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1. Science and Technology Developments

Astronomers make history in a split second

In a world first, an Australian-led international team of astronomers has determined the precise location of a powerful one-off burst of cosmic radio waves. The discovery was made with the Commonwealth Scientific and Industrial Research Organisation (CSIRO) new Australian Square Kilometre Array Pathfinder (ASKAP) radio telescope in Western Australia. The galaxy from which the burst originated was then imaged by three of the world's largest optical telescopes – Keck, Gemini South and the European Southern Observatory's Very Large Telescope – and the results were published online by the journal Science. In 2017 astronomers found a repeater's home galaxy but localising a one-off burst has been much more challenging. Fast radio bursts last less than a millisecond, making it difficult to accurately determine where they have come from. ASKAP is an array of multiple dish antennas and the burst had to travel a different distance to each dish, reaching them all at a slightly different time. The cause of fast radio bursts remains unknown but the ability to determine their exact location is a big leap towards solving this mystery.

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Tackling climate challenges

The Australian Nuclear Science and Technology Organisation (ANSTO) is collaborating on the International Thwaites Glacier Collaboration (ITGC), one of the biggest projects ever to be undertaken in Antarctica that will examine the stability of the glacier. Led by UK and US scientists, the five-year project comprises a series of projects to gain a

better understanding of the key processes impacting Thwaites glacier. This colossal ice stream in the west of the continent is comparable in size to Britain. It is melting and is currently in rapid retreat, accounting for around four per cent of global sea-level rise—an amount that has doubled since the mid-1990s. Knowledge of the history of the ice sheet provides critical data into models that attempt to predict how the ice sheet will behave in the current climate. A research agreement between Imperial College London and ANSTO was formalised in support of this project.

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Researchers develop 'vaccine' against attacks on machine learning

Researchers from the Commonwealth Scientific and Industrial Research Organisation's (CSIRO) Data61, the data and digital specialist arm of Australia's national science agency, have developed a world-first set of techniques to effectively 'vaccinate' algorithms against adversarial attacks, a significant advancement in machine learning research. In a research paper accepted at the 2019 International Conference on Machine Learning (ICML), the researchers also demonstrate that the 'vaccination' techniques are built from the worst possible adversarial examples, and can therefore withstand very strong attacks. CSIRO recently invested AU$19M into an Artificial Intelligence and Machine Learning Future Science Platform, to target AI-driven solutions for areas including food security and quality, health and wellbeing, sustainable energy and resources, resilient and valuable environments, and Australian and regional security.

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Window into the cell

The cryogenic electron microscope (Cryo-EM), commissioned and operated by the University of Wollongong (UOW), supported by a number of collaborating institutions and temporarily housed at the Australian Nuclear Science and Technology Organisation's (ANSTO) advanced microscopy facility, provides an extraordinary 'window into the cell' that is leading to important insights into neurological disorders, other diseases, drug discovery, and basic science. The powerfully-engineered Titan Krios is one of only two operating in Australia. It will ultimately be housed in the UOW's purpose-designed Molecular Horizons Building when it is constructed. The development of the technique was so significant it earned the three scientists who pioneered it the Nobel Prize in Chemistry in 2017.

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Cyanide-free gold goes into production

Australia is leading the charge towards greener and safer gold production with an environmentally-superior alternative gold recovery process technology, dispensing with toxic cyanide and mercury currently used in most gold production processes worldwide. On the back of successful industry trials and the first gold pour last year, Australia's national science agency, CSIRO, will transfer its 'Going for Gold' process technology to Australian company, Clean Mining Limited. CSIRO Research Program Leader, Dr Chris Vernon, believes the technology not only overcomes a significant environmental hazard, it also opens the door for Australian and international gold miners and end users to capitalise on demand for sustainable processes and products.

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ANSTO uses nuclear science to help conserve Sydney's Harbour bridge

Sydney's near-on 90-year-old Harbour Bridge will get a 21st century makeover thanks to a new collaboration between the Australian Nuclear Science and Technology Organisation (ANSTO), Australian universities and the Government of New South Wales. Through the A$858,000 3-year project, new laser-based, large-scale cleaning methods will be developed for corroded metal and dirt-encrusted surfaces in inaccessible areas on the bridge. The technology uses a new class of powerful industrial ultrafast lasers which reduce heat load to a structure, reducing energy costs and deliver long-term conservation outcomes. The techniques will use robotics and will offer improved safety and economic benefits in building maintenance as well as scrap reduction for the marine, automotive and aircraft industries.

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Standards Australia checks into AI

Standards Australia has called for national feedback on setting standards for the application of artificial intelligence technologies in Australia, as part of the release of a new discussion paper. Developing Standards for Artificial Intelligence: Hearing Australia's Voice outlines how Standards Australia would work with industry, government, civil society and academia to apply standards and materials, such as technical specifications and handbooks, to support the development and use of artificial intelligence in Australia. As part of the consultation, Standards Australia has requested feedback specifically on answering outstanding questions such as what areas of opportunities are there for AI adoption, how can Australia use AI to enhance competitive advantage, what extent should standards play in the implementation of AI, and what are the potential consequences if no AI standards is set.

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2. Education and Science Policy

PM sets new goals for digital skills

In his first major domestic speech since the federal elections, Prime Minister Scott Morrison has pledged to improve Australia's digital skills, and to drive the uptake of new technologies within the nation's financial system. Morrison outlined for the first time the government's response to recommendations of the Joyce Review into Australia's vocational education and training system, which was handed to the government in March. The review, led by former New Zealand minister for tertiary education, skills and employment Steven Joyce, pointed to a need for VET courses to be updated to address skills gaps in emerging industries such as advanced manufacturing, information and communication technology, and cybersecurity. Initial steps would include setting up a National Skills Commission and a new National Careers Institute "to give people the information they need to decide their future careers and the best pathways to get them into a job."

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ARC training a boost for space

A new research training centre based in Sydney will develop a world-class Australian space industry in small satellites and train a skilled workforce to grow the sector. The Government is providing $4.6 million to support the training centre to skill-up the next generation of workers in cutting edge advanced manufacturing in the commercial space and unmanned aerial vehicle industries. The Australian Research Council (ARC) Training Centre for CubeSats, Uncrewed Aerial Vehicles, and their Applications (CUAVA) has been launched at The University of Sydney. CUAVA was setup using $4.6 million of funding from the ARC as part of its Industrial Transformation Training Centre scheme, and an additional $1.2 million from the University of New South Wales and several partner organisations including Saber Astronautics Australia and the Defence Science and Technology Organisation. Specific areas of focus includes developing hyperspectral imaging for agriculture, coastal and environmental monitoring and mineral exploration; high-speed communications for satellite; and using GPS systems to monitor weather conditions.

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