ATNF News

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FEATURES IN THIS ISSUE

New radio astronomy allocations
(front page)

ATNF Director voted President-Elect of IAU
(page 3)

Eternal Life - the science of living forever
(page 6)

HIPASS data release
(page 7)

IAU General Assembly 2003
(page 8)

Parsec-scale structure and evolution in the radio galaxy Pictor A
(page 9)

The Square Kilometre Array
(page 14)

Big wins for radio astronomy at the World Radiocommunication Conference!

John Whiteoak & Tasso Tzioumis, ATNF

In the last issue of the *ATNF News* we reported on radio astronomy preparations for the World Radiocommunication Conference (WRC-2000), a month-long meeting to be held by the International Telecommunication Union (ITU) in Istanbul during May, 2000. The purpose of the meeting was to revise pre-selected parts of the ITU Radio regulations which form the basis of planned international usage of the radio spectrum.

Several of the agenda items for the meeting involved radio astronomy. The most important item concerned spectral allocations to radio astronomy (and the Earth-exploration satellite service) in the frequency range 71–275 GHz. For the first time since 1979 this would enable radio astronomy to improve its allocations in this range in order to protect the greatly increased radio astronomy usage of the band.

We have already reported on the radio astronomy preparations for the meeting, and the development of a set of allocation proposals for which widespread approval had been obtained before WRC-2000 began.

WRC-2000, with about 2,500 attendees, has now come and gone, and we are happy to report that the astronomers' careful preparations have been well and truly rewarded. More than a dozen radio astronomers participated in the meeting and carefully nursed the proposals through the various committees which had to approve them. The result was total success; all the proposals for improved allocations (almost one hundred were needed to cover the 71–275 GHz band) were finally adopted by WRC-2000. Even extra protection proposed only by Asia-Pacific countries for some spectral lines not covered by the allocations was approved.

Continued on page 13

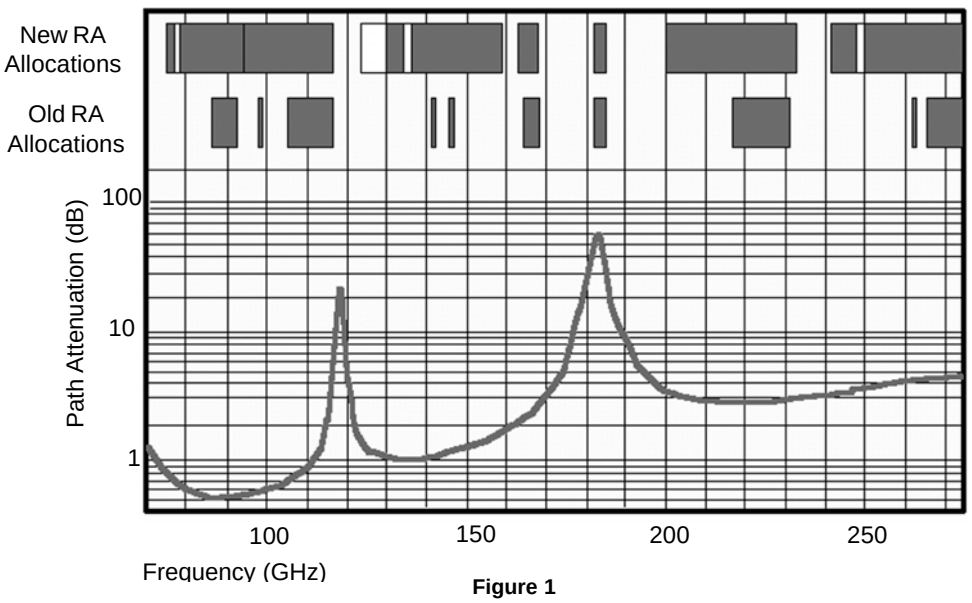


Figure 1
The new radio astronomy allocations for 71 – 275 GHz. Unfilled blocks represent secondary allocations.

Editorial

Welcome to the October 2000 issue of ATNF News, the first edition to be brought to you by a new production team: Steven Tingay, Jo Houldsworth, and Jessica Chapman. On behalf of the ATNF News readership we would like to thank the previous editorial team, Raymond Haynes, Lucia Bromley-Gambaro, Ros Haynes and John Whiteoak for their excellent work over the years in bringing us the latest news from the ATNF.

You will notice that we have changed the ATNF News format, although the content will generally remain the same: news items, articles and regular items. We are also exploring the possibility of making the ATNF News available online, in addition to distributing a paper version. To help us evaluate how useful an online version of this newsletter would be, we ask that you take five minutes to complete the survey form enclosed with this issue of the newsletter and return it to us. Alternatively, you can fill in our online survey response form at http://www.atnf.csiro.au/people/stingay/newsletter.html

We are always happy to receive newsletter contributions. If you have an ATNF-related news item or a short scientific report based on data obtained with ATNF facilities that you would like to see in the ATNF News, please email us at newsletter@atnf.csiro.au

The ATNF News Production Team - Steven Tingay, Jo Houldsworth and Jessica Chapman

Contents

Big wins for radio astronomy at the World Radiocommunication Conference! 1
Editorial 2
The Olympic torch at the Parkes Observatory 3
ATNF Director voted President-Elect of IAU 3
Post-doctoral appointments at the ATNF 4
ATNF graduate program 5
Work experience students at the ATCA 5
Display unit for AT Distributed Clock ready for production 5
Eternal Life - the science of living forever 6
Full HIPASS data release 7
Promoting IAU2003 at Manchester (UK) IAU GA XXIV 8
Parsec-scale structure and evolution in the radio galaxy Pictor A 9
My time at the Compact Array 12
Square Kilometre Array program 14
Australia Telescope Compact Array report 15
Parkes Observatory report 18
Time Assignment information 20
ATNF publications list 21
Contact information 24

News items

ATNF Director voted President-Elect of IAU

The Director of the ATNF, Professor Ron Ekers, has been voted in as the president-elect of the International Astronomical Union (IAU), his new role confirmed at the final meeting of the IAU General Assembly, held in Manchester last August.

Professor Ekers will serve on the executive committee of the IAU for the next three years and then take up the position of president at the next General Assembly, to be held in Sydney in 2003. Professor Ekers will remain president until 2006.

The IAU was founded in 1919 and is the internationally recognised authority overseeing the science of astronomy, with a membership of more than 8000 individuals from 66 countries.

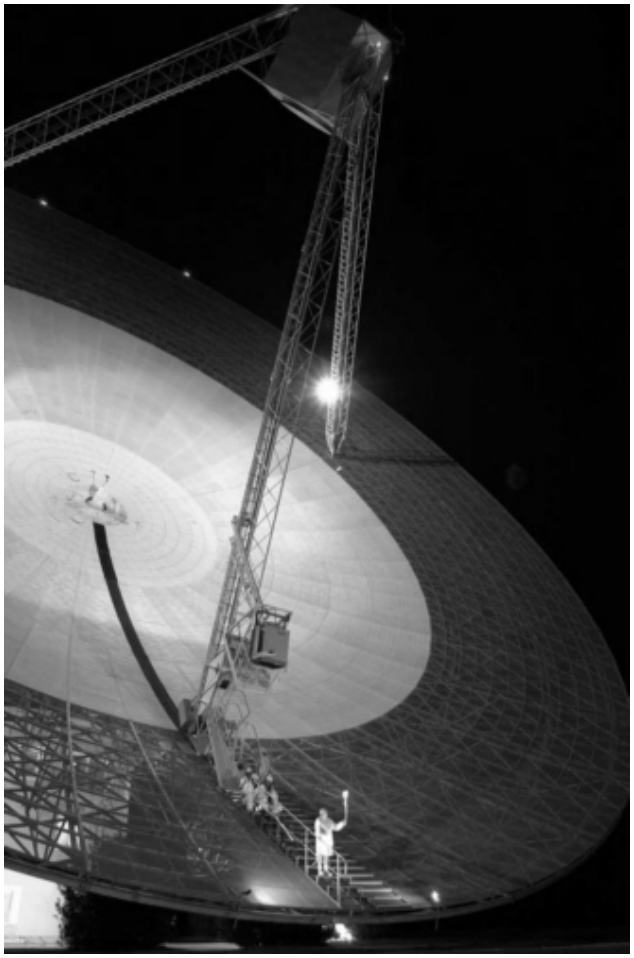
Professor Ekers says his appointment is a good opportunity to increase Australia's international visibility in the field of astronomy.

"It is an opportunity for me to make a contribution to this very accessible area of science by encouraging scientific cooperation at an international level."

S Tingay
October 2000

The Olympic torch at the Parkes Observatory

The Mayor of Parkes, Robert Wilson, on the Parkes radio telescope with the Olympic torch



news

Post-doctoral appointments at the ATNF

The ATNF is pleased to announce the appointment of two post-doctoral fellows. This year's Bolton Fellow is Tony Wong. Tony graduated with a BA *summa cum laude* in Physics and Astronomy from Harvard University in 1994 and is currently completing a PhD at the University of California, Berkeley, under the supervision of Leo Blitz. His main interest is in understanding the evolution of the interstellar medium in spiral galaxies and its relation to star formation, and he has made extensive use of the mm interferometer system at Hat Creek. He has studied the galaxy NGC 4736 in detail, investigating its kinematics and star-formation history. He has also worked on several 3-mm CO-line surveys of galaxies. In addition to these studies, Tony has worked with Don Backer on pulsars, and is a co-author of a paper describing pulse timing and scattering observations of the Crab pulsar.

Tony Wong

Tony expects to complete his PhD in September-October and to arrive at ATNF in November. He will be based at ATNF Headquarters in Sydney.

The second appointment this year is Dr Roopesh Ojha. Roopesh received his initial training in India, graduating with an MSc from Poona University in 1990. He completed his PhD at Brandeis University, Massachusetts, in 1997 using VLBI polarisation observations to study Blazars. As part of this, he helped with the commissioning of the VLBA correlator at Socorro. He then held a post-doctoral appointment at the Center for Astrophysics, Harvard University, where he has been working on the Antarctic Submillimeter Telescope/Remote Observatory project. During his term at CfA he twice worked in Antarctica, during the summer of 1997-98 and for a full year from November 1998 to November 1999, where he had sole responsibility for operating and maintaining the Submillimeter Telescope.

Dr Roopesh Ojha

Roopesh has been appointed to a position supported by the US Naval Observatory to work on the Southern Hemisphere VLBI astrometry program. Roopesh arrived in Australia at the end of September and is now based at the ATNF Headquarters in Sydney.

Dick Manchester
Chair, Senior Staff Rewards and Appointments Committee
(Richard.Manchester@atnf.csiro.au)

ATNF graduate program

It is a pleasure to welcome the following three Ph.D. students who have recently joined the ATNF/Universities co-supervision program:

Daniel Santos-Costa: "Physical modelling of the inner radiation belts of Jupiter". Supervisors: Sebastien Bourdarie (ONERA) & Bob Sault (ATNF)

Dion Lewis: "Pulsar Timing". Supervisors: Peter McCulloch (University of Tasmania) & Dick Manchester (ATNF)

Emma Ryan: "Column Density Distribution Function of the Local Universe" Supervisors: Rachel Webster (University of Melbourne) & Lister Staveley-Smith (ATNF)

There are now 21 Ph.D. and 5 Masters students enrolled in this program. For more details, including the new ATNF travel scholarships, see our web page at www.atnf.csiro.au/educate/graduate.

Raymond Haynes and Lucia Bromley-Gambaro deserve many thanks for their administration of the Graduate program for the last few years.

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

Work experience students at the ATCA

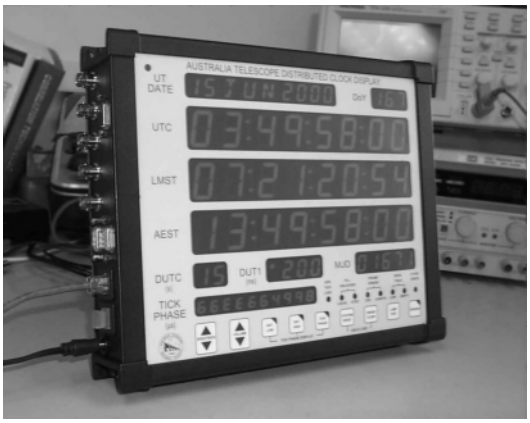
Over recent months staff at the ATCA have enjoyed hosting two work experience students. In June and July Katrina Wellink joined the observatory during a break from her studies at the University of Western Sydney. Katrina worked with Steven Tingay, processing ATCA data, producing images of galactic X-ray binary candidates, and identifying them using optical data. Katie Barnard joined us next, supervised by Naomi McClure-Griffiths, from the University of Minnesota. Katie gives us her account of observatory life and her work while here in an article printed in this issue of ATNF News. Good luck to both Katrina and Katie for the future.

S Tingay
October 2000

Display unit for AT Distributed Clock ready for production

A display unit that connects directly to the output of the Australia Telescope Distributed Clock (ATDC) is now at the end of the prototyping stage and is ready for production. Initially fifteen units will be produced to replace the current ATDC terminal screens at Parkes, Narrabri, Mopra and Epping.

The unit is housed in an aluminum box and uses seven segment displays as the display medium. The prototype version of the unit was used as a test bed for evaluating various techniques to reduce the amount of electromagnetic interference produced by the internal circuits from escaping to the external environment. The openings on the front panel display area posed the biggest problem. This was overcome by using a fine transparent conductive mesh over the display area to attenuate the interference.



A prototype display unit for the Australia Telescope Distributed Clock.

Pre-compliance testing using near-field probes produced very promising results. Tests were performed with and without the conductive mesh in place. A difference of 45 dB of attenuation was measured before the noise floor of the measuring instrument was reached.

To meet the requirement of an aesthetically pleasing design, a membrane which incorporates both graphics and switches, was used for the front panel. The unit will be available with a red, amber or green display area.

Paul Hales, ATNF (Paul.Hales@atnf.csiro.au)

Eternal Life - the science of living forever

During science week in May, the ATNF, in conjunction with the Anglo Australian Observatory (AAO), mounted an exhibit as part of the Powerhouse Museum's exhibition, *"Eternal Life - the science of living forever"*. It was held over four days from 13-16 May.

The ATNF/AAO exhibit was titled; "Limits to eternal life: how the universe will get you in the end". The theme of the exhibit was the cosmological limitations to the possibility of living forever. Four main ideas were explored - the end of the universe in either a "heat death" or "big crunch", massive asteroid impacts with the Earth, nearby supernova explosions, and cosmic rays as a hazard to future space travel.

A 67-kgm iron-nickel meteorite was displayed (courtesy of the Australian Museum) to emphasise the potential hazards posed by asteroid/comet impacts with the Earth. Visitors were encouraged to touch and attempt to lift the meteorite. It was a great hit with the visitors.

A Cloud Chamber (courtesy of Sydney University) was also displayed, to show visitors the tracks left by cosmic rays penetrating the atmosphere and the substantial Museum walls.

An interactive computer display allowed visitors to explore the themes at their leisure. This included video clips, audio files and images from David Malin etc.

For the younger visitors, a "Warps and Worm Holes" board game was used to teach the life history of the Universe from the Big Bang to the Heat Death. It emphasised cosmological hazards to life. Any event that was detrimental to life resulted in the player sliding down a worm hole backwards several places. Any event that was beneficial to life resulted in the player jumping forward several places at warp speed.

The exhibit was staffed by volunteers. John Sarkissian (ATNF) was there for the all four days, with help from Roberto De Propris (UNSW), Malte Marquarding (ATNF), Jessica Chapman (ATNF) and Joerg Lippold (UNSW).

The exhibits from other groups were just as interesting. They included an Egyptian Mummy to demonstrate how desires live on in the after life, a cryonics demonstration on how to freeze people and thaw them back to life, the recycling of life, DNA extraction workshops and lectures, and many more.

Joeg Lippold (UNSW), Jessica Chapman (ATNF) and John Sarkissian (ATNF) at the Powerhouse museum.

The Sunday of the exhibition was Mother's Day, and special events were organised around the Mummy display, with the day renamed as "Mummy's Day".

The exhibition was a great success, with the participants enjoying the opportunity to view astronomy from a different perspective.

Pictures of the event as well as an interactive computer display can be accessed on the Web at URL:
http://www.parkes.atnf.csiro.au/people/jsarkiss/eternal_life/

John M. Sarkissian
(John.Sarkissian@atnf.csiro.au)

Full HIPASS data release

The full HIPASS database is now available on-line at www.atnf.csiro.au/research/multibeam/release.

Data from the HI Parkes All-Sky Survey (HIPASS) for Declinations less than + 2 degrees were released on 13 May 2000. Spectra for any position can now be downloaded from the above web address in a variety of formats (fits, ascii, postscript, gif). The velocity range of HIPASS is –1200 to 12700 km/s and the rms noise is 13 mJy/beam. On 29 June 2000, the www interface was upgraded to Version 2, allowing selection of different plotting parameters on the same page as the spectrum appears. The figure below shows an example spectrum of NGC 6744. As of Aug 21, Version 1 of the interface has ceased working (following an upgrade to Perl), so please change your bookmarks if necessary!

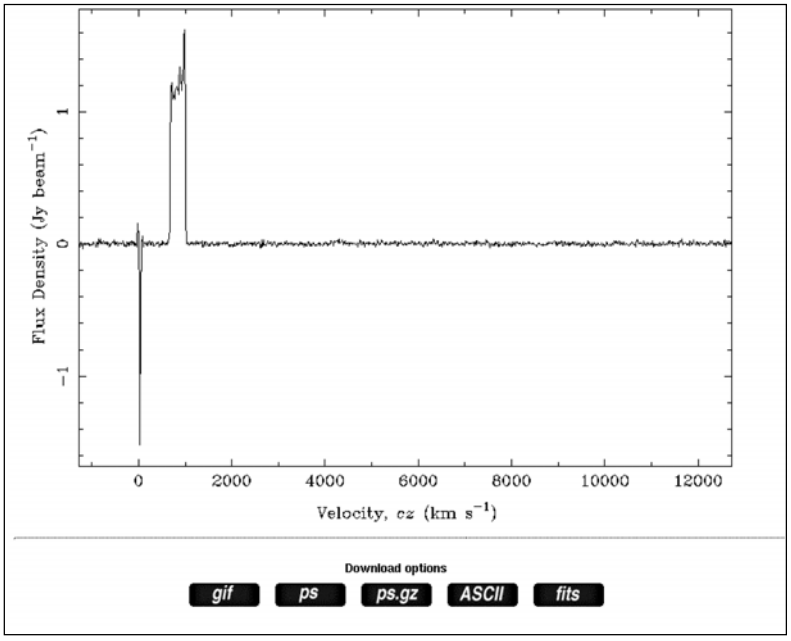
The data available via the web has a spatial binning size of eight arcmin (compared with the 15.5 arcmin resolution of HIPASS) but are otherwise identical to the cubes available to the HIPASS team. We plan to enable access to the four arcmin pixel data, and to sub-cubes later in the year. This involves re-writing the www interface in Glish and AIPS++ rather than the existing Perl/Miriad interface, so this is a major exercise.

Data for the northern extension continues to be taken at Parkes telescope. Coverage of the sky between Declinations +2 and +25 degrees is 76 per cent complete and should be completed in 2001.Observations for the deep Zone of Avoidance survey are complete and are currently being gridded.

Lister Staveley-Smith
Ken Freeman
Malte Marquarding
Rachel Webster

on behalf of the Multibeam Survey Working Group
(enquiries to Lister.Staveley-Smith@atnf.csiro.au)

HIPASS public data release - v1.2 May 13 2000



Articles

Promoting IAU2003 at Manchester (UK) IAU GA XXIV

As most readers will know the next General Assembly of the IAU (IAU2003) is to be held in Sydney at the Darling Harbour Convention Centre in the period 13-26th July 2003. To promote this event, the National Organising Committee (NOC) in Australia worked with Catherine Ross from ICMS Aust. Ltd to develop a 5 m x 2 m display to take to Manchester.

During the two weeks of the Manchester IAU meeting a group of nearly 20 Australians (plus two overseas volunteers) manned the display and provided information and guidance to the 2130 registrants at the Manchester meeting on coming to Australia in 2003.

The display was a great success with the volunteers on duty each day receiving thanks from many IAU attendees. People who talked to the "Australians" all received a miniature Koala as a reminder for them to come to Sydney. Some also received extra koalas for their children, 2400 koalas are today spread around the world and now grace either the homes or offices of just about all of the Manchester attendees!

It was very gratifying that nearly 450 people attending the Manchester congress took the time to fill in our "Expression of Interest" cards for the Sydney meeting. A quick check of the responses suggests that all of the five proposed major excursion tours will go ahead in the weeks both before and after the IAU General Assembly. All tours appear to have at least 60 "starters", with the more popular ones attracting upward of 100 attendees.

The NOC hopes to run all the tours as an incentive to encourage the maximum number of the world's astronomers to come to Sydney.

My thanks to all of those people who volunteered to help in Manchester. I would also like to thank Catherine Ross who, with some help, put the display together before most of us arrived in Manchester, thus making our job of providing information to the Manchester congress participants so successful.

The NOC members and other Australians who went to Manchester are now providing feedback to me on their Manchester experiences so that the congress we organise in Sydney can be the best ever.

Raymond Haynes
Chairman, NOC, IAU2003
(Raymond.Haynes@atnf.csiro.au)

Parsec-scale structure and evolution in the radio galaxy Pictor A

Pictor A is one of the very few nearby FR-II type radio galaxies with a core bright enough to study routinely using standard very long baseline interferometry (VLBI) techniques. While not as luminous as Cygnus A, the prototypical FR-II radio galaxy, Pictor A lies well above the FR-I/FR-II luminosity break and is approximately 40% closer than Cygnus A, allowing a detailed high-resolution study of the parsec-scale nucleus and radio jet in a powerful radio galaxy.

Systematic VLBI observations of FR-II type sources are important for testing theories that unify radio sources based on the orientation of their jets relative to the observer. Since the jets of FR-II type sources are supposed to be more in the plane of the sky than directed towards our line of sight, we should expect to find smaller apparent speeds in FR-II jets than in core-dominated radio sources, in which the jets are supposed to be much more aligned with our line of sight. Systematic studies are underway, mainly of FR-II quasars (e.g. Hough et al. 1999; Vermeulen et al. 1993; Hough & Readhead 1989). It is important to add galaxies to these studies so that the statistics are unbiased by orientation.

To study the parsec-scale structure and evolution of Pictor A, VLBI observations were undertaken with the Southern Hemisphere VLBI array, on 1993 July 3, at 8418 MHz with the following antennas: Tidbinbilla (70 m), Parkes, Hobart, ATCA (one antenna), Mopra, Perth (15 m), and Hartebeesthoek. Also, VLBA observations were undertaken on 1999 March 7, at 8391 MHz with seven of the 10 VLBA antennas; the Hancock, North Liberty, and Brewster antennas lie too far north to observe Pictor A.

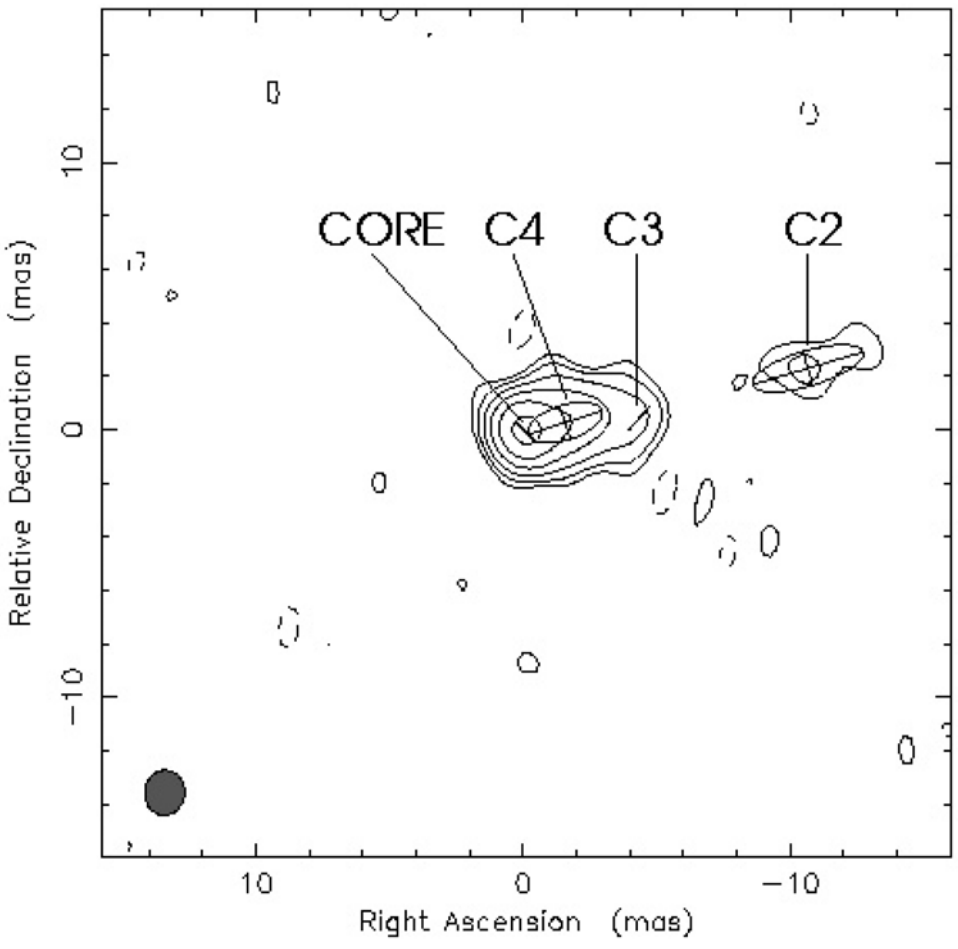


Figure 1. Southern Hemisphere VLBI image from 1993 July 3. Map peak 0.32 Jy/beam, beam FWHM 1.7 X 1.5 mas at –5.1°. Contours start at +/-2.5% of peak and progress in powers of 2.

Figure 1 shows the image from the Southern Hemisphere observations. Figure 2 shows the image from the VLBA observations, using a restricted set of short baselines. Figure 3 shows the full resolution VLBA image. Full details of the data reduction and analysis are given in Tingay et al. (2000).

The most plausible identification of components is shown in Figures 1, 2, and 3, indicating that over the 5.6 years between observations, components C2, C3, and C4 have travelled at apparent speeds of 0.5+/-0.4 $h^{-1}c$, 1.1+/-0.5 $h^{-1}c$, and 0.4+/-0.7 $h^{-1}c$, where h is Hubble's constant in units of 100 km/s/Mpc. Further observations will be required to pin down the apparent jet speed more accurately. However, it appears likely that the apparent speed is subluminal or at most only mildly superluminal.

Figures 2 and 3 reveal the existence of an apparent bend in the jet, approximately 10 mas from the nucleus, between components C2 and C3. A hint of the bend is also apparent in the earlier Southern Hemisphere observation. It is unclear whether the apparent bend is due to precession or jet deflection. Both mechanisms have problems when the large-scale structure of the radio source is taken into consideration. If the bend is due to a deflection in a relativistic jet then a simple model predicts that the intrinsic deflection angle be less than 30° (Tingay 1997). If this is the case for Pictor A then it can be inferred that the angle between the initial jet direction and our line of sight is less than 51° (Tingay et al. 2000). The jet angle to the line of sight for Cygnus A has been estimated at greater than 44° (Carilli et al. 1996). Thus, it may be that the Pictor A jet lies significantly closer to our line of sight than that of Cygnus A. A comparison of the optical emission lines from the nuclei of these two galaxies would seem to support this suggestion. Cygnus A has a narrow-line optical spectrum (Tadhunter et al.

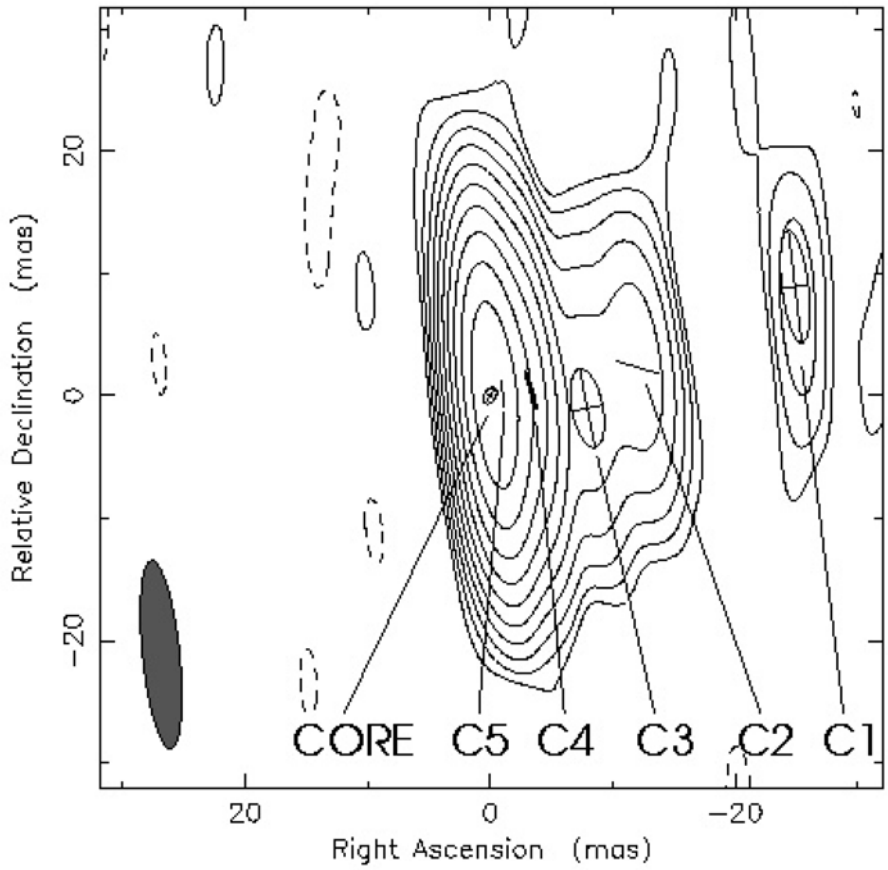


Figure 2. Short baseline VLBA image from 1993 March 7. Map peak 0.72 Jy/beam, beam FWHM 15.5 X 3.0 mas at 5.8°. Contours start at +/-0.1% of peak and progress in powers of 2.

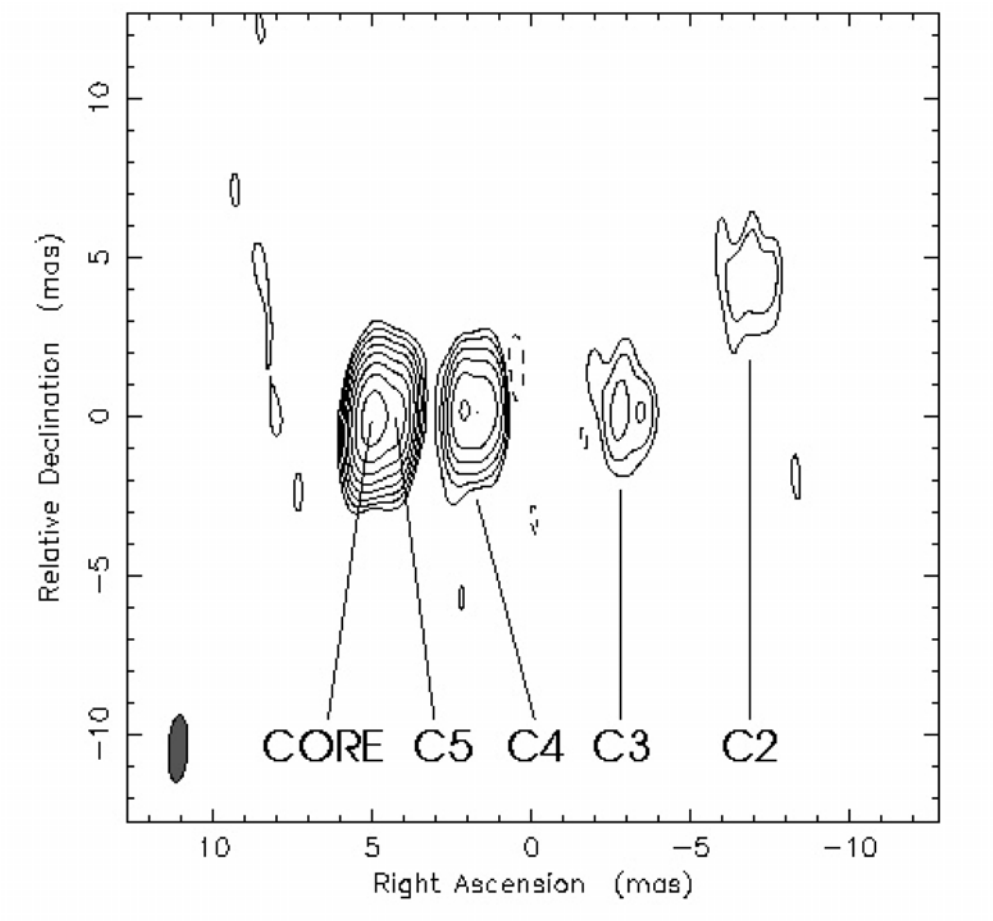


Figure 3. Full resolution VLBA image from 1993 March 7. Map peak 0.40 Jy/beam, beam FWHM 2.1 X 0.6 mas at –3.4°. Contours start at +/-0.5% of peak and progress in powers of 2.

1994), whereas Pictor A has broad, variable nuclear emission lines (e.g. Filippenko 1985), indicating that the Pictor A accretion disk may be more face on or less obscured by a dusty torus than that in Cygnus A.

If the jet deflection hypothesis is correct then the large-scale radio jet must undergo additional bending, so that the jet reaches the north-west lobe hotspot. Previous VLA and ATCA images have not determined the properties of the large-scale jet sufficiently well to test this hypothesis. Currently a program of observations with multiple configurations of the ATCA at 20, 13, and 6 cm is aimed at producing the best large-scale images of Pictor A to date, concentrating specifically on revealing the large-scale jet in detail.

Also of interest, in terms of the large-scale jet, is the recent Chandra X-ray observation of Pictor A, which reveals the jet to be a strong source of X-rays. Comparison between the X-ray images and detailed images of the radio jet may help to constrain the X-ray emission mechanism in the jet.

Filippenko, A.V. 1985, ApJ, 289, 475
Hough, D.L. et al. 1999, ApJ, 511, 84
Hough, D.L. & Readhead, A.C.S. 1989, AJ, 98, 1208
Tadhunter, C.N. et al. 1994, MNRAS, 268, 989
Tingay, S.J. 1997, A&A, 327, 550
Tingay, S.J. et al. 2000, AJ, 119, 1695
Vermeulen, R.C. et al. 1993, ApJ, 417, 541

Steven Tingay, ATNF Narrabri
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My time at the Compact Array

*A special report by **Katie Barnard** on her work experience at Narrabri*

So there I was, quietly flagging data, and Naomi came up to me: "Oh by the way Katie, I've volunteered you to do a research talk"... WHAT!? And so, work experience student that I was, I ended up giving a research talk to a group of PhD astrophysicists, and others, about astronomy. There's something not quite right with that picture...

But that was only one of the exciting things I did in my three weeks at the ATCA. The purpose of the work experience was basically to see what it's like to be an astronomer. I am in the process of trying to decide what to do at university next year, having finished year 12 last year, I decided to take a year off to enjoy life and figure out what I want to do as a career. I have been interested in astronomy for some time, and so I thought work experience would be a good idea to see what it was *really* like. And so, with the help of Raymond Haynes from the ATNF, in mid-July I was on my way up to Narrabri!

In my time at the ATCA, I worked with Naomi McClure-Griffiths, a PhD student from the university of Minnesota. Having done no university-level study, it was a little bit difficult at first to understand what was going on. For the first couple of days I felt a little overwhelmed by it all, but through Naomi's patient explanations and diagrams I soon began to grasp the basic ideas.

It was really interesting finding out about the telescope and how it worked, learning how radio waves from space are collected and then transformed into pictures of what is there. Whilst I was there I was able to do some observing by myself, which was a little scary at first (having a $50 million telescope under my control!), but I need not have worried as everything went relatively smoothly. I also learned about all the processing the data has to go through before it can be seen as a picture. Naomi showed me how to load the data onto the computer and how to flag it (i.e. take out the bad data) before it is turned into a picture.

However, I think the most exciting thing I did whilst I was there was looking for, and then analysing shells. A shell is a huge 'bubble' in space - a large area which contains very little gas and dust, and is surrounded by 'walls' of relatively dense areas of gas and dust. Naomi gave me some 'cubes' (seen as movies) of different sections of the sky, from observations at Parkes, to look through and identify possible shells.

To identify them as shells, the first thing is to look for areas of non-emission with what looks like walls of swept-up mass on the sides. I also looked at the velocity profiles, looking for a dip with a peak on either side in the profile. The peaks indicate the walls of emission and the dips show the empty centres of the shells. I then worked out the basic properties for each – the centre coordinates, central velocity, angular diameter and angular height.

Having looked through all the different cubes, I chose the most interesting one (cube 295) to study further. For this, I identified three different shells which I named 'Shelby' (from Shell B) 'Teddy Bear' (because of it's shape) and 'Small' (because of it's size relative to the others).

I then worked out more properties of these three; their physical height and diameter, distance, column densities, ambient density, swept-up mass, expansion energy, kinetic energy and expansion velocity. I also looked for front and back caps for the shells. The distances involved I find hard to comprehend. 'Small' has a diameter of 630 pc, or 2054 light years, which of course means that if you were travelling at the speed of light, it would take you *2054 years* to get form one side to the other. I find that absolutely incredible!

There are a number of computer programs which are used to work out the properties, or look at the shells in different ways. One such program makes a 3D picture of the cube, and turns it around so you can see it from all different angles. This was really good for visualising the shells, and seeing how

they all seem to join up, which I had noticed in the movie. I also plotted where the shells are on a map of our galaxy and was quite surprised by how far out they are. The most distant of the three (Small) is 15.7 kpc from us, and the closest, (Shelby) is 11.5 kpc, which poses an interesting question of why they are so far out in the galaxy.

Having done all this work on the shells, they became the topic of my research talk. It was a little difficult, in that I'm still trying to get my head around a lot of the 'basic' concepts, but it went well.

Another highlight of my time at the ATCA was a tour of one of the antennas. It was an amazing experience actually going up onto the dish. The antennas, while looking huge from the ground, seemed even higher from the top, with an incredible view in all directions. Of course I didn't spend all the time working, I had fun playing volleyball, table tennis, appreciating the countryside and just enjoying being out in the country – a lovely change from the city!

Thanks to all the people that made this work experience possible. Especially to Raymond Haynes for organising it all for me, to Dave McConnell, Robin Wark and all the staff at Narrabri for making me feel welcome, and of course to Naomi for all the time and effort she put into explaining things to me and showing me around. I had a really fantastic time, and it showed me just how fascinating astronomy really is!

Continued from page 1

Big wins for radio astronomy at the World Radiocommunication Conference!

So what have we gained? The results are shown in the accompanying figure (figure 1). The line profile shows the variation of zenith atmospheric attenuation with frequency. Atmospheric 'windows' containing attenuation minima occur in the ranges 70–115 GHz, 125–175 GHz, and 195–275 GHz. The new radio astronomy allocations now extend across most of the windows, and for the central window in particular, the improved protection is enormous. Note that in addition, an allocation covers the H_2O line at 183 GHz. It was considered that the line may be useful for phase correction during the operation of future high-elevation facilities such as the Atacama Large Millimetre Array (ALMA).

We should point out, however, that as a consequence of the bargaining to increase the allocations, some of the allocated frequencies will have to be shared with ground-based fixed, mobile or satellite uplink services. If these services are developed, their operations will have to be coordinated with radio astronomy however, it is commonly believed that this will not be a problem at these high frequencies where ground-level atmospheric attenuation is high.

Unfortunately, the situation at lower frequencies is not so rosy. WRC-2000 provided no opportunity to review the radio astronomy allocations. In any event, the spectrum is so congested with services that it is difficult to see how radio astronomy could gain more allocations without impacting on the operation of other existing services. The only possible gain may be in the protection of allocated bands from unwanted emissions of transmitters operating at frequencies outside those bands. A dedicated task group has been working on this problem for several years, and this will continue. Hopefully this work will result in improved radio astronomy protection levels which can be included in the Regulations at the next WRC. Because of the low-frequency situation, radio astronomers planning next-generation low-frequency facilities such as the SKA, which will operate with large bandwidths, are pinning their hopes on developing effective interference mitigation strategies as well as persuading governments to proclaim 'radio-quiet' reserves for the facilities.

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Square Kilometre Array program

Things have been exciting in the SKA arena, with new technical results in two projects as well as intensive preparation of our contributions to the Jodrell Bank workshop in August, a gathering convened to investigate technical paths to SKA realization. Our Web site at http:www.atnf.csiro.au/SKA has also been updated in recent months, with new reports and working documents added.

In the antennas area, we are continuing to explore the feasibility of refracting antennas (such as Luneburg Lenses) as a way of obtaining widely placeable, full-sensitivity, multibeaming. Production of cheap, low-loss, artificial dielectrics is essential if lenses are to be practical and, as well as our own "cottage industry" efforts (see picture) at making test samples by threading short wires into bean-bag beads, we have begun discussions with CSIRO Molecular Science, and CSIRO Manufacturing Science and Technology. Tests on the homemade dielectric were promising: the permittivity was as predicted and the loss almost too small to measure. However, Andrew Parfitt has estimated that, even with 24-hour production and generous coffee supplies, it would take until 2075 to produce enough material for the SKA!

The interference mitigation project has been producing interesting new results, most notably the recent work by Mike Kesteven and colleagues in the field of post-correlation RFI suppression for single dishes and arrays. We hope to make some of these techniques available to ATCA observers fairly soon, and expect that Daniel Mitchell, a new postgraduate student from Sydney University, will take a role in this.

Happy bead stringers:
(left to right) Alex Dunning, Andrew Parfitt, Ian Chu, Florence Chow, Anne Barends, Jay Ekers, Graeme James, John Kot.
Not shown: Raja Chekkala, Christine Duffy, Peter Hall (the photographer), and Kieran Greene.

In the last Newsletter Bruce Thomas outlined in some detail SKA the preliminary site–investigation work that is being conducted in collaboration with the WA Government; this work is continuing and it is expected that some new branches will be incorporated following the Jodrell Bank and IAU meetings.

Finally, it is clear that continuing technical progress in the international SKA project now demands some form of technical overview structure to co-ordinate, track and report project work from around the world; CSIRO has formulated some recommendations in this area, and more details should be available in the next Newsletter.

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Australia Telescope Compact Array report

STAFF

Graham Baines departed from the Observatory at the end of June after more than seven years of service to take up a position at NASA'S Canberra Deep Space Communication Complex at Tidbinbilla. Graham worked as System & Coordination Engineer, and for a time as Electronics Group Leader. His contributions are greatly appreciated and have been an important part of the efficient operations of the Observatory.

We also extend thanks to Mark Bland who moved on from the Observatory in early May. Mark worked in the Electronics Group in the Cryogenics section. In addition, his organisation of the Drawing Office was notable and of much assistance.

As well, Fred Badia was farewelled in early October after three years. A notable contribution was his work with the on-line imaging.

Prof. Avinash Deshpande arrived in early June to spend six months on the Australia Telescope Distinguished Visitors Program. Desh comes to us from the Raman Research Institute in India, and whilst here will be assisting with the Compact Array Pulsar Back End Project and carrying out research in collaboration with the staff astronomers.

Dave Rayner has been employed with us for a brief period following the completion of his PhD working to understand some array performance issues, particularly circular polarisation.

Ron Beresford has been appointed Deputy OIC at the Narrabri Observatory.

OPERATIONS

Compact Array usage

The charts below (figure 1) outlines details of Compact Array usage for the 2000 January and 2000 May Observing Terms. During 00JANT there was a larger than usual amount of down time (7%). This was due to two independent failures:
an azimuth gearbox failure on antenna #2; and
a major electrical fault occurring on antenna #6.

There was also more maintenance than usual for the 00MAYT. This was primarily due to fibre optic cable pulling for the new local oscillator system.

Figure 1: Compact Array Usage for 00JANT & 00MAYT

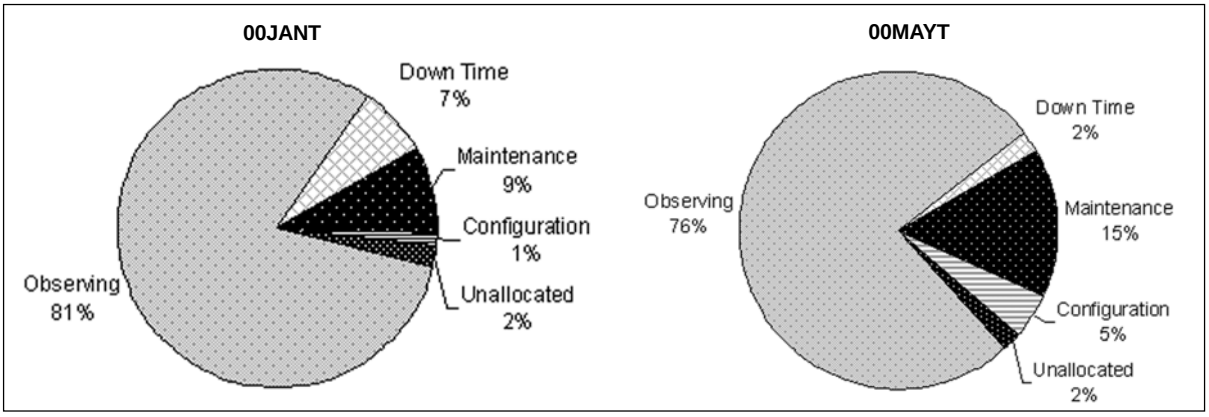

Table 1: User Feedback for 00JANT and 00MAYT

		1996	1997	1998	1999	00JANT	00MAYT
OBSERVING SUPPORT	Duty Astronomer	4.7	4.8	4.8	4.8	**4.8**	**4.4**
	Observatory Staff	4.7	4.7	5	4.7	**5.0**	**4.9**
	Observatory Staff (After hours)	4.8	4.8	4.8	4.7	**5.0**	**4.8**
DOCUMENTATION	ATCA Users' Guide	3.9	4.2	4.3	4.1	**4.0**	**4.0**
	On-line help	3.4	4	4.3	4.0	**4.2**	**4.8**
	Calibrator Information				3.4	**4.7**	**4.7**
TECHNICAL SERVICES	Imaging Facilities (Miriad etc)	4.2	4.3	4.3	4.2	**4.3**	**4.0**
	On-Line Processing				3.8	**4.5**	**5.0**
	Vaxes	4	3.7	4.2	3.8	**3.9**	**4.3**
	UNIX Computers	3.4	4	4.3	4.3	**4.5**	**4.5**
	PCs	2.8	3.6	4.5	4.1	**4.0**	**4.3**
	Library	4	4	4.5	4.4	**4.8**	**4.8**
OTHER (Remote Observing)	Tie Line	3.4	4.4	4.8	4.4	**5.0**	**4.5**
	Marsfield Services	4	3.3	4.0	4.8	**5.0**	**N/A**
	Marsfield Staff	5	3	5.0			**5.0**
	Remote Observing Web Page	4.3	4.5	4.8	4.5	**5.0**	**4.0**

USER FEEDBACK

Observers at the Compact Array are asked to assess the quality of support at the Observatory by rating a number of services on a scale of one to five. The table above (Table 1) gives a summary of User questionnaires for the years 1996 to 1999 and for the 2000 January and 2000 May observing terms.

The signficant increase in the approval rating for on-line imaging reflects an increased success in drawing this facility to the attention of more visiting scientists. In several cases there has been great enthusiasm and encouragement to continue developing the facility.

COMPACT ARRAY UPGRADE

As part of the upgrade of the Compact Array, the local oscillator distribution system which uses a coaxial cable "daisy chain" topology is being replaced with a "star" topology which uses an optical fibre connection from each of the antenna station posts to the Control Room. As part of this task, two major efforts have been made towards "cable-pulling" at Narrabri, with the job nearing completion. Staff members from Narrabri, Parkes and Marsfield sites have contributed to the effort, and "pullers' " dinners were much enjoyed after days of hard work.

Splicing of the cables is under way using a "splicing caravan", which was manufactured for this purpose at Narrabri, making regular trips along the Array from station to station. Leigh Panton is undertaking a major proportion of the work and has become very familiar with life in the caravan.

Ravi Subrahamanyan has carried out further tests with the 22 GHz system.

VISITORS CENTRE AND OPEN DAY

As the April issue of ATNF news was going to press the Observatory was conducting an Open Day. On April 16 more than 600 people took advantage of this event, some travelling from as far away as Melbourne and Brisbane. Two antennas were made available for inspection and judging by the continuous stream of visitors wishing to take part in the inspection, this was a star attraction. Feedback from the visitor questionnaires also reflected the popularity of the inspections. The four remaining antennas were used to observe the Doradus Nebula in the Large Magellanic Cloud and the incoming data were viewed by visitors in the Compact Array Control Room.

In the preparations for the Open Day, the Receiver Group had some "inflated" ideas of displays in their

area. Clandestine negotiations were undertaken with people in the meteorology business in order to acquire a weather balloon that could be flown above the Receiver Laboratory, thereby creating a landmark. With a 150-metre tether and a northerly wind the balloon located itself above the Officer in Charge's residence. The Receiver Group displays included MMIC technology, fibre optics, cryogenics and a novel correlator that worked at audio frequency.

Six talks covering astronomical and technical topics were conducted during each of two sessions, attracting packed houses. It was easy to see that there is great demand for these types of sessions. A 20-cm optical telescope with a neutral-density filter was employed for live viewing of the Sun, but unfortunately this was limited to one hour due to cloud cover.

A barbecue conducted by the staff club did brisk business especially around lunchtime, and visitors were able to relax in a marquee with free tea and coffee while they watched their children exhaust themselves on the jumping castle.

All in all the Open Day was a terrific success, and many thanks go to those who volunteered their time to assist. A few lessons learned on the day will ensure that future Open Days will be even better.

During Science Week in May the Visitors Centre Manager, Tim Kennedy, had the opportunity to publicize CSIRO and the ATNF in a different arena. Tim joined a group of scientists and science communicators when "Science in the Pub" went outback in a DC 3 aeroplane. The astronomical contingent comprised David Malin and Fred Watson from the Anglo-Australian Observatory, and Michael Burton and Mel Hulbert from the University of New South Wales. The group conducted sessions that included debates on astronomical topics and night-time viewing through telescopes at centres which included Silverton, Birdsville, Longreach, Charleville and Bourke. Also on the agenda was a stand at the Longreach Show, school visits, and a chance to address Australia's biggest classroom via the School of the Air.

Many thanks must go to the Science in the Pub organisers, especially Robyn Stutchbury, for the effort involved in getting this innovative program off the ground. With any luck there will be a future trek in which the ATNF can promote the science that it conducts so successfully.

FIREWORKS & BONFIRE NIGHT

The Staff Club organised a fireworks and bonfire night on 17 June at the Paul Wild Observatory. The night started out with a barbecue and was followed by the bonfire and fireworks display, which was quite spectacular. Tim Kennedy, as a licensed person, "drove" the fireworks with help from Staff Club Commitee members Graeme Sunderland and Jock McFee. Toasting of marsh mallows, drinking of the sacred "gluwine", and other such bonfire frivolities followed. The night was well attended and very successful.

Dave McConnell
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Guests queuing for an antenna inspection during the Open Day.

Parkes Observatory report

STAFF

Two members of staff have left us recently. In June we farewelled Eric Wildner who had worked assiduously with Site Services for 18 months and has now returned to his home town of Winmalee. Eric spent many of his last weeks with us atop a cherry picker working around on and around the tower, surprising the occasional observer with unexpected appearances at the window - just one of his many entertaining contributions to Observatory life over his all-too-short sojourn with us.

Bob Livingstone also of Site Services was farewelled in July. Bob's position as handyman and bus driver at the Observatory began 16 years ago, and it was truly a sad occasion to see the end of an era coming to a close.

The Operations Scientist position (formerly Ian Stewart's position) is currently being advertised and we hope to fill this position shortly.

SITE SERVICES

Site Services spent a large proportion of time over the last quarter continuing the construction and outfitting of the demountable office complex adjacent to the administration building. All new tenants have now moved in to the "Olympic Village", as the complex has been dubbed, greatly alleviating the Observatory's office space shortage.

Re-adhering the delaminating vermiculite on the Tower heat shield has been completed successfully, most of the work being done by Eric Wildner prior to his departure. A final re-coat of the Tower to repair the exposed surface will be carried out once the weather is suitable. Concurrently work was undertaken to repair and upgrade the Observatory water supply system. This should help to mitigate the low water pressure problems experienced during the last four or five summers.

Site services has also played an important role in support of the building project being undertaken to extend and upgrade the Visitors Discovery Centre. This has involved moving 50 tonnes of gravel to provide an all weather access road into the site, the removal of trees and top soil and provision of safety fencing. There has also been a considerable amount of work associated with removal of stores and displays, furniture and projection equipment etc. to allow the building work to proceed. New hand rails, display boards and access paths were all prepared for the re-opening on 12th August.

Planning is also under way for the August shut down when one of the Azimuth jacks is to be removed for refurbishing, some electrical repairs and investigations will be undertaken and installation of new encoders on the Master Equatorial.

OPERATIONS

The 2000 MAYT has seen the nominal completion of the multibeam ZOA (Zone of Avoidance) Survey, while the northern extension of HIPASS and the re-observation of the Sculptor region in Southern HIPASS is progressing smoothly.

The multibeam Galactic pulsar survey is now 78 per cent complete, with a total of 570 new pulsar discoveries. This term has also seen the start of the semi-daily observations of the bright southern millisecond pulsar J0437-4715. This ambitious pulsar timing project is being tackled jointly by the Swinburne Centre for Astrophysics and Supercomputing, and the staff at Parkes Observatory (principally John Sarkissian). The results to date have been excellent, with timing residuals significantly better than for any previous measurements of this kind anywhere. More information on the project is available on the web at:

http://mania.physics.swin.edu.au/research/observing/daily_0437/

Radio frequency interference (RFI) monitoring and characterisation is continuing at the observatory. John Sarkissian has developed software called "INTER_HPF" that has allowed Mal Smith to process the archived HIPASS raw data files for interference analysis and detection. This work is currently progressing and will hopefully show interference positional dependency on the telescope. A success was registered alomost immediately after this software became available, with the TV camera

in the focus cabin identified as a long-standing source of RFI (see below).

Downtime for this term has been very low. Winter months are usually less windy at Parkes and this is reflected in the very low downtime due to wind. Overall, for the period 1 May to 30 August time lost to equipment failures was just 0.8 per cent and time lost to bad weather 0.4 per cent.

RADIO FREQUENCY SYSTEMS

The Parkes conversion system is now essentially complete, with only some minor fine-tuning to be completed. It has performed well in all observations to date, and has made good the promise of greatly simplified observing configuations, particularly for spectral-line observations and VLBI. Thanks to George Graves, Suzy Jackson, Mark Bowen and Mike Kesteven from Marsfield, for their assistance to local staff in commissioning this important new system.

A number of interference sources have been identified in the last few months. One of the main sources of interference, which has been affecting multibeam HIPASS observing since commissioning in Feb 97, is the video camera mounted in the focus cabin. This camera was installed to monitor translator movements in the early days of operational use, and has been the source of interference producing harmonically related tones at 6.75 MHz spacing across the HIPASS spectrum. This source accounts for 8 of the listed 19 frequencies which regularly appear in the HIPASS data. Operationally, observing now occurs with the video camera powered down. The dataset and associated electronics strapped alongside the multibeam receiver package accounts for another 7 of the listed 19 frequencies appearing in the HIPASS data, and work is currently in progress to replace the dataset with a new unit, which has better RFI mitigation techniques. There are 4 remaining intermittent frequencies which appear in the HIPASS data, and a database is currently being assembled, to identify the telescope positional dependency of these interferers. The airport DME interference has reappeared, and efforts are underway to have Air Services Australia investigate the unwanted out-of-band emissions.

VISITORS CENTRE

A major upgrade of the Visitors Discovery Centre commenced in June, with construction of a major addition to the existing building, new toilet block and other facilities. The Centre was closed to the public from 17th July to allow integration of the new work, refurbishment of the existing interior, and a new path from the car park. The centre was reopened on 12th August and has been generating good responses from visitors and staff alike.

The new slide show is complete and was installed on the last weekend of August. Initial reactions from visitors again are very encouraging. A VHS video version of the show is in production, and will be on sale within a month or two. Staff are busy enhancing and enlarging the displays in the Centre, with much work in this area still to be done.

The Olympic Torch Relay came to Parkes on the 18th of August, a day which culminated in memorable scenes of the Mayor of Parkes, Robert Wilson, riding the floodlit dish, the torch held aloft. The event received good media coverage and was an invaluable opportunity to further consolidate good relations with the local community and council.

A film featuring the Parkes Telescope, called “The Dish” is due for national release on 19th October and is currently being promoted in cinemas across the country. A significant increase in visitation to the Vistors Centre is expected to ensue!

COMPUTING

Two new Sun Ultra 10 systems have arrived and will be installed shortly. This will make at least one additional high-end workstation available for visitors in the Opera House.

Multibeam Receiver Monitor - a data logging function has been added to the PC based monitoring program to allow capturing and archiving of data. This will aid in tracking down the source of the cryogenic temperature fluctuations experienced recently, as well as allowing limited remote monitoring.

BECC and FECC - The Back End Control Computer and Front End Control Computers. These projects are in construction, led by Simon Hoyle, to extend the computer control and monitoring of the back-end (Conversion System, Correlator, Cal Control) and the front-end (Receivers) of the observing system. The BECC and FECC will be rack-mounted PCs running the Linux operating system.

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Time Assignment information

Who uses the ATNF facilities?
Each year the facilities provided by the ATNF are used by a large number of Australian and overseas astronomers. For the calendar year 1999, the proposals allocated time on all facilities included a total of 317 different authors. Of these:

- 39 authors were from the ATNF;
- 72 authors were from 15 other Australian institutions; and
- 206 authors were from 86 overseas institutions in 17 countries.

Figure 1

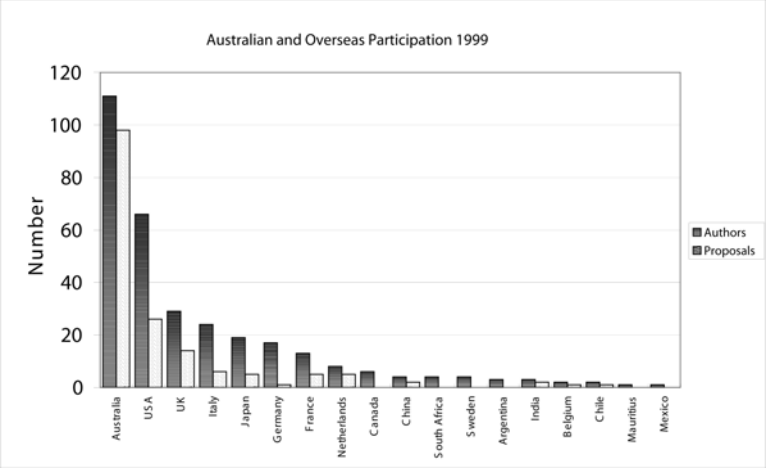
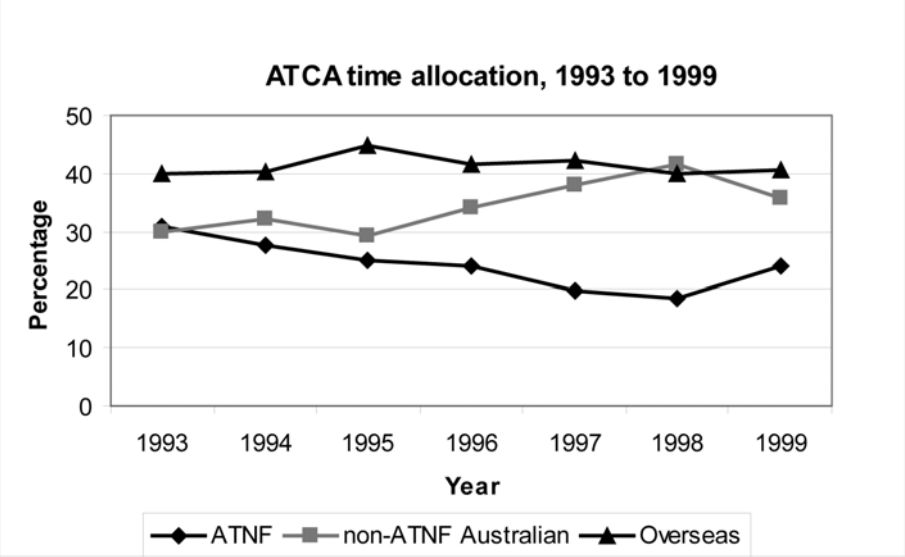


Figure 1 shows the total number of authors, in 1999, from each country. Also shown are the number of proposals allocated time, counted using the principal investigators

The ATNF sets a target that at least 60% of allocated time should be used by astronomers at the ATNF and other Australian institutions with a maximum time allocation of 40% for astronomers at overseas institutions. Figure 2 shows the time allocated to observing teams on the Australia Telescope Compact Array as a percentage of the total allocated time (counted by affiliation of the principal investigator). From 1993 to 1999 the overseas use of the ATCA has been close to 40%. For the Parkes telescope the time allocation has been more variable, with an averaged allocation to overseas users, for the years 1993 - 1999, of 35%.



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ATNF publications list

Publication lists for papers which include ATNF data are available on the web at http://www.atnf.csiro.au/research/publications/. Please email any corrections or additions to Lucia Bromley-Gambaro (lgambaro@atnf.csiro.au).

This list includes published refereed articles and conference papers including ATNF data , compiled since the April 2000 newsletter. Papers including one or more ATNF authors are indicated by an asterisk.

*BELL, J., HALL, P., WILSON, W., EKERS, R., KESTEVEN, M., FERRIS, D., SMEGAL, R., BAILES, M. & VAN STRATEN, W. "Software radio telescope: interference atlas and mitigation strategies" In: Perspectives on radio astronomy: technologies for large antenna arrays, 93-98 (2000)

* BRITTON, M.C., VAN STRATEN, W., BAILES, M., TOSCANO, M. & MANCHESTER, R.N. "High precision timing of PSR J0437-4715" IAU Coll. 177: Pulsar astronomy - 2000 and beyond, Bonn, 30 August-3 September, 1999, 202, 73-76 (2000).

*CAMILO, F., LORIMER, D.R., FREIRE, P., LYNE, A.G. & MANCHESTER, R.N. "Observations of 20 millisecond pulsars in 47 Tucanae at 20 centimeters" ApJ, 535 , 975-990 (2000).

*CASWELL, J.L., YI, J., BOOTH, R.S. & CRAGG, D.M. "Methanol masers at 107.0 and 156.6 GHz" MNRAS, 313, 599-616 (2000).

*de BLOK, W.J.G. & WALTER, F. "Evidence for tidal interaction and a supergiant HI shell in the local group dwarf galaxy NGC 6822" ApJ (Letters), 537, L95-L98 (2000).

*DICKEY, J.M., MEBOLD, U., STANIMIROVIC, S. & STAVELEY-SMITH, L. "Cold atomic gas in the Small Magellanic Cloud" ApJ, 536, 756-772 (2000).

DUROUCHOUX, P., SOOD, R., SMITH, I., CORBEL, S., HANNIKAINEN, D. & LOVER, R. "Millimeter observations of the candidate soft gamma-ray repeater SGR 18114-13" Advances in Space Research, 25, Issue 3-4 765-768 (2000).

*DWARKADAS, V., BALL, L., CASWELL, J., GREEN, A., JOHNSTON, S., SCHMIDT, B., & WARDLE, M. "Supernova Remnants, Pulsars and the Interstellar Medium - Summary of a workshop held at the University of Sydney, March 1999" PASA, 17, 1 (2000).

*FREIRE, P.C., CAMILO, F., LORIMER, D.R., LYNE, A.G. & MANCHESTER, R.N. "Millisecond pulsars in 47 Tucanae" IAU Coll. 177: Pulsar astronomy - 2000 and beyond, Bonn, 30 August-3 September, 1999, 202, 87-88 (2000).

FRUCHTER, A.S. & GOSS, W.M. "Deep radio imaging of globular clusters and the cluster pulsar population" ApJ, 536, 865-874 (2000).

GAENSLER, B.M., BOCK, D.C-J. & STAPPERS, B.W. "Non-detection of a pulsar-powered nebula in Puppis A, and implications for the nature of the radio-quiet neutron star RX J0822-4300" ApJ, 537, L35-L38 (2000).

GAETZ, T.J., BUTT, Y.M., EDGAR, R.J., ERIKSEN, K.A., PLUCINSKY, P.P., SCHLEGEL, E.M. & SMITH, R.K. "Chandra X-ray Observatory arcsecond imaging of the young, oxygen-rich supernova remnant 1E 0102.2-7219" ApJ, 534, L47-L50 (2000).

*GELLER, R.M., SAULT, R.J., ANTONUCCI, R., KILLEN, N.E.B., EKERS, R.D. & DESAI, K. "Cosmological halos: a search for the ionized intergalactic medium" ApJ, 539 73 (2000).

*GWINN, C.R., REYNOLDS, J.E., JAUNCEY, D.L., [ET AL.] "Measuring the size of the Vela Pulsar's radio emission region" IAU Coll. 177: Pulsar astronomy - 2000 and beyond, Bonn, 30 August-3 September, 1999, 202, 211-214 (2000).

*GWINN, C.R., REYNOLDS, J.E., JAUNCEY, D.L., TZIOUMIS, A.K., et al. "Observations of the Vela pulsar using VSOP" In: Astrophysical phenomena revealed by space VLBI: proceedings of the VSOP Symposium, January 2000, 117-120 (2000).

*HALL, P.J. "The Square Kilometre Array Radio Telescope" Engineering World, June-July 2000 14-17 (2000).

*HAN, J.L., MANCHESTER, R.N. & QIAO, G.J. "Polarization characteristics of pulsar profiles" IAU Coll. 177: Pulsar astronomy - 2000 and beyond, Bonn, 30 August-3 September, 1999, 202, 251-252 (2000).

*HANNIKAINEN, D.C., HUNSTEAD, R.W., CAMPBELL-WILSON, D., WU, K., McKAY, D.J., SMITS, D.P. & SAULT, R.J. "Radio emission from GROJ1655-40 during the 1995 jet ejection episodes" ApJ, 540, 521 (2000).

*HENNING, P.A., STAVELEY-SMITH, L., EKERS, R.D., GREEN, A.J., HAYNES, R.F., JURASZEK, S., KESTEVEN, M.J., KORIBALSKI, B., KRAAN-KORTEWEG, R.C., PRICE, R.M., SADLER, E.M. & SCHRODER, A. "HI bright galaxies in the southern zone of avoidance" AJ, 119, 2686-2698 (2000).

*JAUNCEY, D.L., KEDZIORA-CHUDCZER, L.L., LOVELL, J.E.J., NICOLSON, G.D., PERLEY, R.A., REYNOLDS, J.E., TZIOUMIS, A.K. & WIERINGA, M.H. "The origin of intra-day variability" In: Astrophysical phenomena revealed by space VLBI: proceedings of the VSOP Symposium, January 2000, 147-150 (2000).

JUNOR, W., MANTOVANI, F., MORGANTI, R. & PADRIELLI, L. "VLA polarimetry of two extended radio galaxies" A&AS, 143, 457-464 (2000).

*JURASZEK, S., STAVELEY-SMITH, L., KRAAN-KORTEWEG, R.C., GREEN, A.J., EKERS, R.D., HENNING, P., KESTEVEN, M.J., KORIBALSKI, B., SADLER, E.M. & SCHRöDER, A. "A blind HI survey for galaxies in the Zone of Avoidance, 308 ° < l < 332°" AJ, 119, 1627-1637 (2000).

*KASPI, V.M., LACKEY, J.R., MATTOX, J., MANCHESTER, R.N. & BAILES, M. "High-energy gamma-ray observations of two young, energetic radio pulsars" ApJ, 528, 445-453 (2000).

*KEDZIORA-CHUDCZER, L.,JAUNCEY, D. L.,WIERINGA, M. W., REYNOLDS ,J. E., TZIOUMIS, A. K., WALKER, M. A. & NICOLSON, G. D. "The smallest radio sources: Implications for future space VLBI missions" Advances in SpaceResearch, 26, Issue 4, 727-730 (2000).

*KEDZIORA-CHUDCZER, L.L., MACQUART, J-P., JAUNCEY, D.L. & RAYNER, D.P. "Circular polarization of intraday variable sources" Astrophysical phenomena revealed by space VLBI: proceedings of the VSOP Symposium, January 2000, 143-146 (2000).

*KRAAN-KORTEWEG, R.C., & JURASZEK, S. "Mapping the hidden universe: the galaxy distribution in the zone of avoidance" PASA, 17, 6-12, (2000).

*LAZENDIC, J.S., DICKEL, J.R., HAYNES, R.F., JONES, P.A. & WHITE, G.L. "Radio properties of the supernova remnant N157B" ApJ, 540, 808 (2000).

*LAZIO, T.J.W., FEY, A.L., DENNISON, B., MANTOVANI, F., SIMONETTI, J.H., ALBERDI, A., FIEDLER, R., GARRETT, M.A., HIRABAYASHI, H., JAUNCEY, D.L., JOHNSTON, K.J., MARCAIDE, J., MIGENES, V., NICOLSON, G.D., & VENTURI, T. "The extreme scattering event towards PKS 1741-038: VLBI images" AJ, 534 706 (2000).

*LOVELL, J.E.J., TINGAY, S.J., PINER, B.G., JAUNCEY, D.L., PRESTON, R.A., MURPHY, D.W., McCULLOCH, P.M., COSTA, M.E., NICOLSON, G., HIRABAYASHI, H., REYNOLDS, J.E., TZIOUMIS, .A.K., JONES, D.L., LISTER, M.L., MEIER, D.L., BIRKINSHAW, M., CHARTAS, G., FEIGLESON, E.D., GARMIRE, G.P., GHOSH, K.K., MARSHALL, H.L., MATHUR, S., SAMBRUNA, R.M., SCHWARTZ, D.A., TUCKER, W.H., WILKES, B. & WORRALL, D.M. "VSOP and ACTA observations of PKS 0637-752" Astrophysical phenomena revealed by Space VLBI, Proceedings of the VSOP symposium, held at the Institute of Space and Astronautical Science, Sagamihara, Kanagawa, Japan, January 19-21, 2000, 215-218 (2000).

*LYNE, A.G., MANKELOW, S.H., BELL, J.F. & MANCHESTER, R.N. "Radio pulsars in Terzan 5" MNRAS, 316, 491 (2000).

*MACQUART, J.-P., KEZIORA-CHUDCZER, L., RAYNER, D. P. & JAUNCEY, D. L. "Strong, variable circular polarization in PKS 1519-273" ApJ, 538, 623-627 (2000).

*MAJUMDAR, S. & SUBRAHMANYAN, R. "Constraints on structure formation models from the Sunyaev-Zel'dovich effect" MNRAS, 312, 724-732 (2000).

*MARX-ZIMMER, M., HERBSTMEIER, U., DICKEY, J.M., ZIMMER, F., STAVELEY-SMITH, L. & MEBOLD, U. "A study of the cool gas in the Large Magellanic Cloud I. Properties of the cool atomic phase - a third HI absorption survey" A&A, 354, 787-801 (2000).

*McCLURE-GRIFFITHS, N.M., DICKEY, J.M., GAENSLER, B.M., GREEN, A.J., HAYNES, R.F. & WIERINGA, M.H. "Two large HI shells in the outer galaxy near l = 279o" AJ, 119, 2828-2842 (2000).

*McGAUGH, S.S., SCHOMBERT, J.M., BOTHUN, G.D. & de BLOK, W.J.G. "The baryonic Tully-Fisher relation" ApJ, 533, L99 (2000).

*NORRIS, R.P. "How Old is ET?" When SETI Succeeds: The impact of high-information contact", ed. A. Tough, Published by the Foundation for the Future, Washington DC, ISBN 0-9677252-2-4 (2000).

*OOSTERLOO, T.A., MORGANTI, R., TZIOUMIS, A., REYNOLDS, J., KING, E., McCULLOCH, P. & TSVETANOV, Z. "A strong jet-cloud interaction in the Seyfert galaxy IC 5063: VLBI observations" AJ, 119, 2085-2091 (2000).

*OTRUPCEK, R., HARTLEY, M. & WANG, J.-S. "Catalogue of J=1-0 CO emission towards southern dark clouds" PASA, 17, 92-101 (2000).

PUTMAN, M.E. "The Magellanic system's interactive formations" PASA, 17, 1-5 (2000).

*RHIE, S.H., BENNETT, D.P., BECKER, A.C., PETERSON, B.A., FRAGILE, P.C., JOHNSON, B.R., QUINN, J.L., CRUOCH, A., GRAY, J., KING, L., MESSENGER, B., THOMSON, S., BOND.I.A., ABE, F., CARTER, B.S., DODD, R.J., HEARNSHAW, J.B., HONDA, M., JUGAKU, J., KABE, S., KILMARTIN, P.M., KORIBALSKI, B.S. et al. "On planetary companions to the MACHO 98-BLG-35 microlens star" ApJ, 533, 378-391 (2000).

*STANIMIROVIC, S., STAVELEY-SMITH, L., van der HULST, J.M., BONTEKOE, Tj.r., KESTER, D.J.M. & JONES, P.A. "Cool dust and gas in the Small Magellanic Cloud" MNRAS, 315, 791-807 (2000).

*SUBRAHMANYAN, R., KESTEVEN, M.J., EKERS, R.D., SINCLAIR, M. & SILK, J. "An Australia Telescope survey for CMB anisotropies" MNRAS, 315, 808-822 (2000).

TARTER, J., BACKUS, P., DREHER, J., HEILIGMAN, G. & LAROQUE, S. "Studies of radio frequency interference at Parkes Observatory" Acta Astronautica, 46, 683-691 (2000).

TAURIS, T. & SENNELS, T. Formation of the binary pulsars PSR B2303+46 and PSR J1141-6545. Young neutron stars with old white dwarf companions" A&A, 355, 236 (2000).

*THOMAS, B. McA. "SKA: matching the specifications and antenna technologies" In: Perspectives on radio astronomy: technologies for large antenna arrays, 93-98 (2000)

*TINGAY, S.J., JAUNCEY, D.L., REYNOLDS, J.E., TZIOUMIS, A.K., McCULLOCH, P.M., ELLINGSEN, S.P., COSTA, M.E., LOVELL, J.E.J., PRESTON, R.A. & SIMKIN, S.M. "The parsec-scale structure and evolution of the nearby FR-II radio galaxy Pictor A" AJ, 119, 1695-1700 (2000).

*TINGAY, S.J., REYNOLDS, J.E., JAUNCEY, D.L., TZIOUMIS, A.K. et al. "VSOP observations of bright, compact southern hemisphere AGN" In: Astrophysical phenomena revealed by space VLBI: proceedings of the VSOP Symposium, January 2000, 313-316 (2000).

*VAL'TTS, I.E., ELLINGSEN, S.P., SLYSH, V.I., KALENSKII, S.V., OTRUPCEK, R. & LARIONOV, G.M. "Detection of new sources of methanol emission at 95 GHz with the Mopra telescope" MNRAS, 317, 315 (2000).

*van den BOSCH, F.C., ROBERTSON, B.E., DALCANTON, J. & de BLOK, W.J.G. "Constraints on the structure of dark matter halos from the rotation curves of low surface brightness galaxies" AJ, 119, 1579-1591 (2000).

*van den HOEK, L.B., de BLOK, W.J.G., van der HULST, J.M. & de JONG, T. "The evolution of the stellar populations in low surface brightness galaxies" A&A, 357, 397 (2000).

*van KERKWIJK, M.H., BELL, J.F., KASPI, V.M. & KULKARNI, S.R. "The temperature and cooling age of the white dwarf companion to the millisecond pulsar PSR B1855+09" ApJ, 530, L37-40 (2000).

van STRATEN, W., BRITTON, M., BAILES, M., ANDERSON, S. & KULKARNI, S. "Pulsar applications of the Caltech Parkes Swinburne baseband processing system" Pulsar Astronomy - 2000 and beyond, ASP Conference Series, Vol 202; Proceedings of the 177th Colloquium of the IAU held in Bonn, Germany 30 August - 3 September 1999. (San Francisco: ASP). 283 (2000).

VENTURI, T., BARDELLI, S., MORGANTI, R. & HUNSTEAD, R.W. "Radio properties of the Shapley Concentration III. Merging clusters in the A3558 complex" MNRAS, 314, 594-610 (2000).

*WANG, N., MANCHESTER, R.N., PACE, R., BAILES, M., KASPI, V.M., STAPPERS, B.W. & LYNE, A.G. "Glitches in southern pulsars" IAU Coll. 177: Pulsar astronomy - 2000 and beyond, Bonn, 30 August-3 September, 1999, 202, 109-110 (2000).

*WANG, N., WU, X., ZHANG, J., MANCHESTER, R.N., YUSUP, A. & CHENG, K.S. "Pulsar timing at Urumqi Astronomical Observatory" IAU Coll. 177: Pulsar astronomy - 2000 and beyond, Bonn, 30 August-3 September, 1999, 202, 65-66 (2000).

*WOERMANN, B., GAYLARD, M.J. & OTRUPCEK, R. "Hydrogen recombination lines from the Gum nebula" MNRAS, 315, 241-247 (2000).

*YOUNG, M.D., MANCHESTER, R.N. & JOHNSTON, S. "Ha, ha, ha, ha, staying alive, staying alive: a radio pulsar with an 8.5-s period challenges emission models" IAU Coll. 177: Pulsar astronomy - 2000 and beyond, Bonn, 30 August-3 September, 1999, 202, 185-188 (2000).

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