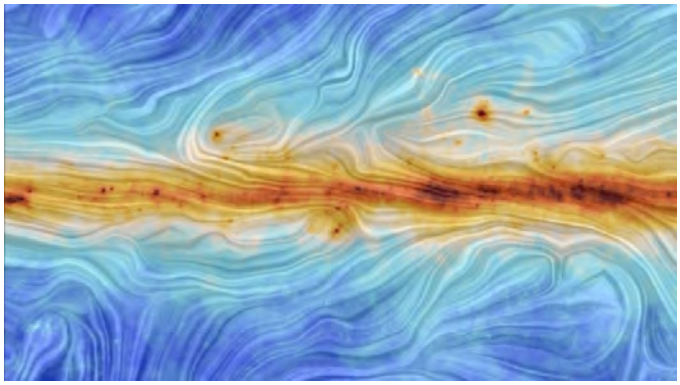
A giant magnetic bridge between galaxies

This story was released earlier this month, but it wasn't until May 18, 2017 that it made a splash on social media.

Known as the **Magellanic Bridge**, it's a huge stream of neutral gas stretching 75,000 light-years between the two Magellanic Clouds orbiting our Milky Way. There were hints that this magnetic field might exist, but no one had observed it, until now. You cannot actually see magnetic fields. So, what do we mean here by "observed"?

Australia Telescope Compact Array with the Large and Small Magellanic Clouds in the background. The telescope is located at the Paul Wild Observatory in New South Wales, Australia.

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. In this case the Australia Telescope Compact Array radio telescope observed radio signals from hundreds of very distant galaxies lying in the space beyond the Large and Small Magellanic Clouds. Radio emission from the distant galaxies served as background 'flashlights' that shine through the Bridge. Its magnetic field then changes the polarization of the radio signal. This change tells us about the intervening magnetic field.



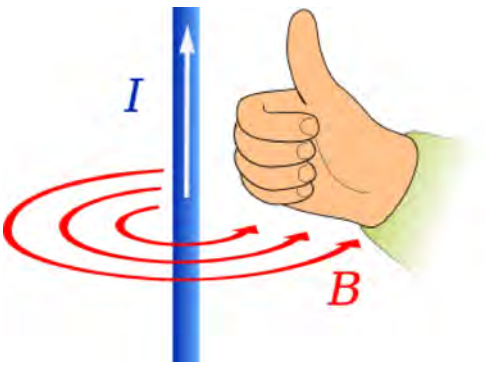
The sun-orbiting Planck satellite made this high-resolution map of our Milky Way galaxy's magnetic field in 2014.

The details of the magnetic field, which is only one millionth the strength of the Earth's, may provide insight into how the structure formed, or 'ripped' from the dwarf galaxies, perhaps when they interacted sometime in the past.

When speaking of magnetic bridges between galaxies, we are truly on the frontier of what's known about outer space. We don't know how such vast magnetic fields are generated, nor how these large-scale magnetic fields affect galaxy formation and evolution. 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. 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.

Our current understanding of magnetism is that it is caused by electric charges in motion. In everyday life an electric current – consisting of free electrons flowing in a wire – creates a magnetic field around the wire. The direction of the magnetic field lines can be determined by using the "right hand grip rule" (see figure at right). The strength of the magnetic field decreases with distance from the wire proportional to the distance.



Right hand grip rule: a current flowing in the direction of the white arrow produces a magnetic field shown by the red arrows

The relationship between electric Charge and Magnetism can be seen as two complementary sides of the one force: a change in an electric charge is stored in a magnetic field, which in turn in its collapse will tend to restore (maintain) the original charge. The combination is known as the Electromagnetic Force, the driving mechanism behind all the Radiation we know. **The contents of the cosmos are in constant relative motion, either expanding, contracting or rotating, with much of it consisting of positive or negatively charged particles, generating magnetic fields in the process.** These fields can, under the right conditions, add up to vast regions of such magnetic bridges as the one mentioned above. But how this Electromagnetic Force fits into our picture of the Universe, why fundamental particles can only be created with electric charges, is still to be explained. Perhaps it is the driving force behind evolution?

AK, with EarthSky and Wikipedia Notes