anzska
Square Kilometre Array ▸ Australia ▸ New Zealand

Fact sheet

What is radio astronomy?

Radio astronomy, like optical astronomy, examines the electromagnetic radiation from objects outside the Earth's atmosphere – stars, galaxies and other cosmic objects. Where optical telescopes gather light, radio telescopes gather radio waves.

Astronomers use both light and radio waves to learn about the objects in space that emit them. Information about objects, including their size, shape and composition, can be ascertained from their radio or light emissions. Radio waves can penetrate through cosmic dust allowing astronomers to look into regions such as the centre of our Galaxy, the Milky Way, which is obscured by dust at optical wavelengths.

What are radio waves?

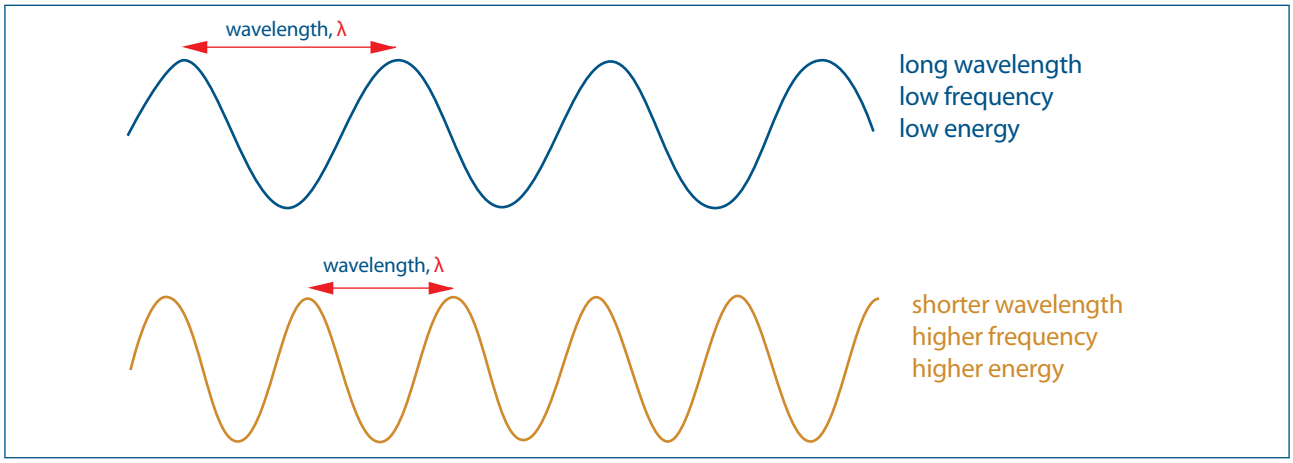
Radio waves are a form of electromagnetic radiation, as are light waves. Since wavelength and frequency are inversely related, lower frequency means longer wavelength. Radio waves are low frequency waves and thus have a greater wavelength than light waves. In fact light waves have wavelengths measured in hundreds of nanometres, while radio waves are measured in up to tens of metres. Low frequency also means low energy, so radio waves have less energy than light waves as well.

Since radio waves can penetrate through dust, and different cosmic objects radiate most strongly at different frequencies, something which cannot be seen with an optical telescope can often be 'seen' with a radio telescope.

The longer wavelength of radio waves means radio telescopes need to be much larger than optical telescopes to generate high resolution images. Radio telescopes are some of the largest scientific instruments in the world.

CSIRO's Australia Telescope Compact Array near Narrabri in NSW.
Credit: *David Smyth, CSIRO.*

Electromagnetic waves



Radio telescopes

Radio telescopes are very sensitive devices that measure the intensity of radio waves over a band of frequencies. Their antennas are often in the shape of a 'dish' or cylindrical reflector to provide a large collecting area. The radio waves are reflected off the collector surface and are focused onto a receiver. Australia's largest single dish radio telescope is CSIRO's Parkes radio telescope, also known as 'The Dish'. The information, once collected, is then electronically amplified and processed so that it can be measured by a computer and interpreted by astronomers.

When two (or more) signals are combined from separate antennas the telescope is known as an *interferometer*. Signals from an interferometer can be electronically combined to simulate a single dish of a size equal to the largest antenna separation – the bigger the separation, the better the resolution of the image that can be produced. The sensitivity of an interferometer increases as the total amount of collecting area increases. This is one reason why the Square Kilometre Array will be such a revolutionary radio telescope.

CSIRO's Parkes radio telescope is also known as 'The Dish'.
Credit: *David McClenaghan, CSIRO.*

Where are radio telescopes sited?

Because they are so sensitive to radio emissions, radio telescopes are highly susceptible to interference from modern-day radio-communication services and emissions from other electrical equipment. To minimise such interference radio astronomy antennas are usually placed in remote locations where there is a low population density.

Artist's impression of the Australian Square Kilometre Array Pathfinder (ASKAP) telescope, a new telescope being built by CSIRO in Western Australia.
Credit: *Swinburne Astronomy Productions, design data provided by CSIRO.*

History of radio astronomy

The first radio astronomy observations were made in 1932 by the USA Bell Laboratories physicist Karl Jansky. He detected cosmic radio noise from the centre of the Milky Way galaxy while he was investigating radio disturbances to a trans-oceanic telephone service. Then, with the development of radar in the Second World War, improvements to antennas and electronics were made. This meant that after the war, scientists could start to investigate radio signals coming from space.

Australia's role in radio astronomy

Australia has been at the forefront of radio astronomy since the early days with scientists at CSIRO's Radiophysics Laboratory using an antenna perched high on a cliff at Dover Heights in Sydney to make many important discoveries. Since then Australia has developed a strong tradition of excellence in radio astronomy and is acknowledged as a world leader in this field.

For further information

Contact:
Rob Hollow
CSIRO Astronomy and Space Science
Email: robert.hollow@csiro.au

Australian Government

New Zealand Government

CSIRO

The Government of Western Australia

July 2010