Mapping the magnetic bridge between our nearest galactic neighbours

May 12 2017

The Large (centre left) and Small (centre right) Magellanic Clouds are seen in the sky above a radio telescope that is part of the Australia Telescope Compact Array at the Paul Wild Observatory in New South Wales, Australia. Credit: Mike Salway

For the first time, astronomers have detected a magnetic field associated with the Magellanic Bridge, the filament of gas stretching 75 thousand light-years between the Milky Way Galaxy's nearest galactic neighbours: the Large and Small Magellanic Clouds (LMC and SMC, respectively).

Visible in the southern night sky, the LMC and SMC are dwarf galaxies that orbit our home galaxy and lie at a distance of 160 and 200 thousand light-years from Earth respectively,

"There were hints that this magnetic field might exist, but no one had observed it until now," says Jane Kaczmarek, a PhD student in the School of Physics, University of Sydney, and lead author of the paper describing the finding.

Such cosmic magnetic fields can only be detected indirectly, and this detection was made by observing the radio signals from hundreds of very distant galaxies that lie beyond the LMC and SMC. The observations were made with the Australia Telescope Compact Array radio telescope at the Paul Wild Observatory in New South Wales, Australia.

"The radio emission from the distant galaxies served as background 'flashlights' that shine through the Bridge," says Kaczmarek. "Its magnetic field then changes the polarization of the radio signal. How the polarized light is changed tells us about the intervening magnetic field."

A radio signal, like a light wave, oscillates or vibrates in a single direction or plane; for example, waves on the surface of a pond move up and down. When a radio signal passes through a magnetic field, the plane is rotated. This phenomenon is known as Faraday Rotation and it allows astronomers to measure the strength and the polarity—or direction—of the field.

The observation of the magnetic field, which is one millionth the strength of the Earth's, may provide insight into whether it was generated from within the Bridge after the structure formed, or was "ripped" from the dwarf galaxies when they interacted and formed the structure.

"In general, we don't know how such vast magnetic fields are generated, nor how these large-scale magnetic fields affect galaxy formation and evolution," says Kaczmarek. "The LMC and SMC are our nearest neighbours, so understanding how they evolve may help us understand how our Milky Way Galaxy will evolve."

"Understanding the role that magnetic fields play in the evolution of galaxies and their environment is a fundamental question in astronomy that remains to be answered."

The paper is one of a growing number of new results that are building a map of the Universe's magnetism. According to Prof. Bryan Gaensler, Director of the Dunlap Institute for Astronomy & Astrophysics, University of Toronto, and a co-author on the paper, "Not only are entire galaxies magnetic, but the faint delicate threads joining galaxies are magnetic, too. Everywhere we look in the sky, we find magnetism."

The paper appeared in the *Monthly Notices of the Royal Astronomical Society*.

More information: J. F. Kaczmarek et al. Detection of a Coherent Magnetic Field in the Magellanic Bridge through Faraday Rotation, *Monthly Notices of the Royal Astronomical Society* (2017). DOI: 10.1093/mnras/stx206 , On *Arxiv*: arxiv.org/abs/1701.05962

Provided by University of Sydney