

# Astronomers reveal best image yet of mysterious odd radio circles in space

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Data from SARAO's MeerKAT radio telescope data (green) showing the odd radio circles, is overlaid on optical and near infra-red data from the Dark Energy

Survey. Credit: J. English (U. Manitoba) / EMU / MeerKAT / DES(CTIO)

Astronomy's newest mystery objects—odd radio circles, or ORCs—have been pulled into sharp focus by an international team of astronomers using the world's most capable radio telescopes.

When first revealed in 2020 by the ASKAP [radio telescope](#), owned and operated by Australia's national science agency CSIRO, odd radio circles quickly became objects of fascination. Theories on what causes them ranged from galactic shockwaves to the throats of wormholes.

A new detailed image, captured by the South African Radio Astronomy Observatory's MeerKAT radio telescope and published today in *Monthly Notices of the Royal Astronomical Society*, is providing researchers with more information to help narrow down those theories.

There are now three leading theories to explain what causes ORCs:

- They could be the remnant of a huge explosion at the center of their host galaxy, like the merger of two [supermassive black holes](#)
- They could be powerful jets of energetic particles spewing out of the galaxy's center
- They might be the result of a starburst "termination shock" from the production of stars in the galaxy.

To date, ORCs have only been detected using radio telescopes, with no signs of them when researchers have looked for them using optical, infrared, or X-ray telescopes.

Dr. Jordan Collier of the Inter-University Institute for Data Intensive

Astronomy, who compiled the image from MeerKAT data, said continuing to observe these odd radio circles will provide researchers with more clues.

"People often want to explain their observations and show that it aligns with our best knowledge. To me, it's much more exciting to discover something new, that defies our current understanding," Dr. Collier said.

The rings are enormous—about a million [light years](#) across, which is 16 times bigger than our own galaxy. Despite this, odd radio circles are hard to see.

Professor Ray Norris from Western Sydney University and CSIRO, one of the authors on the paper, said only five odd radio circles have ever been revealed in space.

"We know ORCs are rings of faint radio emissions surrounding a galaxy with a highly active black hole at its center, but we don't yet know what causes them, or why they are so rare," Professor Norris said..

Professor Elaine Sadler, Chief Scientist of CSIRO's Australia Telescope National Facility, which includes ASKAP, said that for now, ASKAP and MeerKAT are working together to find and describe these objects quickly and efficiently.

"Nearly all astronomy projects are made better by [international collaboration](#)—both with the teams of people involved and the technology available," Professor Sadler said..

"ASKAP and MeerKAT are both precursors to the international SKA project. Our developing understanding of odd radio circles is enabled by these complementary telescopes working together."

To really understand odd radio circles, scientists will need access to even more sensitive [radio telescopes](#) such as those of the SKA Observatory, which is supported by more than a dozen countries including the UK, Australia, South Africa, France, Canada, China and India.

"No doubt the SKA telescopes, once built, will find many more ORCs and be able to tell us more about the lifecycle of galaxies," Professor Norris said.

"Until the SKA becomes operational, ASKAP and MeerKAT are set to revolutionize our understanding of the universe faster than ever before."

Dr. Fernando Camillo, Chief Scientist, SARAO, observed, "MeerKAT was conceived, designed, and built over 15 years through the dedicated effort of hundreds of people in South African research organizations, industry, universities, and government. It's a testament to their skill and dedication, and of those SARAO colleagues who maintain, operate, and continue to develop MeerKAT, that it's now a much sought-after telescope by astronomers world-wide."

Dr. Bärbel Koribalski, CSIRO, who discovered an odd radio circle in 2021, remarked, "Research into odd radio circles makes for fantastic collaboration. You need so many people with different experience and knowledge. My team includes everyone from students to senior researchers: those that work in data processing to theoretical modeling, from observations to simulations. There are so many exciting discussions to be had."

**More information:** *Monthly Notices of the Royal Astronomical Society* (2022). [DOI: 10.1093/mnras/stac701](https://doi.org/10.1093/mnras/stac701)

Provided by CSIRO

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