HIGHLIGHTS

Astronomy highlights

First observations of SNR 1987A at 12 mm (page 19)

One of the principal scientific justifications for the 12-mm upgrade on the Compact Array was to obtain higher resolution images of continuum sources, in particular for the radio remnant of the supernova SN 1987A. In October 2001, the first 12-mm image of SN 1987A was obtained using three Compact Array antennas equipped with interim 12-mm receivers. The data quality shows that the full 12-mm system will be able to produce excellent high-resolution radio continuum images.

HIPASS J0352-6602: a nearby galaxy forming its first stars (page 21)

A massive cloud of neutral hydrogen gas has been discovered from observations taken with the Parkes radio telescope and the Compact Array. The cloud, known as HIPASS J0352-6602, appears to be a very young galaxy that is just beginning to form its first generation of stars.

Polarization in methanol masers (page 22)

The role of magnetic fields in star formation is a matter of heated debate. One way to probe the magnetic fields is to use the polarization properties of masers associated with high-mass star-formation regions. The Compact Array has been used to make the first full polarization observations of methanol maser emission at 6.7 GHz. Four sources were observed with linear polarization detected in all cases.

Searching for neutral hydrogen in groups of galaxies (page 24)

The so-called "high-velocity clouds" are clouds of neutral hydrogen that have higher velocities than expected for sources in our Galaxy. It has been proposed that at least some of the high-velocity clouds are primordial material associated with the formation of the Local Group of galaxies. If so, then other groups of galaxies may also contain similar hydrogen clouds. To test this hypothesis the Parkes radio telescope and multibeam receiver have been used for a sensitive search of neutral hydrogen emission in loose groups of galaxies. For the galaxy group LGG 93, four new detections of hydrogen were made, with hydrogen masses of 10 – 100 million solar masses. For the group LGG 180, three detections were made with slightly higher hydrogen masses.

The magnetic fields of barred spiral galaxies (page 26)

Magnetic fields are believed to play an essential role in determining the large-scale properties of galaxies. Radio observations taken with the Compact Array are being used to produce an atlas showing the magnetic field structures in barred spiral galaxies. The data show that galaxies with strong central bars are associated with a high rate of star formation.

PKS 1257-326: a scintillating quasar (page 28)

Compact Array monitoring observations of the quasar PKS 1257–326 have demonstrated that rapid variability on time scales shorter than a day is a result of interstellar scintillation. The scintillation patterns are produced by focusing and defocusing the radio emission from the quasar, as it passes through patches of turbulence in the interstellar medium. The radio variations follow an annual cycle and this shows unequivocally that the variability is due to scintillation.

On the trail of gamma-ray burst progenitors (page 30)

Gamma-ray bursts provide some of the most luminous events in the Universe but they have not given up their secrets easily. Observations of the gamma-ray burst GRB 011121, taken with the Compact Array and other telescopes, have provided a direct link between gamma-ray bursts and the death throes of massive stars. The optical and radio data for this source are consistent with a supernova explosion of a star that was at least twenty times as massive as the sun, and the birth of a stellar black hole.

Other highlights

Public outreach (page 35)

In 2001, the number of visitors to the Parkes Visitors Centre more than doubled to approximately 125,000. A new Visitors Centre building with upgraded exhibits and audio-visual shows was opened in March 2001.

Public Open Days held at the Parkes Observatory and at Marsfield, Sydney, were hugely successful, attracting several thousand visitors. Feedback from visitors was entirely positive.

MNRF (page 43)

The Major National Research Facilities program funded in 1997 is nearing completion. In 2001 three interim 3- and 12-mm receiver packages were installed on three antennas at the Compact Array. The first of the new array configurations, the EW352 array, was first used in October 2001.

MNRF-2001 (page 53)

On 21 August 2001, the Minister for Industry, Science and Resources announced the allocation of $23.5M to an ATNF-led proposal put forward by the Australian astronomical community. The MNRF-2001 funding will be used to increase Australia's share in the international Gemini Telescopes, and to develop technologies for the Square Kilometre Array (SKA).

Square Kilometre Array (page 55)

The ATNF is one of a consortium of major radio astronomy insititutions in 11 countries now planning the world's next-generation large radio telescope, the SKA. In collaboration with universities and other CSIRO Divisions the ATNF is contributing to the design of the array in several key areas. In 2001, three types of prototype antenna designs were considered, using Luneburg lenses, cylindrical reflectors and phased array antennas. Other development work involved coherent and incoherent interference mitigation techniques. Site investigations within Australia continued to survey and characterize possible locations for the SKA.