

Lofar's record-sharp image gives astronomers a new view of galaxy M82

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The centre of the galaxy M 82 at very long radio wavelengths (2.5 m/118 MHz [orange] and 1.9 m/154 MHz [blue]). The bright points are most likely supernova remnants. The image is about 3300 light years across. Credit: E. Varenius/Onsala Space Observatory/Lofar collaboration

An international team of astronomers led from Chalmers University of Technology has used the giant radio telescope Lofar to create the sharpest astronomical image ever taken at very long radio wavelengths. Made by observing simultaneously from four countries, including Sweden, the image shows the glowing centre of the galaxy Messier 82 – and many bright remnants of supernova explosions.

Astronomers have taken the sharpest image yet of the sky at very long [radio wavelengths](#). The image shows the centre of the galaxy Messier 82 (M 82), also known as the Cigar Galaxy, 11.5 million light years from Earth. M 82 is forming stars much faster than our galaxy, the Milky Way, and is a favourite object for many astronomers who investigate the evolution of stars and [galaxies](#).

In images taken in visible light, M 82 is a riot of stars, gas and dust. Lofar shows us a completely different scene.

"In Lofar's new extremely sharp image we're seeing a collection of bright spots, which are most likely [supernova remnants](#)," explains Eskil Varenius at Chalmers University of Technology, who led the international team of scientists behind the new image.

A supernova remnant is a shining shell of shock waves from an exploded star, ploughing into its surroundings. Supernova remnants are huge objects by everyday standards, much larger than the size of our own solar system, but look small from a distance.

"This galaxy is millions of light years away, and each remnant can be as little as a few [light years](#) across. We need extremely sharp images to study them," says Eskil Varenius.

The supernova remnants are embedded inside a huge, diffuse cloud of charged particles, or plasma, which absorbs radio waves from these sources. By investigating how different wavelengths pass through the plasma, scientists can learn more about how a gigantic star factory like M 82 works.



The Swedish station in the giant radio telescope Lofar is located at Onsala Space Observatory, 45 km south of Gothenburg. Credit: Onsala Space Observatory/R. Hammargren

"We're surprised that Lofar can see as many as 16 bright supernova remnants in M 82. This image can give us new clues to the structure of M 82 and why so many stars are being formed there," says John Conway, part of the team and director of Onsala Space Observatory where Sweden's Lofar station is located.

This exciting image of M 82 is the first of many that Lofar and its international stations will be able to give us. The scientists are now working on new super-sharp Lofar images of other galaxies.

"Lofar is showing us the sky in a way that we've never seen before, and in in exquisite detail. This beautiful image is just a foretaste of what the telescope is capable of," says Mike Garrett, director of Astron, the Netherlands Institute for Radio Astronomy.



The International Lofar Telescope has its core in the Netherlands and stations in Sweden, France, the UK and Germany. Three new stations are being built in Poland. Credit: Astron

More information: "Subarcsecond international LOFAR radio images

of the M82 nucleus at 118 MHz and 154 MHz" arxiv.org/abs/1411.7680

Provided by Chalmers University of Technology

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