



Next generation astronomers win national recognition

Massive X-ray blasts, thousands of black holes revealed; a universe in a computer and more

A Sydney student, early-career researchers from Perth and Melbourne, and a fast telescope have received awards for changing our view of our galaxy and the Universe.

- **Our Milky Way may just have two arms**, says University of Sydney student Maria Djuric.
- **A rare X-ray blast a thousand times brighter than the sun was predicted and observed** by ICRAR astrophysicist Adelle Goodwin from Monash University and Curtin University.
- **Thousands of black holes are pictured in colour** by Curtin University/ICRAR radio astronomer Natasha Hurley-Walker.
- **The laws of the universe have been manipulated in a supercomputer** by University of Western Australia/ICRAR theoretical astrophysicist Adam Stevens.
- **A telescope is opening up the sky** thanks to CSIRO's ASKAP radio telescope team.

The Astronomical Society of Australia (ASA) will honour the five at its Annual Scientific Meeting in Hobart 27 June – 1 July.

"Australian astronomers are among the best in the world, and the breadth of these prestigious awards shows why we lead the world in so many areas. It is a pleasure to recognise these examples of individual brilliance, as well as teamwork, and technical innovation," says ASA President Professor John Lattanzio.

- For pictures of the winners or their research, visit www.scienceinpublic.com.au
- For interviews, email Jane Watkins at Science in Public at jane@scienceinpublic.com.au

It looks like the Milky Way is a giant Swiss roll

Maria Djuric, University of Sydney, winner of the Astronomical Society of Australia's Bok Prize 2022 for outstanding research by an honours student or eligible masters student



The Milky Way may have just two arms that wrap around in layers, something like cream and sponge in a Swiss roll, according to Maria's honours research.

We can't see the whole shape of the Milky Way from our location, halfway between the galaxy's centre and the outer rim.

"We can see streams that are obviously part of a larger spiral but, when we look at a bunch of streams, we're not sure if it's just two arms wrapped up twice as much or if it's four separate arms because we can just see a snippet of the galaxy," the 22-year-old says.

Maria used information on thousands of stars tracked by the European Space Agency's GAIA spacecraft to show the Milky Way is likely to have just two arms. She is now moving to University College London where, for her PhD, she will use up to 35 million stars in a fresh GAIA data release.

Explosive observation shines brighter than a thousand suns

Dr Adelle Goodwin, Monash University/Curtin University/ICRAR, winner of the Astronomical Society of Australia's Charlene Heisler Prize for the most outstanding PhD thesis



Adelle predicted an outburst from neutron star SAX J1808.4–3658, enabling five groups of researchers and seven telescopes to examine the onset of such an event in detail for the first time.

Neutron stars are extreme objects. Just one handful of their matter weighs as much as five Mount Everests. What's more they are dark and hard to find.

When they're part of a binary system, they steal matter from their partner star, producing bright X-ray emission and occasionally explosions a thousand times the energy of our sun.

The project, one of six that made up her thesis, included Neils Gehrels Swift X-ray Observatory, the International Space Station's Neutron Star Interior Composition Explorer, Las Cumbres Observatory, and the South African Large Telescope. Adelle undertook her PhD at Monash University and is now a post-doctoral researcher at Curtin University.

Thousands of black holes in a new vision of the night sky

Dr Natasha Hurley-Walker, Curtin University/ICRAR, winner of the Astronomical Society of Australia's Anne Green Prize 2022 for a significant advancement by a mid-career scientist



The recently published image of the black hole at the heart of the Milky Way was captured by massive radio telescopes and a big global team.

Meanwhile, Natasha has worked with a small team of early career researchers to use Australian telescopes to create a new vision of the entire southern sky, in radio colour.

This work enabled the imaging of hundreds of thousands of black holes in distant galaxies, and the identification of a remnant supernova that lit up the sky for Indigenous Australians when it exploded 9,000 years ago.

Natasha is an ARC Future Fellow at Curtin University in Perth and a member of ICRAR. She completed her PhD in radio astronomy at Cambridge University in the UK. Her prize-winning project is the Galactic and Extragalactic All-sky MWA (GLEAM) extragalactic catalogue.

A universe in a computer shows where galaxies are headed

Dr Adam Stevens, The University of Western Australia/ICRAR, winner of the Astronomical Society of Australia's Louise Webster Prize 2022 for outstanding research by a scientist early in their post-doctoral career



Imagine playing God within a supercomputer simulation.

That's what Adam did in his University of Western Australia post-doctoral research, which was one of the most cited physics and astronomy papers for the year it was published.

Adam simulated and tested predictions of what radio telescopes might see in the actual sky.

Those predictions have helped scientists understand the evolution of galaxies.

Adam used the IllustrisTNG simulation on the Draco supercomputer at the Max Planck Institute in Germany.

He says: "What's wonderful about a simulation is you can track exactly what happens to a galaxy: you can play back the simulation and it can spit out data. Whereas, when you observe a galaxy, you just see how it is now."

Big honour for scientists' big pictures of a big Universe

CSIRO's ASKAP radio telescope team, winner of the Astronomical Society of Australia's Peter McGregor Prize 2022 for innovation in astronomical instrumentation



The ASKAP team created a new kind of receiver, backed by computing power, to broaden our understanding of the Universe by broadening our view of it.

ASKAP is the fastest radio telescope in the world. With a 30-square-degree field of view for each dish it can take panoramic snapshots more than 100 times the size of the full Moon.

Each of the 36 dishes is equipped with a phased array feed with 188 individual receivers in a chequerboard arrangement.

Working together, these arrays capture so much data that the CSIRO team needed to develop powerful computing technologies

to process the imagery in real time and avoid a massive data backlog.

The Prize recognises the efforts of more than 100 engineers and researchers including the ASKAP Project Scientists over the years: Ilana Feain, Lisa Harvey-Smith and today, Aidan Hotan.

Aidan says: "Past telescopes have told us a lot about individual objects and galaxies in space, but it's hard to piece together how these objects fit with each other on the scale of the entire Universe. ASKAP provides that big picture."

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