement.

We're looking for two postdoctoral research fellows to work on different aspects of privacy-enhancing technologies at the Optus Macquarie University Cyber Security Hub.

And with Macquarie being the new home for the instrumentation group of the AAO, over the next 12 months it is expected that a number of new positions will be available, including:

- Director, responsible for overall leadership of AAO-Macquarie including strategic planning and all operations,
- Program Manager, responsible for leading project management for the instrumentation group,
- Project Manager, responsible for management of multiple astronomical instrumentation projects,
- Optical Engineer, responsible for engineering/designing optics for spectrographs and imagers,
- Mechanical Engineer, responsible for design and analysis of precision mechanical parts,
- Instrument Scientist, responsible for systems and science analysis.

Additionally, AAO-Macquarie staff will be interested to engage with potential new PhD students and undergraduate interns for a variety of projects related to astronomical instrumentation.

Enquiries and informal expressions of interest for these roles are welcomed. In all cases, please contact aaoinfo@mq.edu.au.

National Youth Science Forum's 'Next Step' visit to Macquarie

Students participating in the National Youth Science Forum's Next Step program will be visiting Macquarie on **Monday 16 July**.

While they're on campus they will be able to learn about the science and engineering research being undertaken here, take part in hands-on demonstrations and talk to Faculty researchers. Our STEM student ambassadors will be involved throughout the day, and all departments are offering workshops and activities.

Transient astronomy: bursts, bangs and things that go bump in the night public lecture

In partnership with the Department of Industry, Innovation and Science, AAO-Macquarie is delighted to be hosting Dame Jocelyn Bell Burnell, who will be presenting the Allison Levick Memorial Lecture on **Thursday 19 July**.

With the advancement of new technology and equipment, astronomers can now study the sky in new ways. In particular, they are able to see things that vary quickly in brightness, and things that move, revealing a host of new phenomena. In a 50-minute lecture, radio astronomer Dame Jocelyn Bell Burnell will introduce some of these discoveries.

British astrophysicist, scholar and trailblazer Jocelyn Bell Burnell discovered the space-based phenomena known as pulsars, going on to establish herself as an esteemed leader in her field. More about the event.

Into the unknown: exploring the frontiers of earth and space science public lecture

Macquarie University and One Giant Leap Australia invite you to attend a free public lecture on **Wednesday 25 July** by US Earth Scientist Tom Nolan and Planetary Scientist Todd Barber.

We have access to more knowledge than at any other time in human history, with new research breakthroughs every day. Yet both the Earth and space still hide many secrets from human understanding. During this talk you will discover and explore some of these unknowns as you are led in a wide-ranging discussion about the near and far universe. Find out more.

Space, STEM and your future workshops for teachers and students

Macquarie University and One Giant Leap Australia are offering exciting science and engineering experiences for both teachers and high school students.

On **Monday 23 and Tuesday 24 July** teachers will have the opportunity to become trained to use NASA's Goldstone Apple Valley Radio Telescope (GAVRT) in California, which will allow them to give their students exclusive access to the Deep Space network without leaving the classroom.

After completing this training, teachers will be able to guide their students to take control of a 34-metre decommissioned NASA radio telescope. Students can collect real-time data on deep space and collaborate with professional radio astronomers in analysing the data.

From **Wednesday 25 July to Friday 25 July** high school students will be able to take part in three days of unique science and engineering experiences.

Students will have the opportunity to participate in practical workshops and hands-on activities provided by Macquarie University and a team of five amazing and inspirational guest scientists from the United States.

Event highlights include keynote lectures by industry experts, leading international and local academics, as well as a host of interactive workshops giving students access to high-tech scientific equipment.

Connect with us

If you have comments, questions or research news you think might be of interest to the rest of Faculty, I'd love to hear from you. Drop me a line at fse.execdean@mq.edu.au.

Connect with your Faculty online:

- Website: science.mq.edu.au
- Faculty on Twitter: @MQSciEng
- Barbara on Twitter: @BarbaraMesserle

Got a story?

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