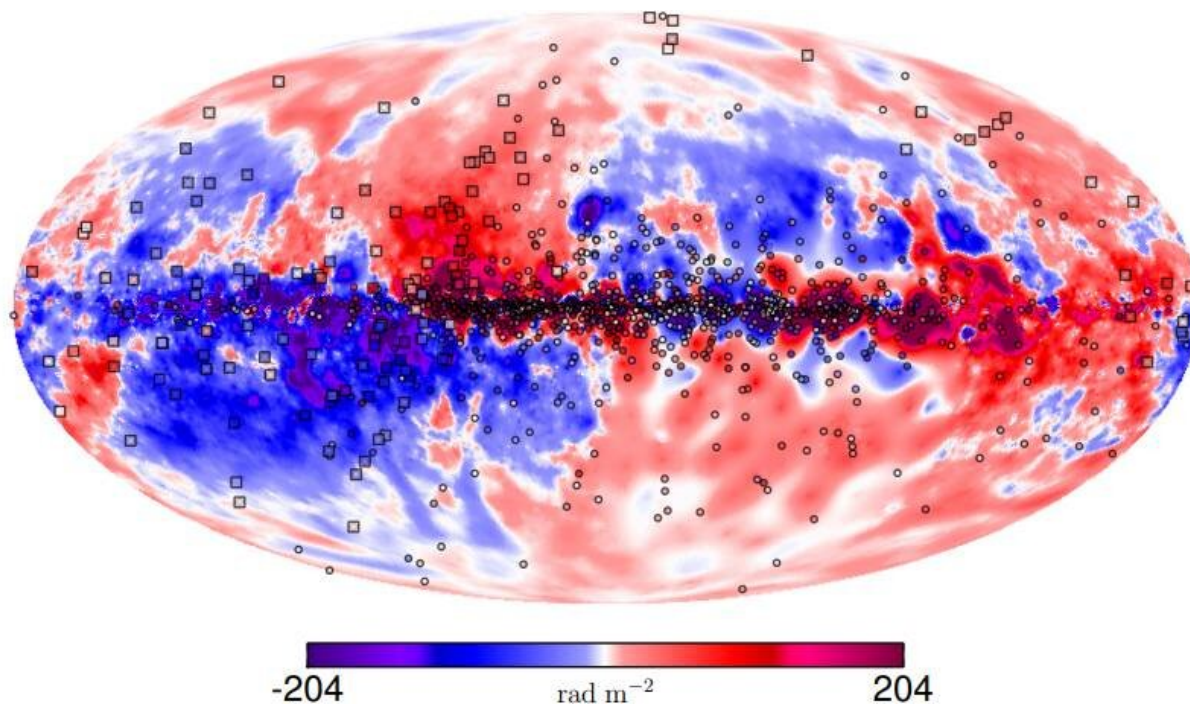


Mapping our galaxy's magnetic field

November 29 2019



A representation of how our Galaxy would look in the sky if we could see magnetic fields. The plane of the Galaxy runs horizontally through the middle, and the Galactic centre direction is the middle of the map. Red–pink colours show increasing Galactic magnetic field strengths where the direction is pointing towards the Earth. Blue–purple colours show increasing Galactic magnetic field strengths where the direction is pointing away from the Earth. The background shows the signal reconstructed using sources outside our Galaxy. The points show the current measurements for pulsars. The squares show the measurements from this work using LOFAR pulsar observations. Credit: Freshscience

Astronomers from CSIRO and Curtin University have used pulsars to probe the Milky Way's magnetic field. Working with colleagues in Europe, Canada, and South Africa, they have published the most precise catalogue of measurements towards mapping our Galaxy's magnetic field in 3-D.

The Milky Way's [magnetic field](#) is thousands of times weaker than Earth's, but is of great significance for tracing the paths of cosmic rays, star formation, and many other astrophysical processes. However, our knowledge of the Milky Way's 3-D structure is limited.

Dr. Charlotte Sobey, the lead author of the research paper, said "We used pulsars (rapidly-rotating neutron stars) to efficiently probe the Galaxy's magnetic field in 3-D. Pulsars are distributed throughout the Milky Way, and the intervening material in the Galaxy affects their radio-wave emission."

Using a large European radio telescope called LOFAR (the Low-Frequency Array), the team assembled the largest low-frequency catalogue of magnetic field strengths and directions towards pulsars, to date. The results were used to estimate how the Galactic magnetic field strength decreases with distance from the plane of the Galaxy (where the [spiral arms](#) are).

Charlotte said "This is an indication of the great results that we can achieve using the next-generation of radio telescopes. Since we cannot observe our entire Galaxy from one place on Earth, we are now using the MWA (Murchison Widefield Array) in Western Australia to observe pulsars in the southern sky."

LOFAR and the MWA are pathfinder and precursor telescopes, respectively, to the low-frequency component of the SKA (Square Kilometre Array) – part of the world's largest radio telescope that will be

constructed in Western Australia. These telescopes are a stepping stone towards the SKA, which will revolutionise our understanding of our Galaxy, plus much more!

This work was presented at Fresh Science WA 2019 and published earlier this year in Sobey, et al., *Monthly Notices of the Royal Astronomical Society*, Volume 484, Issue 3, April 2019, Pages 3646–3664.

More information: C Sobey et al. Low-frequency Faraday rotation measures towards pulsars using LOFAR: probing the 3D Galactic halo magnetic field, *Monthly Notices of the Royal Astronomical Society* (2019). [DOI: 10.1093/mnras/stz214](https://doi.org/10.1093/mnras/stz214)

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Provided by Freshscience

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