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International
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THE GLEAM SURVEY

CASE STUDY

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Curtin University

THE UNIVERSITY OF WESTERN AUSTRALIA

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THE GLEAM SURVEY

An ICRAR-led survey made headlines around the world in late 2016 after showing what the Universe would look like if humans could see radio waves.

The GaLactic and Extragalactic All-sky MWA, or 'GLEAM' survey, produced a catalogue of 300,000 galaxies observed by the Murchison Widefield Array (MWA) radio telescope.

ICRAR early career research fellow Dr Natasha Hurley-Walker said GLEAM was the first radio survey to image the sky in such amazing technicolour. "The human eye sees by comparing brightness in three different primary colours – red, green and blue," Hurley-Walker said. "GLEAM does rather better than that, viewing the sky in 20 primary colours.

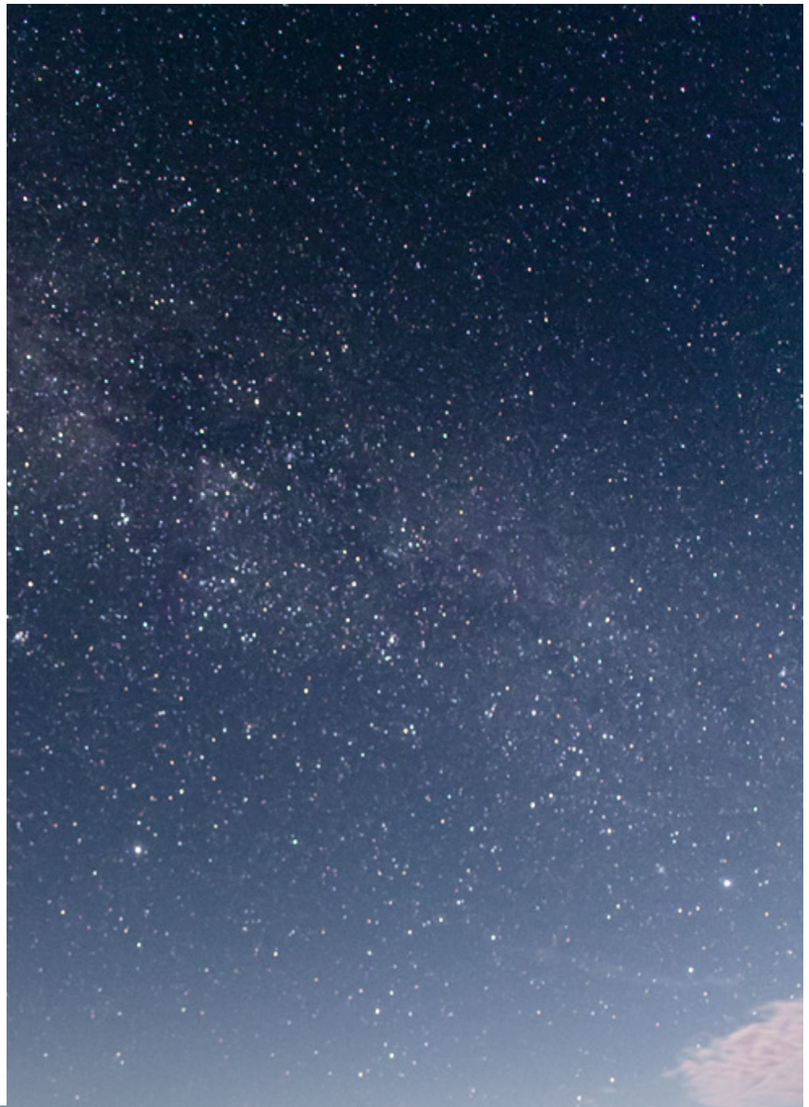
GLEAM is a large-scale, high-resolution survey of the radio sky observed at frequencies from 70 to 230 MHz, observing radio waves that have been travelling through space—some for billions of years.

"Our team are using this survey to find out what happens when clusters of galaxies collide," Dr Hurley-Walker said. "We're also able to see the remnants of explosions from the most ancient stars in our galaxy, and find the first and last gasps of supermassive black holes."

Articles, images and videos of the GLEAM survey were published by more than 300 news outlets worldwide including the New York Times, ABC News, Channel 10, the Sydney Morning Herald, the Daily Mail, the Huffington Post and Australian Geographic.

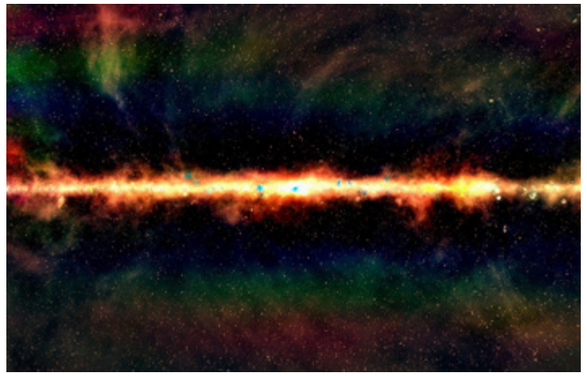
"The $50 million MWA radio telescope is located deep in the West Australian outback, at a remote site north-east of Geraldton."

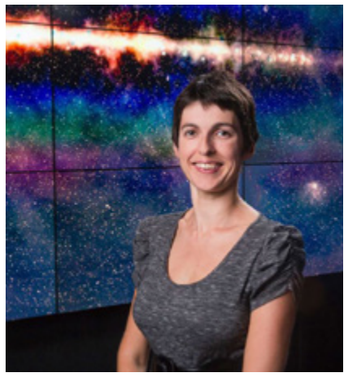
MWA director Associate Professor Randall Wayth said GLEAM is one of the biggest radio surveys of the sky ever assembled. "The area surveyed is enormous," he said. "Large sky surveys like this are extremely valuable to scientists and they're used across many areas of astrophysics, often in ways the original researchers could never have imagined," Associate Professor Wayth said.



Cover A 'radio colour' view of the sky above a 'tile' of the Murchison Widefield Array radio telescope, located in outback Western Australia. The Milky Way is visible as a band across the sky and the dots beyond are some of the 300,000 galaxies observed by the telescope.
Credit: Radio image by Natasha Hurley-Walker (ICRAR/Curtin) and the GLEAM Team. MWA tile and landscape by Dr John Goldsmith / Celestial Visions.

Centre Tile 107, also known as "the Outlier", located approximately 1.5km from the core of the Murchison Widefield Array radio telescope. This is a 30 second exposure captured at night using the Moon to light the landscape.
Credit: Pete Wheeler, ICRAR.





Top Left The GLEAM view of the centre of the Milky Way, in radio colour. Each dot is a galaxy, with around 300,000 radio galaxies observed as part of the GLEAM survey.
Credit: Natasha Hurley-Walker (Curtin / ICRAR) and the GLEAM Team.

Top Right Dr Natasha-Hurley Walker from the Curtin University node of the International Centre for Radio Astronomy Research (ICRAR).

The $50 million MWA radio telescope is located deep in the West Australian outback, at a remote site north-east of Geraldton. A consortium of 13 partner institutions from four countries (Australia, USA, India and New Zealand) financed the development, construction, commissioning and operations of the facility. Since commencing operations in mid 2013 the consortium has grown to include new partners from Canada and Japan.

"Now the data has been published to the world anyone can use it to discover more about our Universe"

Associate Professor Wayth said it was realised in the early days of the MWA that the galactic and extra-galactic science teams using the telescope all wanted to observe different sources in the sky. "It was easier to just survey the entire sky, produce a catalogue of all of the information and then allow everyone to use that catalogue and all the images," he said.

"GLEAM is a large, international team and it is a big amount of work, but now the data has been published to the world anyone can use it to discover more about our Universe."

Associate Professor Wayth said GLEAM was a big highlight for 2016 and the unusual frequency range was allowing astronomers to do some very interesting astrophysics with the data. "It's really quite valuable, and has already been used by a whole bunch of different people for different science projects," Associate Professor Wayth said.

The MWA was the first of the three Square Kilometre Array (SKA) precursors to be completed. Completing the GLEAM survey with the telescope is a big step on the path to SKA-low, the low frequency part of the international Square Kilometre Array (SKA) radio telescope to be built in Australia in the coming years.

"It's a significant achievement for the MWA telescope and the team of researchers that have worked on the GLEAM survey," Associate Professor Wayth said. "The survey gives us a glimpse of the Universe that SKA-low will be probing once it's built. By mapping the sky in this way we can help fine-tune the design for the SKA and prepare for even deeper observations into the distant Universe."

The GLEAM team also created a 'Gleamoscope', an online application to allow people to view the Milky Way in wavelengths from gamma ray to X-ray, visible light, far-infrared, microwave and radio waves.