Astronomers probe swirling particles in halo of starburst galaxy

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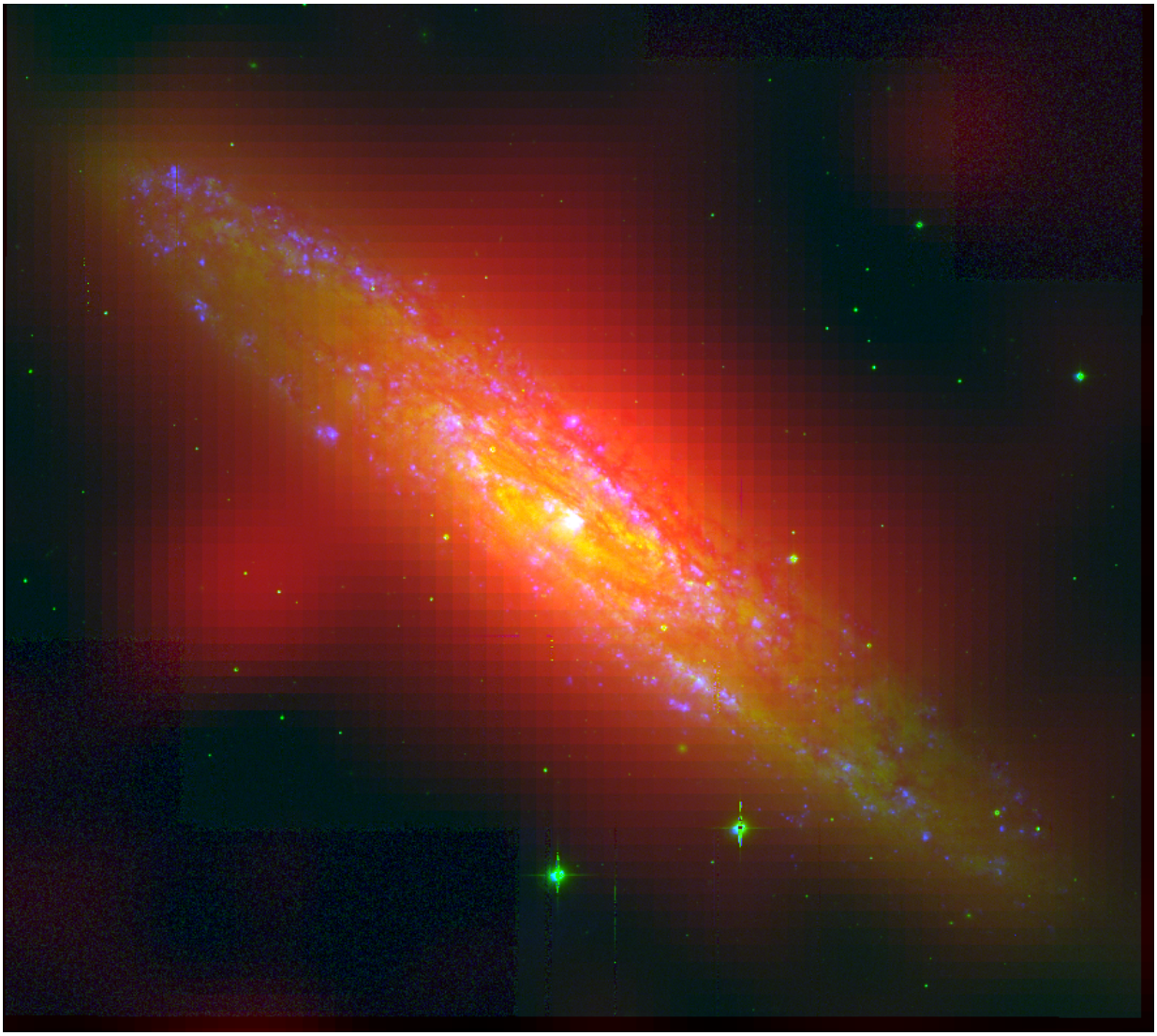


NGC253 starburst galaxy in optical (green; SINGG Survey) and radio (red; GLEAM) wavelengths. The H-alpha line emission, which indicates regions of

active star formation, is highlighted in blue (SINGG Survey; Meurer+2006). Credit: A.D. Kapinska, G. Meurer. ICRAR/UWA/CAASTRO.

Astronomers have used a radio telescope in outback Western Australia to see the halo of a nearby starburst galaxy in unprecedented detail.

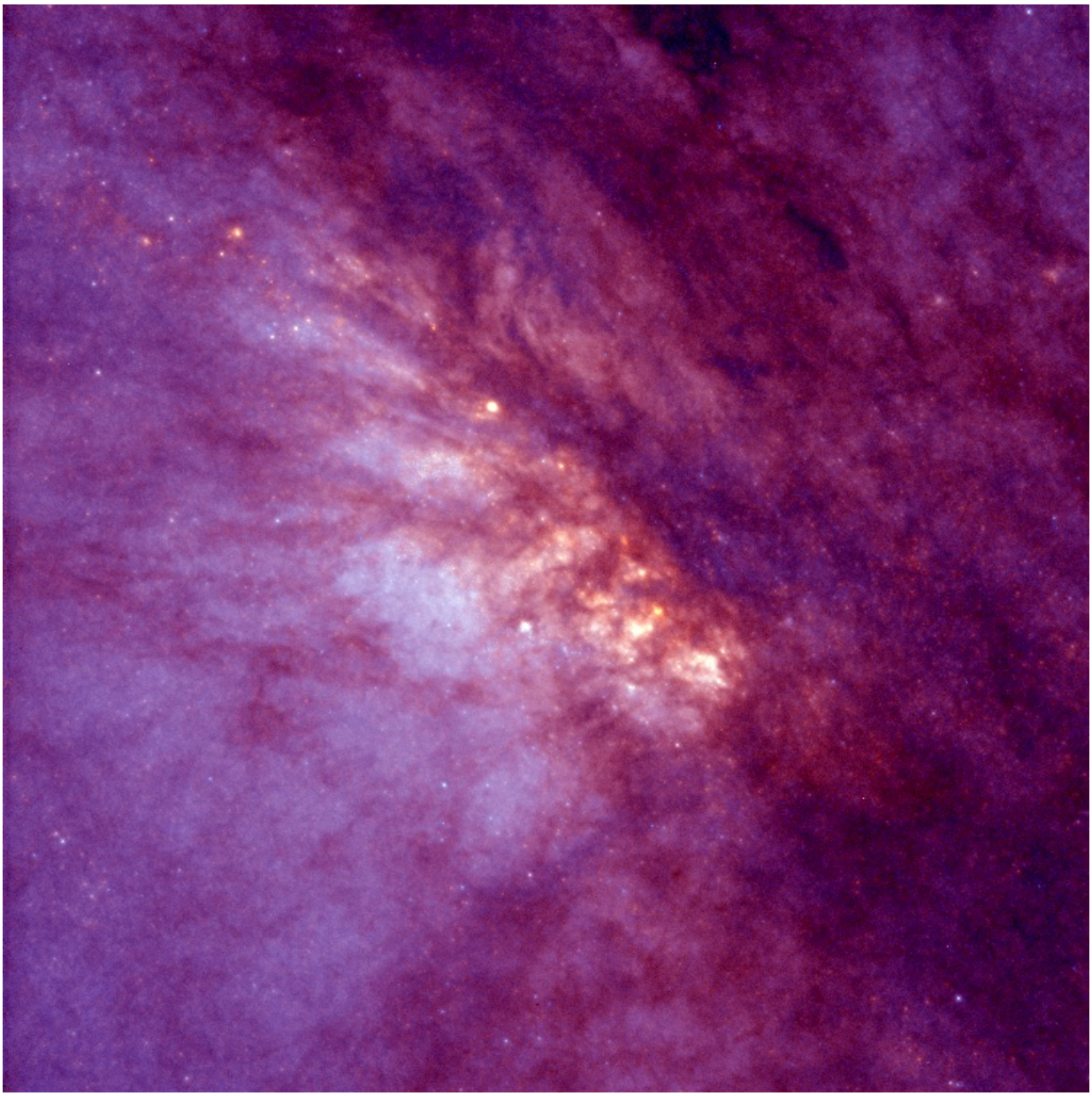
A starburst galaxy is a galaxy experiencing a period of intense star formation and this one, known as NGC 253 or the Sculptor Galaxy, is approximately 11.5 million light-years from Earth.

"The Sculptor Galaxy is currently forming stars at a rate of five solar masses each year, which is a many times faster than our own Milky Way," said lead researcher Dr Anna Kapinska, from The University of Western Australia and the International Centre for Radio Astronomy Research (ICRAR) in Perth.

"This galaxy is famous because it's beautiful and very close to us, and because of what's happening inside it—it's quite extraordinary."

The Sculptor Galaxy has an enormous halo of gas, dust and stars, which had not been observed before at frequencies below 300 MHz. The halo originates from galactic "fountains" caused by star formation in the disk and a super-wind coming from the galaxy's core.

"We're very fortunate to have such a great example of a starburst galaxy in our own cosmic backyard—it's like having a galaxy-sized laboratory on hand to conduct experiments and test our theories," said Dr Kapinska.



This NASA/ESA Hubble Space Telescope image of the core of the nearest starburst spiral galaxy, NGC 253, reveals violent star formation within a region 1, 000 light-years across. A starburst galaxy has an exceptionally high rate of star birth, first identified by its excess of infrared radiation from warm dust. Credit: Carnegie Institution of Washington.

The study used data from the 'GaLactic and Extragalactic All-sky MWA', or 'GLEAM' survey, which was observed by the Murchison Widefield Array (MWA) radio telescope located in remote Western Australia.

"With the GLEAM survey we were able, for the first time, to see this galaxy in its full glory with unprecedented sensitivity at low radio frequencies," said Dr Kapinska.

"It's remarkable how easily the MWA detected the diffuse halo, we managed it with just an hour of observing as the galaxy passed overhead," she said.

"We could see radio emission from electrons accelerated by supernova explosions spiralling in magnetic fields, and absorption by dense electron-ion plasma clouds —it's absolutely fascinating."

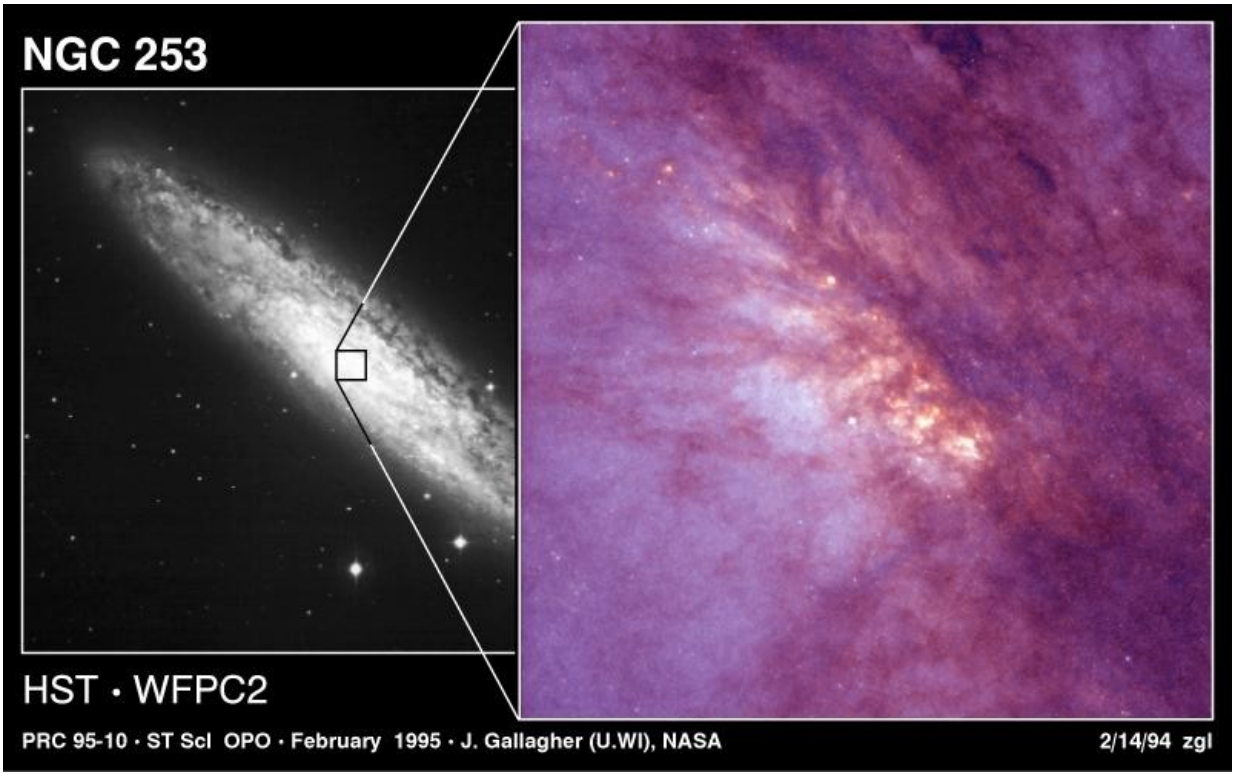
One of 128 tiles belonging to the Murchison Widefield Array (MWA) radio telescope, located in the Western Australian outback. Credit: N. Hurley-Walker. ICRAR/Curtin.

The MWA is a precursor to the Square Kilometre Array (SKA) radio telescope, part of which will be built in Western Australia in the next decade.

Co-author Professor Lister Staveley-Smith, from ICRAR and the ARC Centre of Excellence for All-sky Astrophysics (CAASTRO), said the SKA will be the largest radio telescope in the world and will be capable of discovering many new star-forming galaxies when it comes online.

"But before we're ready to conduct a large-scale survey of star-forming and starburst galaxies with the SKA we need to know as much as possible about these galaxies and what triggers their extreme rate of star formation," he said.

"By getting to the bottom of what's causing this galaxy to produce so many stars, we can better understand how other galaxies form, grow and change over time throughout the Universe."



These images show the spiral galaxy NGC 253. Credit: Jay Gallagher (University of Wisconsin-Madison), Alan Watson (Lowell Observatory, Flagstaff, AZ) and NASA/ESA/HST.

'Spectral Energy Distribution and Radio Halo of NGC 253 at Low Radio Frequencies', published in the *Astrophysical Journal* on March 28th, 2017.

More information: Spectral energy distribution and radio halo of NGC 253 at low radio frequencies, arxiv.org/abs/1702.02434

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