ATNF NEWS

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Editorial

The Easter holiday break is now over and for those of you who enjoyed a few days away from work we hope you have come back refreshed.

A lot has happened at the ATNF since the last issue of the *ATNF News*. A number of research projects have reached interesting conclusions and we highlight some of those in this issue. Also, our engineers in the receiver and electronics groups have been doing some excellent work. They have completed a new receiver and feed for the Parkes Telescope (to support the Galileo tracking mission), they have made the first successful tests of a single-channel prototype broadband correlator system for the multibeam project, completed the S2-correlation system for the Australian Long Baseline Array, and are making excellent progress on the construction of the 21-cm multibeam receiver. And, to top off a great year, the Australian astronomy community has been granted funding by the Major National Research Facility (MNRF) funding body to upgrade the Australia Telescope to both higher frequencies and high-resolution performance. The new radio astronomy facilities, plus extended discussions between Australian astronomers and members of the European Southern Observatory, augur well for Australia to join ESO reasonably soon. For our higher degree students of astronomy, the future of Australian astronomy looks very bright indeed.

Raymond Haynes & Dorothy Goddard, ATNF
(rhaynes@atnf.csiro.au, dgoddard@atnf.csiro.au)

What's in this Issue

Telephone Numbers at ATNF's Headquarters

From July 1, 1996 an extra '9' digit must be added to the telephone and fax numbers for all direct in-dial numbers for the headquarters of the ATNF. The new numbers will be, for example, as below:

Telephone: (61 2) 9 372 4100 *

Fax: (61 2) 9 372 4310 *

STOP PRESS PAGE

PUBLICATIONS

To facilitate electronic searches for publications that include ATNF data, authors are requested to include the term 'ATNF' in the ABSTRACT of their papers. We use this information as a performance indicator for National Facility funding purposes. We appreciate your cooperation.

Jessica Chapman, Dorothy Goddard (jchapman@atnf.csiro.au), (dgoddard@atnf.csiro.au).

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* From July 1, 1996 an extra '9' digit must be added

The ATNF MNRF Upgrade

In 1995 the ATNF applied for funding (A$9.74M) from the Australian Federal Government's newly formed MNRF (Major National Research Facilities) program to upgrade the ATNF to short wavelengths. The ATNF has now been awarded funding under this program and we are in the process of developing detailed plans for the VLBI, the Compact Array and the millimetre-wave (mm) aspects of these new developments. All the relevant information, including technical specifications, can be found on the ATNF WWW page.

One of the most exciting aspects of this upgrade is that we will be able to extend the AT Compact Array to work at mm wavelengths. At these wavelengths, as well as getting higher resolution for the objects we study at present, we will also be able to study other processes (e.g. thermal dust emission) and exciting molecular spectral lines that we haven't been able to study before. The AT Compact Array will be the first array in the Southern Hemisphere able to do this.

However, these mm wavelengths also present more of a technical challenge in receiver design than the longer wavelengths do. The ATNF sites at Narrabri and Mopra are at low altitude, and so the AT will suffer from atmospheric absorption and phase degradation at both 3.5 and 7 mm. We do not yet know exactly how much of a problem this will be to observing time, but we do know that it will be worse at 3.5 mm than at 7 mm. Instrumental problems such as dish efficiency and pointing also become more severe at the shorter wavelengths. On the other hand, although there is exciting new science to do at both 3.5 and 7 mm, there is probably more science at 3.5 mm than at 7 mm — e.g. more spectral lines are accessible. The question is: with our receiver and antenna performance, can we really tap into this extra science at 3.5 mm, or would we be better off at 7 mm?

This triggered some vigorous debate recently on whether 3.5 or 7 mm should be given the higher priority. Much of this debate can be viewed from the ATNF WWW page. The debate culminated in a meeting on 'mm science with the AT' held at Marsfield on Wednesday 27 March. After a spirited discussion, a clear consensus emerged among users that the higher priority be given to the 3.5-mm ATCA upgrade.

As the plans develop, we will continue to post the latest information on the WWW.

Ray Norris (rnorris@atnf.csiro.au)

Official Announcements

1996 and Beyond

GALILEO TRACKING

The observing and operations schedule for the Parkes Observatory over the next 3 yr is rather complex. During 1997 the greatest support effort will be directed into tracking the Galileo spacecraft (see the Parkes Observatory report, p. 14). There will be 3 brief periods when we are not tracking Galileo: 2 weeks in January, 22 days in August and 6 days in September 1997. During those periods we will be able to carry out time-critical astronomical observations and access that part of the Galactic Plane otherwise not accessible during the Galileo tracking period. Otherwise, once tracking starts in November a time interval of ~9 h will be allocated to the Galileo track determined by the position of Jupiter. We give below three examples (in UT time) for this track.

Date	Start Time (UT)	End Time (UT)
1/11/96	01 44	10 49
1/ 5/97	16 41	01 13
31/12/97	00 53	09 22

VSOP COLLABORATION

The Japanese VSOP satellite is expected to be launched in September 1996 and, after initial tests have been done, we will be collaborating on a VLBI program using this satellite (see LBA Operations report, p. 15 for more details). This will commit the ATNF to a fraction of observing time at Narrabri, Mopra and Parkes. For example, at Parkes this time is estimated to be, on average, 3 days a month, and this is expected to be maintained through the life of the VSOP mission (at least 3 yr). We plan to continue to support 'normal' VLBI observations to the extent of approximately 1 or 2 days a month.

21-CM MULTBEAM PROJECT

The new 13-beam hydrogen-line receiver at Parkes will be used to conduct the 2 most comprehensive HI surveys ever undertaken. These 2 major programs, which began in September 1996, plus other special projects using this unique receiver, will take a major amount of observing time (see the 21-cm multibeam report, p. 17, for more details).

Marc Price, Bruce Thomas, ATNF

(mprice@atnf.csiro.au), (bthomas@atnf.csiro.au)

News Items

The Parkes Telescope Recommissioning

On Monday 25 March 1996, a recommissioning ceremony was held at Parkes to celebrate the completion of the new focus cabin for the Parkes radio telescope. The focus-cabin upgrade satisfies NASA's requirements for tracking the spacecraft Galileo, as well as those of the radio astronomy community who will be able to switch receivers quickly and so achieve greater flexibility in changing observing frequencies.

Among those present at Parkes were Dr Ed Stone, Director of the JPL (who had just come from addressing an audience of about 400-450 people at Sydney's Powerhouse Museum about the Galileo mission and the role of the Parkes telescope), Mr Ted Ankrum, the NASA representative in Australia, Mr Malcolm Farrow, Executive Director of the Australian Space Office, Dr Malcolm McIntosh, the new chief executive of the CSIRO, and members of the ATNF Steering Committee. In all we had about 100 visitors at Parkes for the ceremony.

After several weeks of hard work, Parkes staff did a wonderful job of organising, as did, Helen Sim, the ATNF Communications Manager. Our photographers, John Masterson and Stewart Duff, provided photographic displays, and Stewart, together with Tim Becker Productions, put together a 7-min video of the upgrade, edited from his 16 hours of video footage— with voice, music and titles — in only 4 days. This video has been sent to TV studios for inclusion in news broadcasts.

The ATNF staff and the industry collaborators were thanked for their fine efforts in completing the work on time and within budget, and the possibility of future technical collaborative projects with JPL/NASA looks promising. The ceremony ended with a rather dramatic unveiling, complete with rolling clouds of liquid nitrogen, as the new 2.3-GHz receiver and feed, designed and manufactured by the ATNF for the Galileo observations, was revealed. At one stage, it seemed that the receiver would be launched into orbit, but after the 'fog' dispersed, we were all somewhat relieved that it was still with us.

The Parkes staff laid on a first-rate lunch, and then the visitors went on the traditional ride on the dish. Some of our contractors disappeared into the focus cabin without letting the rest of us know, and missed the bus to the airport. We were mystified to discover that, even so, they arrived at the airport before us; it seems that a Parkes driver took them to the airport via a back road (and in the country, this is usually more akin to a dirt track) at high speed.

It was a very successful day, and I think our special guests and the press were favourably impressed. Thanks to all who helped.

B MacA Thomas, ATNF
Project Manager, Parkes Upgrade

(photographs taken at the recommisioning are shown on page 4. Addendum to this News Item on page 10.)

Photographs of the recommisioning of the Parkes 64-m Radio Telescope

l to r.: Bob Frater (Deputy Chief Executive, CSIRO), Marc Price (OIC, Parkes), Malcolm Macintosh (Chief Executive, CSIRO) and (above) Bruce Thomas (Project Manager for the telescope upgrade) at the base of the lift leg shortly after the recommissioning ceremony.

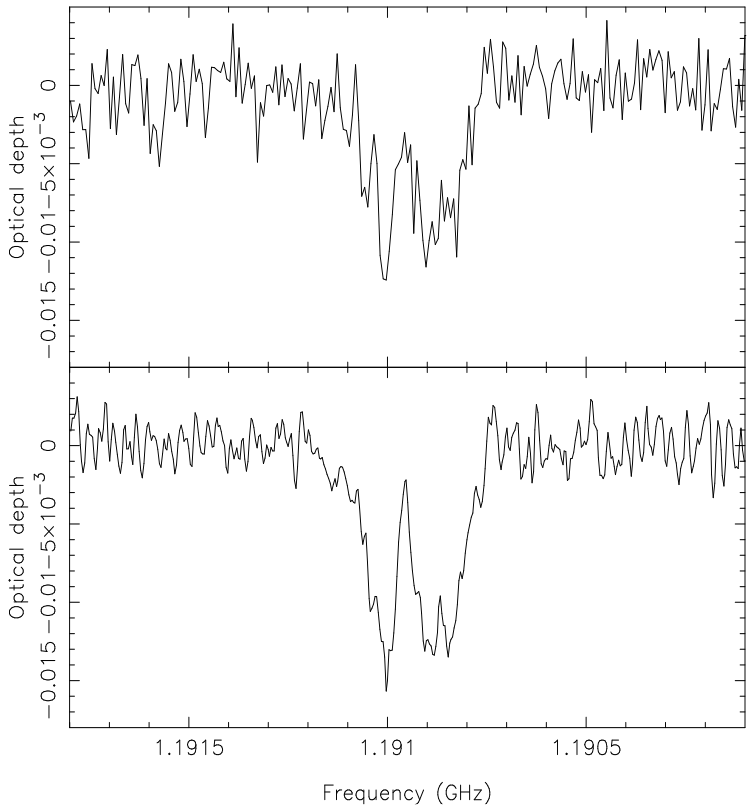
On the azimuth track and near one of the zenith drive gearboxes Dick Manchester (right) explains the working of the telescope to (l to r) Jeff Schafer and Alan Chappel.

Parkes radio telescope with the new focus cabin.

Articles

The Absorption Line towards the Einstein Ring PKS 1830-211

In 1991 we identified PKS1830-211 as an unusually strong, ~10 Jy, Einstein ring/gravitational lens. While the interpretation as an extragalactic gravitational lens is secure, this object lies in a crowded and obscured field close to the Galactic Centre; so far, all attempts to identify optical counterparts for either the lensing galaxy or the lensed object have been unsuccessful. Therefore, in June 1995 we used the Parkes telescope to search for radio absorption over the frequency range 1.0 to 1.7 GHz. (This search was done with the receiver designed for Project Phoenix; see *ATNF News*, no. 26, p. 6.) We were able to confirm the weak, single absorption system at 1.2 GHz using the ATCA (Fig. 1). We interpreted this as HI absorption at a redshift of 0.2 and showed that the absorption was centred on the lens.



HI observations towards PKs1830-211

Successful VLBI observations were made in September 1995 to image the absorption using the ATCA in phased-array mode (Mopra, Parkes and Hobart). The recent discovery of molecular absorption at a redshift of 0.88 covering the south-west component raises the question of whether there are two large mass distributions along the line of sight to PKS1830-211 and suggests that we may be seeing a compound gravitational lens.

J Lovell, E King, P McCulloch, Univ. Tasmania; R Gough, D Jauncey, J Reynolds, A Tzioumis, ATNF; R Preston, JPL (jlovell@phys.utas.edu.au)

Investigating the Compact Radio Emission in 60-mm Peaker Galaxies

Producing a scheme that 'unifies' the many kinds of active galactic nuclei (AGNs) has been a significant aim in astrophysics for several years. According to the 'unified' models, the different optical spectroscopic classifications of AGNs, e.g. Seyfert 1 and Seyfert 2, are the result of orientation and/or obscuration effects. The main observational evidence that AGNs have an aspect-dependent appearance comes from spectropolarimetry studies, which show polarized broad emission lines in Seyfert 2 galaxies. To date, roughly a dozen 'hidden' broad-line regions have been detected in Seyfert 2 galaxies, most of which are contained in the *IRAS*-selected sample of 60-mm Peaker galaxies.

More recently, increasing interest has been shown in the relationship between star-formation activity and AGNs, many authors proposing an evolutionary connection. On the other hand, the differences between the optical spectra of starburst and Seyfert galaxies may be caused by differing degrees of obscuration of the core – an effect of differing orientations.

To investigate the unified scheme for AGNs we used the sample of the 60-mm Peaker (60PK) galaxies already mentioned. The 60PKs consist of all extragalactic sources in the *IRAS Point Source Catalogue* with good-quality detections at 25 and 60 mm at the absolute value of b >10°, and with flux density ratios f(60)/f(100)>1 and 4 >f(60)/f(25)> 1.

We used the 275-km baseline of the Parkes-Tidbinbilla Interferometer (PTI) to study the central powering source in the dust-obscured *IRAS* galaxies. The PTI is ideal for such an investigation because it is sensitive to structures with brightness temperature greater than 10**5 K and sizes less than 0.1 arcsec. Thus the PTI can detect radio emission from compact sources associated with AGNs but does not see extended star-formation regions, which have typical brightness temperatures of less than 10**4 K. Each galaxy was observed for typically 20 min, providing a 5-sigma sensitivity at ~ 3 mJy at 2.3 GHz.

Compact radio cores were detected in 43% of the 60PKs but the detection rate varied markedly according to whether the 60PKs were classified as starburst or Seyfert galaxies. Compact radio cores were not detected in any of the galaxies that were classified by optical spectroscopy as starbursts. On the other hand, of the 60PKs classified as Seyferts, 67% contain high-brightness-temperature,

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compact radio cores. This is higher than the typical detection rate (less than 50%) for other samples of Seyfert galaxies that have not been selected on the basis of their far-infrared spectral energy distribution. It seems, then, that the optical spectroscopic diagnostics by which we classify galaxies as starburst or Seyfert galaxies tell us something about the differences in their radio core properties. The Seyfert and starburst galaxies in the 60PK sample form two distinct populations. We conclude that the starburst 60PKs are not simply dust-obscured active galactic nuclei.

Finally, we have found that the 60PKs without compact radio cores lie along the well-defined correlation between radio and FIR fluxes, while those with compact cores are too radio-loud compared to their FIR emission to fit the correlation. This result is not because of sensitivity in the radio, as many of the galaxies *without* PTI detections have radio luminosities that are as high or higher than 60PKs *with* PTI detections. We conclude that the Seyferts with PTI-detected cores have an additional nuclear component dominated by the radio emission, while those without PTI-detected cores are dominated by starburst activity.

C A Heisler, AAO; R P Norris, D L Jauncey,

J E Reynolds, ATNF; E A King, MSSSO

Water Masers Point to Black Hole

For several years astronomers have been trying to understand a phenomenon known as 'megamaser' activity, in which a substantial fraction of the molecular gas in a galaxy – usually OH or water – is stimulated to emit maser radiation. In the few galaxies where this happens, the energy emitted in the molecular line is typically about a million times brighter than the normal maser emission seen from star-formation regions.

This area of research shot to prominence last year when a Japanese/American team found that the water masers in one of these megamaser sources, a galaxy called NGC 4258, appeared to be rotating around a 10-million solar-mass black hole. This finding is the best hard evidence yet of the existence of massive black holes. Astronomers world-wide are now searching intently for other examples.

A team using the Parkes telescope has found evidence for one in the Circinus galaxy. The masers in this galaxy have velocities that lie up to 200 km/s above and below the systemic velocity of the galaxy. This is less than the +/-900 km/s seen in NGC 4258 but probably indicates that as in NGC 4258 the masers may be distributed in a Keplerian disk, possibly around a lower mass black hole.

Surprisingly, some of the maser features vary rapidly in intensity, e.g. doubling in strength in as little as 10 min. This flickering, which has never been seen before, is probably not caused by the interstellar medium but is intrinsic to the masers: by light-travel-time arguments this means that these masers must be very small, less than a few light-minutes across. A team plans to study the source with

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Time-averaged spectrum of the water maser emission from the nucleus of the Circinus galaxy. The systemic velocity of

Articles

the galaxy is indicated by the arrow.

VLBI in 1996, and these VLBI results, together with the short-time variability, should give us some powerful insights into the nucleus of this galaxy.

R P Norris, R G Gough, M W Sinclair, ATNF; L Greenhill, J M Moran, Univ. Sydney (CfTA), S P Ellingsen, Univ. Tasmania; R Mushotlsky, NASA-Goddard (rnorris@atnf.csiro.au)

NOTE: The high-velocity lines in the Circinus galaxy were also independently discovered at Parkes by a team consisting of: N Nakai, M Inoue, K Miyazawa, M Miyoshi, and P Hall *(eds)*

Radio light curves for 3 of the strongest spectral components from the Circinus Galaxy: top - 561.85, middle - 556.60, bottom - 294.51 km/s.

NGC 7421: Surfing the Intracluster Medium?

A surprisingly large fraction of apparently non-interacting, isolated spiral galaxies display clear asymmetries in their light distribution. Recent results from the *Hubble Deep Field* indicate that such asymmetries may have been even more common in the past. Often however, studies of the underlying mass distribution of neutral hydrogen reveal much of this asymmetry to be mainly 'cosmetic', attributable to (in the case of NGC 1313; Ryder *et al*. 1995, *AJ*, **109**, 1592) such factors as the presence of an HI superbubble. However, the recognition of an inherently non-circular and asymmetric population of galaxies would have major ramifications for topics as fundamental as the derivation of disk inclinations, dark matter haloes, and the Tully-Fisher relation.

NGC 7421 is an SB(r)bc galaxy, seen at low inclination, that appears to sit slightly off centre in a low-surface-brightness envelope some 2 arcmin in diameter. NGC 7421 exhibits a complete inner resonance ring (Buta 1995, *ApJS*, **96**, 39), but instead of a complete outer ring, a semi-circular arc of HII regions forms a sharp western boundary to the galaxy. Since NGC 7421 is a prominent member of Maia *et al*.'s Group no. 40 (Maia *et al*. 1989, *ApJS*, **69**, 809), one gets a strong impression that this arc may represent some sort of a 'bow-shock' effect as NGC 7421 ploughs its way through the intracluster medium, while the off-centre envelope may represent the 'wake' of its passage.

To test this hypothesis, we are currently analysing some 16,000 s of publicly available *ROSAT* PSPC observations to check whether the density of diffuse hot gas in this group is sufficient to account for any gas sweeping. The dynamics of the ionised gas in the inner disk of NGC 7421 are being looked at with the Rutgers Fabry-Perot spectrometer on the CTIO 4-m telescope. We have also mapped the distribution and kinematics of the HI gas in NGC 7421 using a total of 5 configurations of the ATCA (0.375, 750C, 1.5D, 6C, and 6D) between September 1995 and January 1996.

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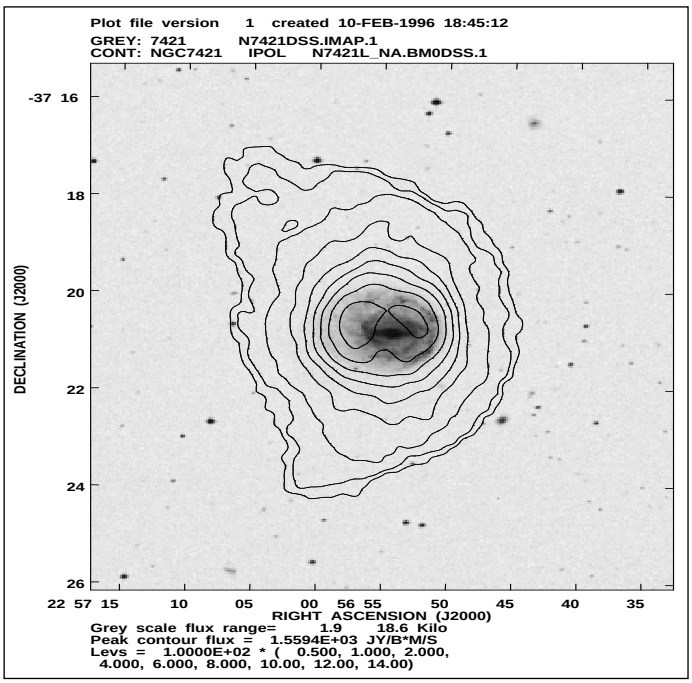


Contours of HI column density in NGC 7421 as mapped with 5 configurations of the ATCA, superimposed on a blue-light image from the Digitized Sky Survey. Note the prominent arc of star-forming regions on the galaxy's western edge, and the 'bow-shock' appearance of the HI disk, both suggestive of an interaction with some form of intergalactic medium.

The figure on p. 7 shows the HI column density (resolution ~ 50 arcsec) overlaid on an optical image of NGC 7421 from the *Digitized Sky Survey*. The gas disk extends over 3 times the size of the optical envelope. The impression of a 'bow-shock' from the optical disk is reinforced by the shape of the HI disk. The northern and southern cusps are consistent with the galaxy's ploughing (or rather 'surfing', since the gas has not been entirely stripped) its way westwards through some intracluster medium. There is not significantly more gas underlying the western arc of HII regions than underlies the eastern half, though vigorous star formation on the western side may have already consumed much of the accumulated gas. The HI velocity field (not shown) is also highly unusual in that the kinematic line-of-nodes (the normal to the isovelocity contours), and the major axis of the HI isophotes, are *perpendicular* to one another, instead of in the conventional parallel alignment. It is possible that ram pressure has 'squeezed' the disk, but then rotation ought to result in the disk's being elongated preferentially in one direction. Alternatively, the gas may actually be 'tumbling' about the galaxy's major axis, as in the amorphous dwarf starburst galaxy NGC 5253 (Kobulnicky & Skillman 1995, *ApJ*, **454**, L121).

NGC 7418 is another member of the same group as NGC 7421 and we were able to construct successfully an HI cube for NGC 7418, even though it lies just outside the 34-arcmin primary beam of the ATCA! The gas isophotes in NGC 7418 show distortions consistent with a more traditional warp, but provide further evidence of the turbulent intracluster environment in which NGC 7421 and NGC 7418 find themselves.

S Ryder, UNSW , D Davis, G Purcell, V Andersen, University of Alabama (sdr@newt.phys.unsw.edu.au)

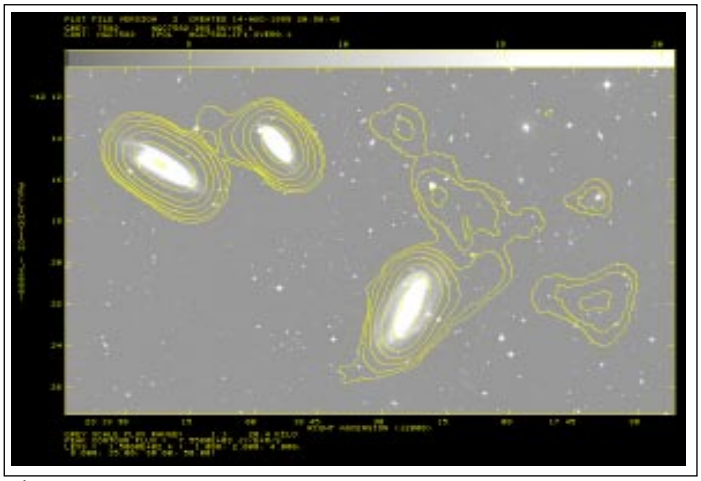
The Grus-Quartet: strongly interacting spiral galaxies

The Grus-Quartet consists of 4 large spiral galaxies which are so close to one another that they should be interacting. The high starburst activity of two of the members, NGCs 7552 and 7582, is also thought to arise from tidal galaxy-galaxy interactions and the subsequent forming of a bar in the disk. As the 21-cm line of the neutral hydrogen atom (HI) is the best tracer for extended emission from galaxies, we have observed the Grus-Quartet with several configurations of the Australia Telescope Compact Array (ATCA). The Figure shows the HI distribution (contours) of NGC 7582 and two neighbours, NGCs 7590 and 7599, overlaid onto the optical emission (grey scale) from the *Digitized Sky Survey.* The contour levels are 0.15, 0.3, 0.6, 1.2, 2.25 and 4.5 Jy/beam km/s. Please note that no primary beam correction has been applied here. Several tidal tails extending from NGC 7582 are visible, one pointing towards the neighbours in the east and the other towards NGC 7552 which lies at a projected distance of about 30 arcmin to the north-west. Data obtained only with the 375-m array of the ATCA have been used to produce this image. The angular resolution is about 1.5 arcmin. The interaction between the group members is also clearly visible in their velocity fields. A detailed description of these and other interacting galaxies plus a global picture relating the tidal interaction to the bars, nuclear rings and starburst activity observed in most of these galaxies is given by

B. Koribalski (1996; in Minnesota Lectures on *Extragalactic HI*, ed. E. Skillman, ASP Conf. Ser. not yet published).

B Koribalski, J B Whiteoak, ATNF (bkoribal@atnf.csiro.au)
T E Lavezzi & J M Dickey , Univ. Minnesota (USA)

Footnote:
The *Digitized Sky Survey* was produced by the Space Telescope Science Institute (STScI) and is based on photographic data from the UK Schmidt Telescope, the Royal Observatory Edinburgh, the UK Science and Engineering Research Council, and the Anglo-Australian Observatory.



HI distribution of 3 galaxies in the Grus-Quartet

Shock-excited OH maser emission

This year a team of Australian and American astronomers used the Australia Telescope to study a new class of 1720-MHz OH masers, found in supernova remnants. Using the Parkes telescope, they made an initial survey of most of the Galactic supernova remnants visible from the Southern Hemisphere; then, with the Compact Array, they followed up the interesting detections to confirm the maser character of the emission and to obtain accurate positions. There is good evidence that 1720-MHz masers occur because the OH is collisionally excited by H_2 molecules, and so the presence of these masers signals that the supernova is interacting with an adjacent molecular cloud.
These 'signposted' supernova remnants are ideal candidates for future millimetre- and submillimetre-wave observations to study the kinematics and chemistry of molecular shocks. And the masers themselves offer the means to measure the density and temperature of the post-

(cont. next page)

Articles

The Mopra 3-mm receiver

The 3-mm receiver has two SIS (superconductor-insulator-superconductor) mixers, one for each orthogonal linear polarization, and operates in the frequency band 90 to 120 GHz. Each channel has a dedicated local oscillator (LO) and phase-lock control panel and an associated SIS mixer bias control panel.

The receiver is mounted on the rotator in the cone room of the Mopra 22-m antenna and was built using a standard receiver frame on top of which is mounted an optics box. The box contains shaped and flat mirrors which translate the cassegrain focus of the antenna to the lens-corrected feed horn within the dewar. Ideally, the receiver would be mounted to avoid using the optics box but physical constraints imposed by the 13 to 20-cm feed do not allow this.

The signal path has both polarizations traversing the optics box and then they are split in wire grids outside the dewar. Each polarization then enters the dewar via a vacuum window, passes through an infrared filter and meets a lens which focuses the signal to a feed horn. The LO is coupled into the signal path via a waveguide coupler allowing both LO and signal to be presented to the mixer. The resulting intermediate frequency (IF) is amplified by a HEMT amplifier; it then exits the dewar to be further amplified in an RF module, mounted on the side of the receiver, before passing to the standard AT conversion rack in the antenna vertex room.

The lens, feed horn, LO coupler, SIS mixer and IF amplifier are cooled to 4 K by a closed-cycle helium system using a Joule-Thomson circuit to liquefy the helium.

The receiver has operated flawlessly since its installation in early August 1995. The cryogenic system has been leak free and the electronics have proven solid with LO phase-lock loops and IF total powers very stable. Initially the time taken to tune the receiver was measured in hours but with experience and by tabulating the settings for a variety of molecular lines, a frequency change is now done in 20 to 25 min. Once the task of automating the remote tuning is completed it will allow the channels to be independently tuned from the control room using a PC. This automation should be done by May 1996.

Receiver SSB noise temperatures have been close to expected values at the lower frequencies of the mixers' tuning range (typically 80 K) but slightly higher at the upper frequencies which includes the CO line at 115 GHz (typically 150-170 K). Tests to investigate this problem will be done before the receiver is re-installed at Mopra.

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Official Announcements

HI in the Local Universe

The ATNF is to be host to a workshop on *HI in the Local Universe*, 13 - 15 May 1996, Marsfield.

The purpose of the workshop is to explore the scientific potential of a new 13-beam, 21-cm receiver due to be put into commission on the Parkes telescope later this year. (See the 21-cm multibeam report, p. 17.)

The workshop will explore issues such as large-scale structure, HI mass functions, Ly-alpha forest lines, EUV background, HI-HII galaxies, crouching giants, zone of avoidance, group dynamics, and galaxy formation. These issues also relate to several other large-scale IR (2MASS, DENIS), optical (2df) and radio surveys (MOST, VLA) which are either under way or are being planned.

There will be 12 invited speakers plus approximately 30 registered speakers from 9 different countries.

Silicon Graphics is providing new demonstration terminals which will be on display during the course of the workshop. The non-scientific highlight of the workshop will be a fully catered dinner cruise (Vagabond Cruises) on Sydney harbour on Tuesday 14 May.

We hope that the workshop will be very successful in promoting many possible future collaboration projects; such projects are planned for discussion during its course.

Our workshop WWW address is:

http://wwwatnf.atnf.csiro.au/people/lstavele/13beam/workshop.html

For further information please contact me at the address shown below.

Lister Staveley-Smith, ATNF
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Shock-excited OH maser emission

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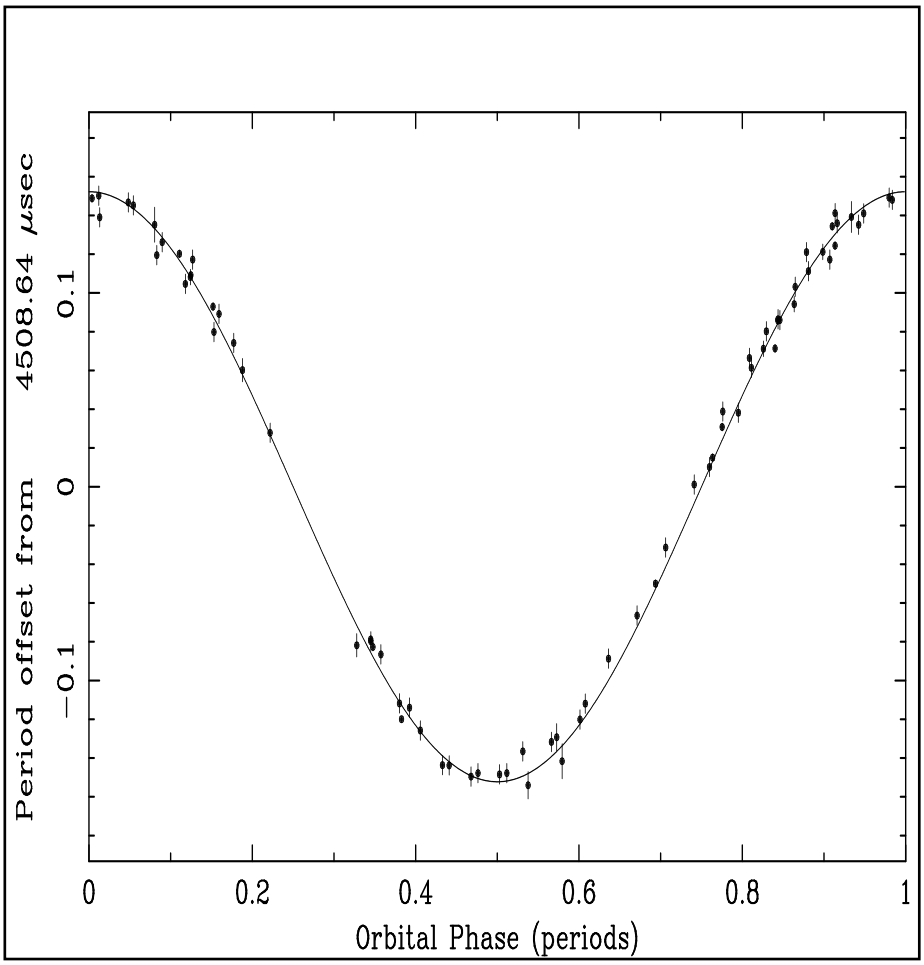
shock gas, to determine the systemic velocity of the remnant and, through Zeeman splitting, to measure the magnetic field.
The Compact Array has found the 1720-Mz maser line not only in Galactic supernova remnants but also at many points in the Galactic Centre. One such region is the interface between the Sgr A East supernova remnant and a molecular cloud (M-0.02,-0.07); another lies in the circumnuclear disk. These exciting new detections give unambiguous evidence for shocks in the Galactic Centre and indicate the presence of magnetic fields of about 4 mG.

D A Frail, W M Goss, NRAO; E B Giacani, E M Reynoso, IAFE; A J Green, Univ. Sydney; R Otrupcek, ATNF; D A Roberts, Univ. Illinois; F Yusef-Zadeh, Northwestern Univ.

Probing the Eclipse Region of a Binary Millisecond Pulsar



PSR J2051-0827 is one of the most exciting objects found in the recently completed survey of the southern sky for pulsars, made with the Parkes telescope. This pulsar has a pulse period of 4.5 ms and so is one of the relatively small group of known 'millisecond pulsars'. Furthermore, it is orbiting around another star with the extremely short orbital period of 2.4 h, and it is apparently blasting the surface of this companion star, creating a stellar wind which eclipses the pulsar every orbit. For approximately 10% of the orbit, when the pulsar is behind the companion star, the gas flowing off the companion either scatters or absorbs the pulsar radio beam. The orbital parameters show that the companion is very light, only about 3% of the mass of the Sun, suggesting that much of the mass of the original companion star may have been blown off by the impact of high-energy particles from the pulsar.

At radio frequencies above 1 GHz the radio beam can usually penetrate the stellar wind. This allows us to measure the time delay arising from the signal's dispersion by the wind, and hence estimate the gas density of the wind. The derived densities vary greatly from one eclipse to another, showing that the gas density in the wind is highly variable. This is the first time such measurements have been possible and they should yield valuable information on the wind structure and mass loss from such binary systems.

B W Stappers, MSSSO; M Bailes, Univ. Melbourne; A G Lyne, Univ. Manchester, NRAL; R N Manchester, ATNF; N D'Amico, Osservatoria Astronomico di Bologna; T M Tauris, Aarhus Univ.; D R Lorimer, MPIfR; S Johnston, Univ. Sydney; J S Sandhu, Caltech. (bws@mso.anu.edu.au)

(continued from page 3)

Addendum: A progress report on performance testing

The Receiver Group and Parkes staff began testing receivers and antennas in February, ready for the 2-days-a-week JPL testing and integrations. JPL then compared the G/T (antenna gain/system temperature) performance of the Parkes telescope with the Tidbinbilla 70-m antenna. The results confirmed the earlier ATNF system temperature of 20.5 K. Even though this is the lowest system temperature ever achieved at Parkes, it is still about 3.5 K above the design objective (3.5 K corresponds to only 0.05 dB loss). Some aspects of the receiver input waveguide, flanging and feed-horn construction will be investigated to try to reduce the 3.5-K short-fall.

Further optimization is being done in collaboration with JPL.

During the shutdown to examine the azimuth bearings, in the week beginning 25 March, both the feed and receiver flange joints will be modified according to JPL's magic methods, developed after years of experience. Many thanks to our machine shop for taking up this challenge at such short notice. The excellent cooperation between CSIRO and JPL has been a key feature of the upgrade program and we look forward to its continuing for many years to come.

B MacA Thomas, ATNF

Project Manager, Parkes Upgrade

News Items

ATNF Repairs and Maintenance (R&M) Program

We are currently engaged in two major R&M projects at the observatories.

PARKES

In October 1994, we found evidence of azimuth roller-bearing failure. Subsequently the two azimuth gearbox rollers and their bearings were removed in December 1994 and both inner and outer bearings were replaced.

In mid-1995 an engineering firm (ICI) was engaged to do vibration and grease analysis tests on all of the Parkes telescope's major bearings. The bearing tests were done at Parkes in August, September and November 1995. In addition, ICI tested the azimuth gearboxes, the results of which indicated that, although no serious problems were evident, we should consider replacing some of the gears within the next 5 yr. However, the vibration analysis of the bearings suggested serious wear problems on all bearings, requiring more immediate attention.

3 of the inner azimuth bearings were inspected in November 1995 to confirm the vibration analysis results. Fortunately, this inspection indicated that all 3 bearings were in good-to-excellent condition, which throws doubt on the ability of vibration analysis techniques to condition-monitor slow-rotation bearings (VLA experience also supports this conclusion; see VLA test memo 195).

However, as part of a risk-management strategy for our forthcoming support for the NASA/Galileo experiment, we are replacing the outer (and perhaps inner) bearings on the 2 idler azimuth rollers. This is being done as this issue of the *ATNF News* goes to press. (The bearings have not been replaced since construction of the telescope was completed in 1961.)

NARRABRI

Over the past few years we have been having problems with the Compact Array rail track and ballast. The problem presents itself as lateral track movement causing a gauge loss of up to plus or minus 12.5 mm in 9.6-m nominal gauge.

Survey indicates that the track movement is confined to the lateral direction and that it has maintained its height setting quite well.

Remedial work to remove, replace and repack the ballast between station 14 and station 23 needs to be done. Additional ties will also be installed to help maintain gauge.

This work is being done right now.

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Articles

Intra-binary Emission in V505 Sgr

We have been investigating the radio emission properties of the active components of RS CVn and Algol binaries. These two types of binary star show very similar radio properties even though Algols contain a single active star, whereas RS CVns, by definition, contain 2.

We observed the eclipsing Algol-type binary system V505 Sagitarii with the Australia Telescope Compact Array at 6 and 3 cm in April 1995. We found unresolved radio sources at the 1.5-m Jy level coincident with the optical position of the target. Fig. 1 shows the cleaned 6-cm image of V505 Sgr.

We have analyzed the radio flux variations for V505 Sgr after carefully removing contaminating sources from the image plane. The flux evolution was formed by vector averaging the real components of the visibility data after carefully shifting the source position to the phase centre. Fig. 2 shows the radio light curve at both wavelengths plotted as a function of orbital phase. Error estimates are based on an analysis of confusing sources within the beam of the telescope. We have found substantial variability in the radio flux from V505 Sgr with a high degree of correlation between signals observed at 2 separate wavelengths. Furthermore, the flux levels appear to decrease at orbital phases centred approximately at 0.5 and 1.0, i.e. at both conjunctions of the system. The decrease in flux is about 75% of the mean out-of-eclipse level and, based on error estimates, is approximately 6 times the minimum detectable variation.

We can demonstrate that the radio emission is more than 1x10**8 times the flux expected from a thermally emitting plasma associated with the accretion stream in this system. We assume that the emission mechanism is gyrosynchrotron from mildly relativistic particles in the magnetic field of the active G5 IV star in this system and thereby infer a brightness temperature of $T(b) \sim 2.7 \times 10^{**9}$ K, a magnetic field of $17 < B < 170$ Gauss and an electron density of $N(e) \sim 3.7 \times 10^{**8}$ cm/cc. These values are typical of those found for other active stellar coronae.

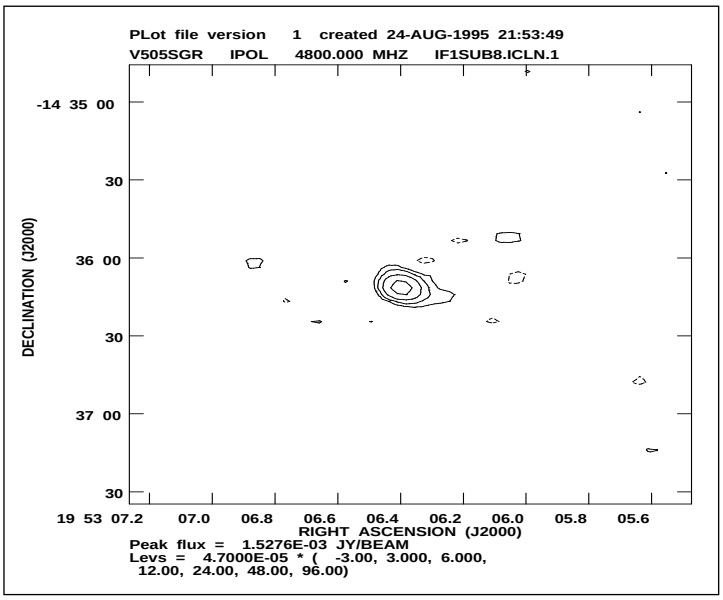
The dual-eclipse nature of the radio light curve implies that the emission region is located between the two stars. VLA observations of this system by Umana *et al.* (1993, *A&A*, **267**, 126) revealed evidence for a core-halo structure with a core size almost equal to the intra-binary region, but the observers were unable to infer the spatial location of the emission. The core-halo structure of RS CVn and Algol-type binaries is often explained in terms of an expanding magnetic loop on the active star since this mechanism is independent of binarity and since Algols contain only one active star.

A. G Gunn & J G Doyle

Armagh Observatory, College Hill, Armagh,

N. Ireland, BT61 9DG

Fig. 1



ATCA 6-cm cleaned image of V505 Sgr. The flux contour levels are at -3, 3, 6, 12, 24, 48, and 96 times the rms noise level in the image.

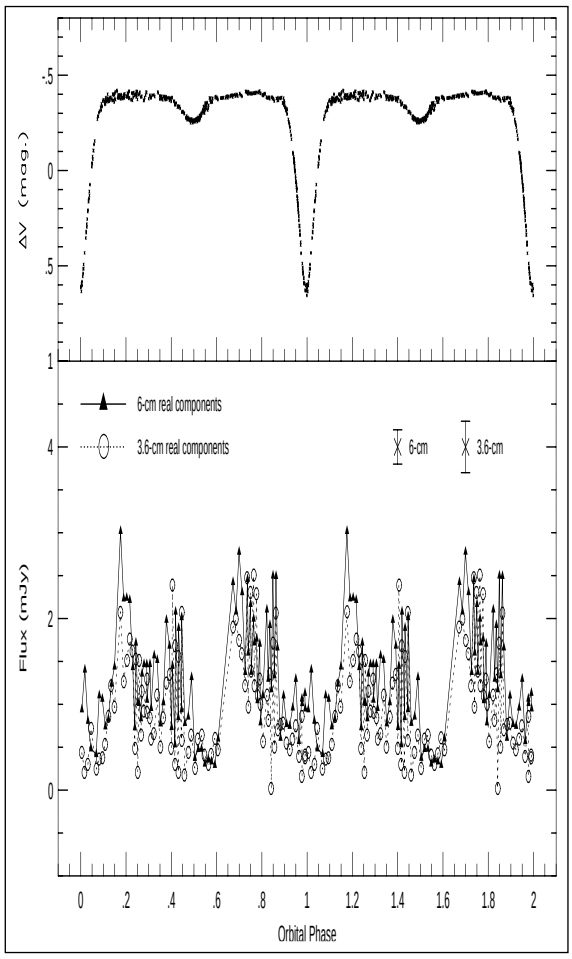


Fig. 2
Radio flux variations in V505 Sgr at 6 and 3.6 cm. Also plotted are estimated error bars for both wavelengths. The upper panel shows the optical light curve (V-magnitude). Note that data have been plotted twice to help interpret the variations.

Regular Items

Computer Group Report

COMPUTER SERVICES

Building moves

The computer room move is now complete, and the Convex will be switched off and disposed of as soon as the old computer room is needed. The network infrastructure, including the FDDI fibre, the old thin Ethernet segments and the local-talk telephone cable, has been re-routed.

Central services

Nearly all our Sparcstations have now been upgraded to Solaris 2. The Computer Group has undertaken a 'Continuous Improvement' project looking at user support. The number of support people has been increased from 3 to 8 and a rolling 8-day cycle has allowed a more flexible support arrangement.

An NT server is now running. This provides a number of services including a central password validation point for Microsoft-based network services. This server will become more important as the Windows 95 (96/97) operating system starts to be used (after validating the programs that run at Marsfield).

The link from Mopra has now been reconnected directly to Narrabri rather than via Parkes. The whole issue of link capacity and future needs is being examined by a working group, who have noticed that when remote observing is being run from Marsfield, it can inflict a constant 25% load on the link.

ATNF DATA ANALYSIS SUPPORT

General

(i) The new DEC Alpha (running Unix) servers are being installed at Parkes and Narrabri.

(ii) As part of the plan to distribute software code and binaries to the observatory sites also, so that all platforms are running the same software, NIS was extended from the Marsfield network to Parkes and Narrabri.

Miriad

As usual, there have been many minor bug-fixes, enhancements and extensions to Miriad in the last few months. Notable changes follow:

(i) an updated version of the Miriad manual has been produced. Copies are available from Bob Sault or Henrietta May. This includes new chapters on spectral-line analysis (contributed by Keith Jones & Tom Oosterloo);

(ii) the procedure to apply "XY phase" corrections has changed. Previously there was a special task to do this (ATXY); now we recommend that you apply the on-line XY phase measurement to the data directly, during loading (options=xycorr in ATLOD);

(iii) there are two new tasks for source finding: *imsad* (written by Niven Tasker) and *sfind* (written by Andrew Hopkins);

(iv) a LINUX version of Miriad is now available at Marsfield;

(v) a DEC Unix version of Miriad is now available on the new DEC Alphas;

(vi) there are some new tasks and subroutines giving planetary ephemerides;

(vii) the cg tasks have been extensively reworked, completing the upgrade calculations to within Miriad from linear to fully nonlinear. The changes seen by the user are minor;

(viii) a new visibility file editor (similar to the AIPS task IBLED) is being written.

AIPS

15JAN95 is now running smoothly and installation of AIPS on DEC Alphas has begun.

SPC

Several bugs have been fixed, port/installation is starting and WWW documentation is being improved.

aips++

We have acquired a new Sun Ultra 140 server specifically for aips++ work. It is configured with 192 MB of memory (essential for aips++ C++ compilations to run at a reasonable speed) and a fast-wide 9 GB disk.

ATNF contributions to aips++ have been

(i) implementing a simple system for putting template instantiations in the class library;

(ii) finishing the basic coordinate conversion routines (precession, nutation, annual aberration and solar position for gravitational bending). Also, the unit and quantum class speeds were improved substantially;

(iii) re-working the visibility MeasurementSet. It is now a table with a collection of subtables for antenna, feed, frequency etc. information;

(iv) updating the single-source FitsFiller, the visibility iterator and the VisSet to use the new MeasurementSet;

(v) working on simulation software so that the MEGI formulation can be well explored;

(vi) planning the general layout of the 21-cm multibeam display software, and writing the user specifications for the multibeam visualisation software multibeam.

Also, the multibeam receiver project is using aips++ as its software base (see the 21-cm multibeam report, p. 17).

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Electronics Group Report

STAFF

After over 30 years' service to CSIRO, Keith Cambridge retired at the beginning of February. We thank Keith for his sterling efforts for the ATNF over the years. The special qualities he brought to his work, particularly his dependability and attention to detail, will be sorely missed. Keith's position has been filled by Chris Lamont who most recently worked for Electrodata; he has an RAAF background.

Evan Davis left in January to join the NRAO in Tucson as part of the continuing exchange scheme between the ATNF and the NRAO. Evan is expected to be away for 12 months.

PARKES MULTIBEAM SYSTEM

A 2-channel prototype of the multibeam sampler/correlator system has been very recently tested at Parkes (see detailed 21-cm multibeam report, p. 17).

LBA CORRELATOR

The LBA correlator was officially opened by Bob Frater during the Asia-Pacific Telescope Conference in early December. Some work remains to be completed, particularly the LBA modifications to the correlator modules.

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Parkes Observatory Report

The Parkes telescope has been successfully re-commissioned following the focus cabin upgrade described in the last AT*NF Newsletter*. The major advantages of the new arrangement are the ability to track the elevation-dependent focus position and to change receiving packages on timescales of minutes, giving the telescope much greater frequency agility. Parkes staff were heavily involved in the engineering aspects of the upgrade and local operational staff were primarily responsible for the characterisation of what is effectively a new instrument. An official re-dedication ceremony for the telescope was held on March 25 (see story on p. 3).

First indications are that the upgrade project will produce the expected performance and operational advantages despite some teething troubles with the receiver platform translator, particularly the transverse-drive-motor assembly. Telescope sensitivity is close to that expected although tests above 8 GHz have yet to be done. Interestingly, first indications are that astigmatism is now evident at 8 GHz. Work continues to optimize performance at 8 GHz and above. Telescope-pointing performance appears unchanged although more detailed investigations are yet to be made.

Scheduled astronomy resumed at the beginning of March but most daytime programs are affected either by first-round Galileo test observations or by Parkes system/technical tests. Following a major shutdown at the end of March for more azimuth bearing replacements, the telescope will be available for an increased amount of scheduled astronomy. However, two 10-h Galileo tracks a week will continue until late 1996, when tracking commitments rise to one track of Galileo for, nominally, 9 h a day until 31 December 1997.

Activities at Parkes now centre on Galileo support, the multibeam HI receiver (due in the middle of the year), the ATOMS project, and local refurbishment and expansion programs. The Galileo tracking commitment requires us to hire 3 new support staff for the duration of the 2-yr support of Galileo. Other positions currently advertised include an additional RF technician and a mechanical fitter.

Staff movements since the previous *ATNF News* include Jared Thompson (returned to the University of Technology, Sydney after a 6-month stint as an engineering work-experience student), David McGregor (resigned as our mechanical fitter), Leanne Charlton (appointed as a trainee administration officer), James Campisi (appointed as a casual groundsman for 3 months) and Gareth Banks (joining us as a PhD student from Cardiff University to work on the HI multibeam project).

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Observing Statistics 96AprT (April - July)

COMPACT ARRAY

In the 4-month period, 37 programs involving 97 scientists were allocated time with the Compact Array. Of these:

- 41 were overseas observers from 30 institutions in 10 countries
- 26 were ATNF observers
- 30 were observers from 10 other Australian institutions.

In 8 of the programs the principal investigator (PI) was a PhD student, and PhD students were involved in 4 other programs.

PARKES

Observing time at Parkes was allocated to 21 proposals involving 73 scientists. Of these:

- 40 were overseas observers from 25 institutions in 8 countries
- 16 were ATNF observers
- 17 were observers from 9 other Australian institutions.

In 5 of the programs the principal investigator (PI) was a PhD student, and PhD students were involved in 3 other programs.

MOPRA

Observing time at Mopra was allocated to 19 proposals. Of these:

- 10 were overseas observers from 8 institutions in 6 countries
- 10 were ATNF observers
- 21 were observers from 8 other Australian institutions.

In 7 of the programs the principal investigator (PI) was a PhD student, and PhD students were involved in 2 other programs.

B Siegman, ATNF (bsiegman@atnf.csiro.au)

Regular Items

Long Baseline Array Operations

MARK2 RECORDING SYSTEM

After more than 20 yr of use around the globe, the Mark-2 VLBI recording system was used for probably the last time in an international experiment in January 1995. Stations participating were Narrabri, Tidbinbilla, Hobart, Perth, Hartebeesthoek and Usuda. Shortly after the successful correlation of the data at Caltech, the Block-II correlator was relocated to the Jet Propulsion Laboratory's main laboratory where it will continue to be used for the Deep Space Network's (DSN) Mark-3 experiments. Some capability for Mark-2 has been retained, but will be supported only at a low level, given the anticipated small demand. There are no plans for further Mark-2 observations in Australia, though the recording equipment will be retained for a further year or two.

S2 RECORDING SYSTEM

Routine VLBI observations with S2 resumed in the second half of 1995, after the Parkes and Mopra antennas completed their Project Phoenix commitments, and a number of successful observations were completed. Our S2 array continues to grow, with an S2 system successfully installed at Perth in July, and new systems now installed at Tidbinbilla (by NASA) and Ceduna. It is also likely that Hartebeesthoek will have an S2 recorder funded this year by the Canadian Space Agency.

Development of the LBA correlator continued apace throughout the year, culminating in the official opening of the full 6-station correlator at Marsfield in December. The new data-acquisition systems are close to completion, with recordings currently taking place with interim sampler and filter systems.

NARRABRI TIED-ARRAY

The September 1995 LBA run marked the first scheduled observations using the AT Compact Array in 'tied-array' mode. (As an historical note, the first serious scientific observation of any kind to use the ATCA was a VLBI run in November 1988.) Instead of recording the signal from a single dish, the 'tied-array' system allows the coherently summed voltage of all 6 antennas (or any subset) to be recorded, with a consequent 6-fold increase in effective collecting area. The observations were a complete success, and preliminary results from the run are reported on p. 5.

CEDUNA AND THE MNRF

The most significant event during 1995 for the LBA was the formal transfer of ownership to the University of Tasmania of Telstra's 30-m tracking antenna at Ceduna, South Australia, some 500 km west of Adelaide (see also report on MNRF funding, p. 2).

VSOP

With the launch of the Japanese Space VLBI mission (VSOP) rapidly approaching, and with observations scheduled for the start of 1997, planning for the support of VSOP co-observing with Australian and other Southern Hemisphere telescopes continues. The acquisition of the Ceduna antenna and the funding of 22-GHz receivers for the ATCA, Mopra, Ceduna and Hobart antennas provide the potential for significantly increased scientific returns from the VSOP mission.

A VSOP test run was scheduled in February 1996 to test the readiness of co-operating, ground-based radio telescopes, the distribution of schedules, tape management, correlating and a number of related issues. At this stage the test appears to have gone well. The question of support at the ATNF facilities for VSOP co-observing has not fully been addressed however, and options on how to provide the resources to accommodate this substantial observing load are currently under discussion.

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ATOMS - Australia Telescope Observation Management System

The ATOMS project has a long-term aim to replace all observing and control software at ATNF observatories. The primary goals are to increase the uniformity and portability between observatories and to provide systems that are more easily extended than those presently in use. The development is using object-oriented techniques and languages and so has a large training component for the personnel concerned. At present 2 short-term tasks at Parkes are being tackled: a data acquisition system is being provided for the multibeam, multichannel filter-bank pulsar receiver, and the DESK computer, which provides the communications channels to the telescope control computers, is being replaced. These tasks will provide the opportunity to gain experience in using object-oriented techniques. In parallel, the overall design of the final system is being developed.

The project was reviewed in March by a panel comprising representatives from ATNF management and from the Division of Radiophysics (Colin Jacka) and the Division of Information Technology (Lin Zucconi). The review panel's report is in preparation.

David McConnell, ATNF, Narrabri
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Happenings at Narrabri & Mopra

November 1995 to March 1996

STAFF MANOEUVRES AT NARRABRI AND MOPRA

Mark Wieringa returned to Australia for some December-period observing on the Compact Array before disappearing again at the end of January for some more 'aipsing' (AIPS++ing) overseas. Fortunately, Neil Killeen is filling in at Narrabri during Mark's absence.
Long-term visitors to Narrabri during the last 4 months have included Jon Ables (on leave from the Division of Radiophysics), Isabella Prandoni (a PhD student from Bologna observing with Mark Wieringa), Neil Killeen, Maartje Sevenster (PhD student from Leiden), and summer-vacation students Tiffany Haselhurst (working for John Whiteoak) and Damon Ward (working for Ron Beresford). Long-term resident, Sydney University PhD student David Abbott (complete with water vapour radiometer), moved to the Radiophysics Laboratory in February.

OVERVIEW OF COMPACT ARRAY OPERATIONS

The 95 AUG period included 46 allocated programs involving 113 scientists (54 from 30 overseas institutions, 22 from ATNF, and 37 from other Australian institutions). Derek McKay and Robin Wark provided the following statistics on time usage:

observations	67%
reconfigurations and data-quality observing	8%
reported down-time	2%
maintenance and system testing	23%

For some time it has been recognised that the reported down-time must considerably underestimate the total downtime, and a scheme has now been implemented in which a quantitative estimate is obtained starting from the time CAOBS is not operating during periods of scheduled observing. As a result, for the period 1 November 1995 to 8 February 1996 the down-time value was 9%, three times higher than the reported value. During the same period, observations were made during 69% of the total time.

Results of the 95AUG Observers' Questionnaire

(1= low; 5 = high):

Observing support 95AUG	
Duty Astronomer suppport	4.8
Obs. staff support	4.7
After-hours Obs. staff support	5.0
Documentation	
CA Users Guide	3.9
CA Pocket Guide	2.3
Observers Notes	4.5
On-line help	2.6
Technical services	
Online data analysis services	4.0
Imaging facilities services	4.3
General computing	3.6
SUN workstations	3.8
Macintosh	4.5
Library	3.9

The CA Pocket Guide is doing poorly, and will be withdrawn. The Sun workstations have received considerable criticism, but will be replaced soon by a new processing system - a DEC Alphaserver 1000 4/266 (a UNIX system). The library is still short of back issues of some journals.

Remote Compact Array observing from ATNF Headquarters in Sydney is growing in popularity. For example, during the period November 1995 to January 1996, 18% of the total observing was done remotely. However, the success is severely limited by an unreliable data link between Sydney and Narrabri, plus an occasional failure of voice links. For the period given above, only 2% (8 h) of the total remote observing time was lost. When the data link fails for short periods, the Observatory staff or Duty Astronomer continue the observations until the link is restored. However, there is no *guarantee* that operation will continue if the link fails, because there is no obligation on locals to take over the observing for long periods. At last the Mopra link has been returned to its original route; restoring the status quo required substantial coordination at several sites.

The new maintenance philosophy first implemented for the 95AUG term (i.e. 2 or 3 days are allocated for maintenance every 2 weeks) works well and will be continued. It has provided more opportunity to repair Array faults with minimum loss of observing time.

'Service' observing, also initiated in the 95AUG period, has had few customers to date. Although in principle this is to be carried out by Narrabri staff during normal working hours, obliging locals have provided some service observing at other times.

The 'tied-array' mode of operation was tested successfully during the 95AUG period, and final (dual-frequency) hardware will be added in April (see report on VLBI operations, p. 15)

'Data quality observations' (DQO), are continuing (usually by the appropriate Duty Astronomer) in which 12-h observations of either PKS 1934-638 or PKS 0823-500, plus nearby 'dark sky,' are obtained for all frequency bands after Array reconfigurations. Narrabri operations staff have been doing the imaging, and Jim Higdon is now responsible for assessing the results.

Computing liveware is still under-resourced, because Dave McConnell and David Loone are still involved in the Parkes control system upgrade. The current mediocrity of the software at Mopra reflects the status of computing support.

A generator has been purchased to provide power to the Control Building during power failures or electrical

storms. It was installed next to the Control Building late in December. Unfortunately, it appears that the unit was faulty when installed at Narrabri, and negotiations are under way to have the fault fixed. There have been some problems in getting the generator to cut in automatically during mains power failure. Despite these limitations, the generator was extremely effective when it was switched on during severe electrical storms in January.

Many of the new facilities are described on WWW pages; the CA Users Guide, under the new authorship of Derek McKay, is also on the Web.

The general rates charged for Lodge accommodation were changed on 1 December. The daily rates remain unchanged at $50 a day, with 50% reduction for students, but there is now no reduction for those who stay longer than 4 days. However, special rates are arranged for very long-term visitors.

With observing associated with the 95DEC period, there have been complaints that scheduled observers for December were not given sufficient warning. Other observers from overseas have made similar comments, and maybe a review of the time between Time Assignment Committee meetings and the start of the observing term is warranted.

GENERAL ISSUES REGARDING MOPRA OBSERVATORY

Following ATUC recommendations about the need for remote tunability on the 3-mm receiving system, the receiver was removed from the antenna at the beginning of December 1995, and will not be reinstalled at Mopra until the end of April 1996. Proposals submitted for the 96DEC period were reconsidered when allocations were carried out for the 96APR term. During the summer months, Robina Otrupcek used the antenna for 'fill-in' 6-GHz methanol observations.

Because of the occurrence of an outbreak of blue-green algae in Timor Dam, the Coonabarabran Council is threatening to cut off the water supply to Siding Spring Observatory, and therefore also to the Mopra site. As a result, two water tanks have been installed on the site, and appropriate plumbing will be added so that water can be collected from the roof of the Control Building.

COMMENTS ON FUTURE OBSERVING

Compact Array

The 96APR term will finish on 18 July. Scheduling was not continued to the end of July, firstly because the observing time requested was less than usual and, secondly, several of the proposed programs were rejected because they overlapped with programs already carried out using the Array.

Observers should be aware that at 13 cm, beam shapes differ for the two polarizations. This can result in spurious polarization effects at the half-power point of ~4%. The cause and effect of this is currently under investigation.

The Array configuration 6C was a wildcard selection for the 96APR period. It will still be selected at the end of the term, and may be requested in proposals for the start only of the 96AUG, as a wildcard carried over from the previous term. 6C is not part of the standard package of array configurations offered for the 96AUG period.

Mopra Antenna

Observing with the 3-mm system has been scheduled from the first week of May onwards. Some means of having remote tuning available is planned.

Potential observers should be aware of the lack of accommodation at the Mopra site. Only one bedroom is available; observers should organise alternative accommodation at a motel or at the ANU Lodge or cottages on Siding Spring Mountain.

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Parkes 21-cm Multibeam Receiver - A Progress Report

A major milestone in the construction of the multibeam receiver was reached on 20 March when the receiver dewar successfully passed its initial leak test. This was very good news, particularly as our lack of experience in fabricating large welded aluminium dewars led to considerable uncertainty in our time-scale projections. We now expect the completed dewar to be delivered by the end of April. Then the task of assembling the receiver inside the dewar will begin.

20 of the 26 low-noise amplifiers required for the receiver have either arrived, or been dispatched from Jodrell Bank, where they are being produced under a collaborative agreement. In exchange, the ATNF will supply Jodrell Bank with a correlator system for their new multibeam receiver.

A prototype of the multibeam sampler/correlator system was installed and successfully tested at Parkes during a short multibeam test period in mid-March. The tests allowed us to gain experience in operating the new correlator system and to fine tune the control software. The results have not yet been fully evaluated, but first impressions are that the system works well. We had some problems with the reliability of IC sockets for the fast chips; those sockets will not be used in the final version.

The tests have confirmed that the production of the final system can proceed as planned. The tests showed some significant interference over the 64-MHz multibeam band. More investigation is needed in this area. The figure on p. 18 shows the first spectrum from the prototype tested at Parkes.

The Parkes test period was also used to commission the new multibeam observing program MULTI, written by Mike Kesteven. This software allows us to drive the telescope in the usual point-and-shoot mode, as well as the active- and drift-scanning modes. These tests will form the basis for a decision about the observing style to adopt for the multibeam surveys. During this test period, we were able to collect data straight from the correlator using a modified RPFITS format which allows auto-correlation data to be stored efficiently, and which handles telescope coordinates with greater flexibility.

The band-determining 64-MHz filters have been ordered and a random selection of NASA correlator ICs has been tested and shown to operate reliably at the nominal 128-MHz clock rate.

Production is in full swing on the backend components of the system, including the main down-converters, the cable compensation amplifiers and the pulsar up-down converters.

The first production unit of the up-down converter module for the multibeam pulsar backend has also been assembled and is being tested.

Mechanical design is complete and metalwork has been built.

Our main experience to date on the design of the software system for analysing the data from the HI survey comes from David Barnes who spent a successful 2 months in Charlottesville in early 1996. A software collaboration to use AIPS++ as the software framework to handle the data analysis is proceeding well. David Barnes was able to put together a skeleton reduction system relatively quickly (filler-calibrator-browser).

Taisheng Ye has written a trial C++ data filler for eventual incorporation into our aips++ reduction system. Gareth Banks from Cardiff also helped with the observations.

Note that the multibeam survey is due to start at Parkes in September 1996, and will altogether use about 4 weeks of telescope time in the 96Aug period.

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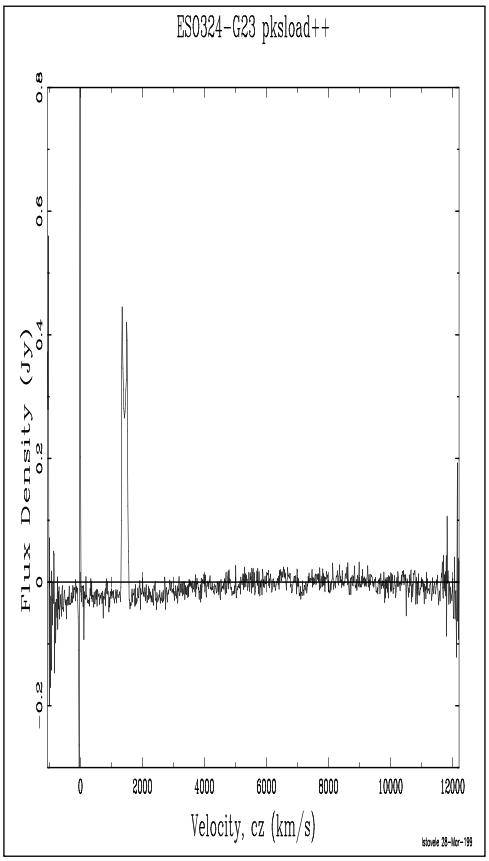
Lister Staveley-Smith (lstavele@atnf.csiro.au)



This spectrum of the Sd galaxy ESO 324-G23 was taken with the Parkes telescope and the first board of the new multibeam correlator at UT 16:36 on 16 March 1996. The standard H-OH receiver (Tsys=23K) was used for the observations which consisted of 300 s on source and 300 s off source. No baseline has been fitted. The spike at zero velocity is Galactic HI.

Observatories Computing Committee report

1995 saw the first full year of operations for the observatories' computing committee.
Membership of the OCC was re-adjusted, resulting in a more equitable representation across the sites, with 2 members each from Parkes, Narrabri (including Mopra), and Marsfield.
After hardware and software requirements for the observatories were analysed, the main activities in 1995 concerned:

(i) upgrading the Parkes control system (Australia Telescope Observatory Management System, ATOMS);
(ii) increasing the reduction facilities at the observatories for visiting astronomers;
(iii) archiving CDs - ROMs at Narrabri;
(iv) unifying the computer interfacing of receiving-system components;
(v) unifying the configuration set-ups across all sites.

Some of these items were initiated, some executed, and some are still being discussed.

ATOMS
After initial approval for the project by AT management in March 1995, a final proposal was made in June 1995, and accepted. A brief report on ATOMS is page 15**.**

OBSERVERS' COMPUTING FACILITIES
At the end of 1995, the Narrabri and Parkes observatories acquired new DEC alpha server computers for use by observers. They were set up at Marsfield and will be fully installed at the observatories this term.

UNIFYING THE COMPUTER SYSTEM
Different areas of unification are being addressed:

(i) the new servers in Narrabri and Parkes are being set up and will be maintained in parallel with Marsfield. Users will have unified access to all the reduction software at the ATNF using the extended system;
(ii) all correlators are now equipped with DEC Alpha's running VMS to ease software maintenance.
(iii) a draft document is being discussed for a standard hardware-to-computer interface.

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Regular Items

Receiver Group Report - March 1996

STAFF MATTERS

Luisa Gallardo has now retired after 10 years with us, during which time she has made a major contribution, not only to the construction efforts of both the Receiver and Electronics Groups, but in many other ways, such as student training, where she will be sorely missed.

Replacing Luisa will be two new wirers, Jean Helouise Burby and Raja Chekkala, and to them we extend a warm welcome.

PROJECT DETAILS

At this stage, the receiver Group is either just completing, or working on, 10 separate projects, if we include the MNRF planning for the 12-mm upgrade.

These are:

(i) a 21-cm multibeam front-end
(ii) a 2.3-GHz Galileo receiver
(iii a 3-mm SIS mixer receiver for Mopra
(iv) an LO and IF upgrade for the Parkes receiver systems
(v) an upgrade to the focus cabin RF electronics installation
(vi) a 3-mm MMIC HEMT receiver demonstrator project
(vii) holography receivers for 7 cm and 2.6 cm
(viii) a 22-GHz receiver for Shanghai Observatory
(ix) a 12 to 18- and 21 to 24-GHz HEMT receiver for the Parkes 64-m telescope
(x) planning the MNRF-funded receiver upgrades.

Some details of the status of these projects are as follows:

THE 21-CM MULTIBEAM FRONT-END

The main dewar has now been machined at SES Engineering and has passed all preliminary leak tests (see the 21-cm multibeam report, p. 17).

A batch of ten 21-cm HEMT amplifiers has now arrived from Jodrell Bank, a participating organisation in the project, and the Receiver Group has begun testing them.

THE 2.3-GHZ RECEIVER FOR GALILEO

This has been successfully installed on the Parkes telescope and has been in operation for tracking the Galileo spacecraft from early April.

The measured Tsys of 20.5 K is still some 3.5 K short of the contract target. (See Bruce Thomas's report on p.3)

Aperture efficiency is averaging around 63% (target of 67%) with the new 2HE feed, and the G/T figure of merit is 48.6 db/K. The difference of 3.73 db between this system and the 70-m antenna at Tidbinbilla (efficiency = 76% and Tsys = 12.5K, G/T = 52.33 db) is reflected almost exactly in the signal-to-noise ratio difference of 3.8 db between each site.

THE 3-MM SIS MOPRA RECEIVER

Work is proceeding on subsystems to provide noise calibrators and Tsys determination, remote monitoring and remote front-end tuning control. The software to provide the remote tuning facility is well in hand, and time will be needed to test the new systems before the start of visitor observing.

LO-IF UPGRADE

This project is to provide a fully functioning AT conversion system for the Parkes telescope, similar to that installed in the Compact Array.

To date, the conversion rack has been fully d.c. cabled. All 4 conversion modules required for the system have been brought up to full specification, and tenders have been let for the 3 local oscillator synthesisers required.

THE PARKES TELESCOPE FOCUS CABIN AND RF ELECTRONICS UPGRADE

Considerable time and effort is being spent to equip the new focus cabin and new translator with a fully functional cable and electronics system to take full advantage, as quickly as possible, of the frequency agility benefits of the new receiver translator system.

This will include installing from the focus cabin racks to the translator, all cryogenic, RF, monitor, control, and d.c. cabling for some 4 individual receiver front-ends.

THE 3-MM MMIC DEMONSTRATOR PROJECT

This collaboration with the CSIRO Division of Radiophysics to develop a cryogenic 3-mm HEMT MMIC receiver for multibeam application is still in the early construction and testing phase. To date, 2 MMIC devices have been successfully tested cryogenically at 12, 25 and 38 GHz.

HOLOGRAPHY RECEIVERS

Two small receiver front-ends operating at 3.95 GHz were built for holographic testing of the Parkes telescope before the focus cabin was upgraded. These systems will again be used to measure the surface of the dish holographically now that the upgrade is nearing completion.

22-GHZ RECEIVER FOR THE SHANGHAI OBSERVATORY

The 22-GHz receiver for the Shanghai Observatory has now been completed. Russell Gough and Graham Gay are in China putting the receiver into commission.

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Observing Proposals Scheduled for the period 1st April - 31st July

COMPACT ARRAY NARRABRI

Abbott	C473	The distribution of HI in the halo of NGC 685
Bock	C437	High resolution radio imaging of the Vela X region
Bourke	C512	OH mapping of RCW 38
Brooks	C534	Kinematics of the Carina HII region/mol. cloud complex
Budding	C515	Co-ordinated observations of the RS CVn system CF Tucanae
Bureau	C528	The structure of the late-type spiral (BCD?) galaxy F35
Bureau	C529	The vertical structure of bars in barred spiral galaxies
Caswell	C347	1665 MHz OH maser survey: part 5
Cote	C495	The extended structure of the Local Group galaxy WLM
Dickel	C394	Polarized emission from LMC SNR N23
Dieters	C532	Radio behaviour of the Z-sources
Dulk	C510	Jupiter's radiation belt in 3 dimensions
Duncan	C186	Continuum and spectral observations of Eta Carinae
Duncan	C505	A high-resolution survey of new, large SNRs in the southern Galaxy
Ehle	C517	Search for magnetic arms in NGC 2997
Fender	C520	A radio survey of LMC supersoft X-ray sources
Fender	C525	Radio counterparts to GX 1+4 and GS 0834-430
Gaensler	C511	The SNR G320.4-1.2 enigma
Getts	C531	An HI dynamical study of southern interacting galaxies
Hawkins	C521	A 6 cm survey of QSOs from a deep Schmidt plate survey
Hill	C527	How many active components can a galaxy have?
Johnston	C326	Monitoring the PSR B1259-63 binary system
Kedziora-Chudczer	C278	Time-scale and frequency dependence of intra-day variability of 5 radio sources
Kenny	C526	Radio imaging of symbiotic stars
Koribalski	C419	Nuclear versus large-scale gas dynamics in galaxies
Koribalski	C518	Search for lines towards the quasar PKS 1251-407 (z = 4.46)
Lim	C519	Imaging the atmosphere of the active binary V824 Ara: radio observations
Manchester	C015	SNR 1987A
Morganti	C158	Radio morphology of 2-Jy radio galaxies
Morganti	C530	HI in elliptical galaxies
Norris	C538	A search for methanol megamasers
Oosterloo	C490	HI observations of the Seyfert galaxy IC 5063
Ryder	C514	Star formation and density waves in NGC 6744
Slee	C460	A search for gravitational images in a southern cluster
Tsarevsky	C535	Magnetic field towards the edge of the radio-loud universe
Venturi	C491	J1324-316: a relict radio source in A3556?
White	C312	The radio properties of luminous blue variables IV: He3-519 & WRA 751

MOPRA OBSERVATORY COONABARABRAN

Allen	M039	A survey for dense cores in Chamaeleon I
Bourke	M022	Star formation in Bok globules
Brooks	M043	The molecular clouds associated with the Carina nebula
Drinkwater	M028	A search for molecular absorption in reddened quasars
Hunt	M013	The interstellar chemistry of southern molecular clouds
Hunt	M032	Search for dense ^{13}CO molecular clouds in the Magellanic Clouds
Kim	M024	CO in selected LMC regions
Koribalski	M046	Testing
Mader	M019	Mapping southern star forming regions
McKay	M027	Mopra antenna pointing
Otrupcek	M007	A methanol maser survey of our Galaxy
Otrupcek	M036	CO (115 GHz) observations towards interesting southern dark clouds
Phillips	M044	Are methanol masers associated with high density gas?
Sridharan	M034	CS mapping of the Southern Coalsack

Regular Items

continued.

Tabone	M041	Star formation in cometary globules
te Lintel Hekkert	M033	Monitoring of IRAS15452-5459 at the SiO 86GHz maser
te Lintel Hekkert	M037	A search for Thorne-Zytkow objects
te Lintel Hekkert	M045	Mapping the stellar envelope of IRAS15452-5459 in CO (1-0)
Wood	M042	Metal abundance ratios: constraining stellar evolution models

PARKES OBSERVATORY

Ables	P211	Polarimetric measurements of pulsar microstructure
Bailes	P140	Precision pulsar timing
Bourke	P167	OH Zeeman measurements of southern molecular clouds
Braatz	P199	Probing accretion disk dynamics in AGN
Deshpande	P079	21 cm observations of southern pulsars
Erickson	P214	Low-frequency carbon recombination lines
Goss	P165	HI study of the Vela SNR and its environment
Johnston	P116	Further observations of PSR B1259-63
Johnston	P212	Interstellar scintillation studies of radio pulsars
Kesteven	P206	12 GHz holography
Kesteven	P207	4 GHz holography
Kunth	P201	Detecting poxy galaxies
Lovell	P218	A search for absorption features in the radio spectrum of the gravitational lens PKS 1830-211
Lundgren	P151	A pulsar search targeted towards high energy sources
Navarro	P136	Polarimetry of millisecond pulsars
Ogley	P209	H2O maser detection around GRO J1655-40
Reynolds	V086	VLBI astrometry of southern radio stars
Roy	P187	Molecular Tori in Seyfert galaxies
Saunders	P148	A uniform, all-sky peculiar velocity survey of IRAS galaxies
Toscano	P220	S2 observations of pulsars
Wilkinson	P216	HI observations of shell galaxies
Young	P221	Nonlinear dynamics of drifting subpulses

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Potential Observers

Interested in observing with the Australia Telescope National Facility systems?

We can provide introductory guides to help you through the process of discovering:

- what facilities are available
- where they are sited
- what their capabilities are
- how to apply for observing time
- how to travel to telescopes
- how to analyse your data

The information is available either through the *World Wide Web* or in hard-copy format via 'snail-mail'. We suggest you send your request for information to the appropriate email address shown opposite and we will mail it to you, or you can write to the ATNF's Headquarters at the address shown opposite.

Through the ATNF Home Pages on the *World Wide Web* (or by *anonymous ftp*) we provide a *README* file as an index to all available documents. These include observing proposal forms and guides, documentation to use our reduction software, and visitors guides to our observatories. Home pages also exist for the Parkes and Paul Wild Observatories; they can be accessed through the ATNF's main home page

ftp, use	ftp.atnf.csiro.au
World Wide Web, use	http://www.atnf.csiro.au

If your system does not recognise the ftp.atnf.csiro.au identification, then please use the address 130.155.194.32

(n.b. this numeric form of the Internet address is subject to change without notice).

ATNF User Documents

Site / Visitor Guides	Marsfield, ATNF Headquarters Paul Wild Observatory, Narrabri Parkes Observatory Mopra Observatory.
User Guides for observing with:	
	the ATCA* the Parkes 64-m telescope the Mopra Telescope the ATCA Users Guide to observing.
VLBI	VLBI/PTI information and observing proposal guide.
ATNF News	Latest ATNF newsletter giving up-to-date information about ATNF facilities and staff activities

(* ATCA = Australia Telescope Compact Array at Narrabri)

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Mopra Observatory
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* From July 1, 1996 an extra '9' digit must be added to the ATNF Headquarters numbers

Applying for Observing Time

The 4-month observing terms for the Compact Array (Narrabri), Parkes Telescope (64-m antenna), and the Mopra Telescope (22-m antenna) begin on: 1 April, 1 August and 1 December of each year.

The closing dates for applications are, respectively: 1 February, 1 June and 1 October of each year.

Applications should be sent either to: The Director (Time Assignment)
Australia Telescope National Facility
at the postal or courier address shown above (ATNF Contact Information)
or they should be submitted electronically to: proposals@atnf.csiro.au .

Email Address Summary

General enquiries	atnf@atnf.csiro.au
Observing information	observing@atnf.csiro.au
Accommodation and travel arrangements	accommodation@atnf.csiro.au
Items for ATNF weekly Event Calendar	calendar@atnf.csiro.au
Marsfield (ATNF Headquarters)	atnf@atnf.csiro.au
Narrabri (AT Compact Array - ATCA)	narrabri@atnf.csiro.au
Parkes (64 m antenna)	parkes@atnf.csiro.au
Mopra (22 m antenna)	mopra@atnf.csiro.au
AIPS enquiries	aips@atnf.csiro.au
General computer accounts and support	support@atnf.csiro.au
VLBI enquiries	vlbi@atnf.csiro.au
Sending SCHED files for observing with the Compact Array at Narrabri	atnf_ca@atnf.csiro.au
Electronic submission of proposals	proposals@atnf.csiro.au
Remote Observing Information	rem_obs@atnf.csiro.au
AT NF News & items for publication	newsletter@atnf.csiro.au
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