What is the Telescope used for?

The Telescope is used to carry out scientific research. Researchers from Australia and overseas apply to use the Telescope in order to unravel the secrets of the Universe. To find the answers astronomers look at a whole gamut of objects in space. Some of these objects include;

Supernovae - the final death throe of a star can create such an eruption that the shockwave can be seen expanding decades later.

Active Galaxies - massive black holes at the centre of some galaxies create jets of plasma that extend into space millions of lightyears from the galaxy.

Pulsars - these rotating supernovae cores produce beams of energy that pass Earth giving the effect of a pulse.

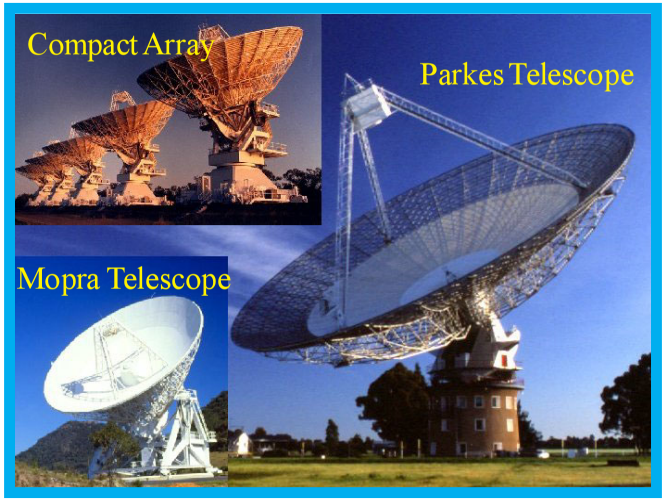
Starbirth - young stars are made from hydrogen gas and radio telescopes are the best instrument for detecting this gas.

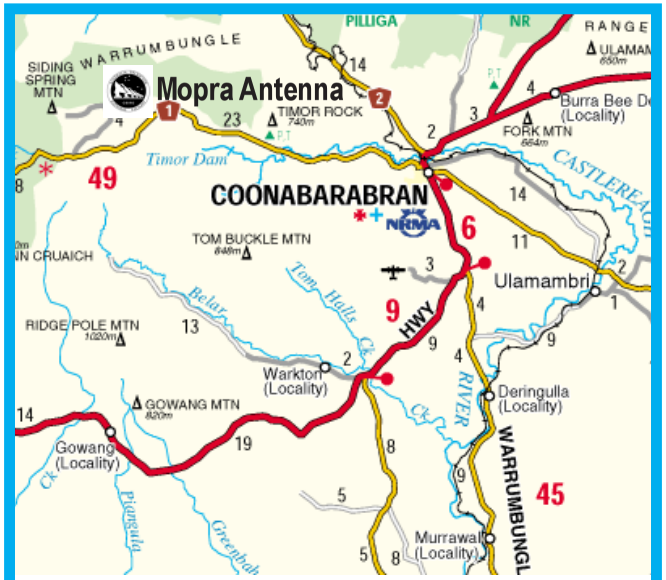
Quasars - giving off more enegy than 100 normal galaxies these bright, starlike sources may be the furtherst objects yet detected in the Universe.

Black Holes - the insatiable glutons of the Universe. Though they can't be seen directly the effects they cause give clues to their hiding places.

Gravitational Lenses - massive objects having enough gravity that they can bend light. Multiple images of the same object can sometimes be seen when the light passes one of these lensing objects.

The Australia Telescope





Map courtesy of NRMA

Located 20km along the Timor Road

Contact details:

Australia Telescope Compact Array
Paul Wild Observatory
Locked Bag 194, Narrabri NSW 2390
Ph: (02) 6790 4070 Fax: (02) 6790 4090
email: narrabri@atnf.csiro.au

Mopra Telescope

CSIRO

AUSTRALIA TELESCOPE NATIONAL FACILITY CSIRO

SCIENTIA MANU ET MENTE

All About The Mopra Telescope

Welcome to the Mopra Telescope, a telescope operated by the Australia Telescope National Facility (a Division of CSIRO). The management of the telescope observations and future development of the facility is through a partnership with the Astronomy Department at the University of New South Wales. The mandate of the Australia Telescope National Facility is to develop and run world-class radio telescope facilities for astronomical research. The Australia Telescope operates three telescopes: as well as Mopra, there is the Parkes 64-m dish (the telescope featured in the movie "The Dish") and an array of six 22-m antennas near Narrabri. Each telescope has its unique strengths: the large size of Parkes means it can see very faint detail, but the detail is somewhat coarse. The Narrabri array sees finer detail, but not as faint. Whereas the Mopra Telescope does not "see" finer or fainter than Parkes and Narrabri, it serves two specialised uses.

Space chemistry

The first of these uses is space chemistry. Mopra has been designed to measure the radio waves that are the tell-tale signs of a large variety of atomic molecules in space. This is particularly relevant to understanding clouds of material in space, which collapse to form stars or which are ejected from stars. It helps us understand the life cycle of stars and the origins of molecules that help to make up all living cells. To observe these molecules, Mopra needs to be in a cool, dry environment at modest height. This is because moisture in the air interferes with the reception of the radio waves from the molecules. Winter nights are the best time to observe.

How it works

Just like a satellite dish, the antenna focuses radio waves into a receiver, which then amplifies the signals. A radio telescope receiver, however, is designed for VERY weak signals, much much weaker than communications signals. The receiver is cooled to 260-270 degrees below zero. At these temperatures air freezes solid! So the receivers are in a vacuum enclosure. Our coldest receiver pumps around liquid helium (nothing gets much colder than this!). The radio signals are not so much signals as we understand it in normal day-to-day life. They are more like the noise we hear between radio stations. What radio astronomers are measuring is the noise strength or noise power. Radio astronomy images are really images of the intensity of this noise power. The noise power is measured by a sophisticated piece of electronics called a "correlator". This is really a super computer which does billions of operations a second. Instantaneously it measures noise power, as a function of frequency at hundreds or thousands of separate frequencies. It is the signature in the change of noise power with frequency that give us information about molecules in the region being observed.

Very fine detail

In addition to studying space chemistry, Mopra is used as one element in a "giant" telescope. By using a technique called "very large baseline interferometry", the Mopra telescope can be used simultaneously with the array at Narrabri and the Parkes dish to see very fine detail. It mimics a telescope at 300km in diameter! Siting the telescope near Coonabarabran was in part for this mode of operation: having a telescope about a third of the way between Narrabri and Parkes was needed.

In addition to working with Parkes and Narrabri, Mopra also routinely works with a number of other radio telescopes. These include telescopes in Hobart and Ceduna (operated by the University of Tasmania), NASA's Tidbinbilla facility (near Canberra), a South African observatory and a Japanese radio astronomy satellite. In conjunction with this satellite, the observations mimic a telescope larger than the size of the Earth in the fineness of detail that it can see!

How do you combine Mopra with other telescopes

When using Mopra with these other telescopes, the noise signals measured by our receiver are recorded on tape. Tapes from all the telescopes are then taken to a central correlator. The correlator compares the signals for all the different telescopes, and from this generates information used to form an image with very fine detail. To achieve this, the clocks used at the different telescopes need exquisite precision: the clocks at these widely separate observatories have to be accurate to better than a billionth of a second.