ATNF News

Issue No. 50, June 2003

ISSN 1323-6326

ATNF has a new Director

A new Director for the Australia Telescope National Facility was announced in April. Professor Brian Boyle, currently the Director of the Anglo-Australian Observatory will take up the position on 11 July 2003. Professor Boyle succeeds Professor Ron Ekers, Director of the ATNF, who has received a Federation Fellowship from the Australian Government to pursue his research interests, and Professor Ray Norris, who has been Acting ATNF Director for much of the last two years.

Professor Brian Boyle

Professor Boyle completed his PhD at the University of Durham in the UK. He held positions at the University of Edinburgh, the Anglo-Australian Observatory and the University of Cambridge before being appointed AAO Director in 1996.

Professor Boyle has published more than 200 papers in astronomy. Last month he received a Centenary Medal from the Commonwealth Government for his contribution to the field.

"I look forward to the ATNF continuing to play a central role in the development and scientific exploitation of the major radio astronomy facilities of the future," says Professor Boyle.

"I am extremely pleased to welcome Professor Boyle to CSIRO," said CSIRO Chief Executive Dr Geoff Garrett, who announced the appointment, "I'm sure that under his guidance the ATNF will continue from strength to strength."

Lakshmi Saripalli and Helen Sim
(*Lakshmi.Saripalli@csiro.au*)
(Helen.Sim@csiro.au)

Editorial

Welcome to the June 2003 issue of the ATNF Newsletter.

We are happy to bring together a set of exciting and inspiring articles and news reports in this issue. There are articles covering recent observational results using nearly all the ATNF's radio telescopes. The Federation Fellowship awarded to ATNF's Dr Dick Manchester is covered on page 3. The much awaited and newly installed antenna control computers for the Compact Array are described on page 8 for the general user. A delightful item by a participant at the recently held synthesis imaging workshop should inspire all students!

This issue has been put together in time for the Sydney IAU General Assembly and we are printing extra copies for the occasion. We hope you enjoy the newsletter. As always we will be very pleased to receive your contributions for the coming issues.

Lakshmi Saripalli, Jessica Chapman, Jo Houldsworth
ATNF News Production Team
(*newsletter@atnf.csiro.au*)

Contents

News

Dr Dick Manchester

Federation Fellowship for Dick Manchester

On 24 March 2003, the Minister for Education, Science and Training, the Honorary Dr Brendan Nelson MP, announced the award of 24 Federation Fellowships, the Australian Research Council's most prestigious and valuable research awards. Included in the list was the ATNF's Dr Dick Manchester, one of three Fellowships awarded to CSIRO researchers in this round. This is the second Federation Fellowship to be hosted by the ATNF, with our ex-Director Professor Ron Ekers being awarded one last year (see October 2002 Newsletter). Dick hopes to take up his Fellowship on 1 June this year.

The title of Dick's project is "Precision Pulsar Timing and its Applications". The aim is to combine timing data from a large sample of millisecond pulsars, widely distributed across the sky, with two main objectives: (a) to detect gravitational waves passing over the Earth and (b) to establish a long-term standard of time based on pulsars. Gravitational waves are predicted by Einstein's general theory of relativity and are generated by any accelerated mass. Potentially observable sources include early phases of the Universe around the epoch of galaxy formation and binary black holes in the cores of merged galaxies. Despite much past and current effort, so far there has been no direct detection of gravitational waves, although the famous Hulse-Taylor binary pulsar has given strong indirect evidence of their existence. Millisecond pulsars have period stabilities, which rival those of the best atomic clocks. Combining data from many such pulsars will give a timescale, which is likely to be more stable over intervals of months and years than the global time standard, Universal Time Coordinated (UTC), which is based on data from the world's most stable atomic clocks.

Much of the observational work will be based at Parkes but international collaboration is important to the project in order to obtain data on northern-hemisphere pulsars. The project will use the new 10/50-cm receiver, currently under construction and due for installation and commissioning at Parkes in September this year. Dealing with radio-frequency interference within the wide bands of this receiver will be an essential aspect of the project. One of our current Bolton Fellows, Dr George Hobbs, will join the project and another post-doctoral appointment will be advertised later this year.

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

New Narrabri postdoctoral scientist

It is a pleasure to welcome Maxim Voronkov to the Narrabri Observatory. Maxim joined us in late March, as a CSIRO postdoctoral fellow. In addition to some private research time, Maxim's position has a specific aim of studying optimum SKA configurations (mainly in an aips++ environment) and liaising with the Swinburne SKA simulation group.

Maxim comes to us from the Moscow State University and the Astro Space Center in Moscow, where he completed his MSc (1999) and PhD (2002) on the modelling and structure of masers. In addition to observational investigations, Maxim has a strong interest in the theoretical aspects of methanol maser pumping mechanisms. Observationally, he has used an array of single dish and VLBI telescopes and techniques in his maser work. Prior to studying for his PhD, Maxim worked on mathematical software in an object-oriented environment.

Maxim Voronkov

Bob Sault
(Bob.Sault@csiro.au)

The IAU 25th General Assembly is about to happen!

By the time you read this report, the General Assembly will be in progress. This long IAU meeting, formally hosted by the National Committee for Astronomy (NCA) (of the Australian Academy of Science) in conjunction with the Astronomical Society of Australia, will take place in the period 13 – 26 July. The venue is the Sydney Convention and Exhibition Centre (SCEC) in beautiful Darling Harbour. The National Organizing Committee (NOC), (with Harry Hyland of James Cook University as the other Co-Chair and a significant representation from ATNF), and its subcommittees are working very hard in conjunction with ICMS Australasia Pty Ltd to provide a successful and exciting meeting, and we now have our fingers crossed that this will happen.

To organize a successful meeting comprising six Symposia, twenty-one Joint Discussions, four Special Sessions, Invited Discourses, and Working group, division/commission and ad-hoc meetings, not to mention an Astro Exhibition, set of daily and longer tours, and Women's Networking Luncheon, is no mean feat. Add to this a spectacular evening Reception and Opening in the Opera House on 15 July and the final 'Party' on the 24th. And there's more – all this will be complemented by a 'Festival of Astronomy' for the public (public talks, a Schools Day organized by UNSW, Astronomy on the Go, Science in the Pub, and other events).

We have been extremely concerned that, as the result of the series of recent international events - the September 11 disaster, the war in Iraq, and now SARS, many astronomers would not travel to Sydney for the General Assembly. Consequently, we have been extremely pleased with the registration figures – by 28 May a total of 1861 people had registered for the meeting. A May tally of posters came to 2700 (including duplicate submissions)!

Results in other areas have also been pleasing. Rather late in the organization we agreed to have an astronomy exhibition ('Astro Expo'), with public access for four days in the period 18 – 21 July. It will be held in Exhibition Hall 5, next to the Convention Centre in which all the meetings will take place, and will share this hall with a communal area for the General Assembly participants, poster area, Internet café, theatrette and café. This late decision (less than a year before the meeting) presented an enormous challenge. With some involvement from one or two NOC members, ICMS has worked very hard against the clock to line up exhibitors, and by the end of May had a total of some 35 exhibitors from Australia and overseas. I had hoped that the Expo would provide a good opportunity for overseas and Australian universities with astronomy/science departments to take advantage of the opportunity to gain some publicity. However, I have been quite disappointed that apart from a handful of institutes the general Australian response has been cool. Despite this, I believe that the exhibition will be very successful.

The costs associated with hiring a world-class convention and exhibition centre for such a long period are high, and this was reflected in our early-registration fee of $880 (increased 10% by Goods and Services tax). Even with this fee level, a few months ago we were concerned that we might end up in debt by several hundred thousand dollars, a rather unpleasant prospect to say the least! Fortunately, helped by the number of registrations, our financial position has improved since then. However, the General Assembly budget set in 2002 included what I regarded as a very optimistic amount of $350K in revenue from sponsorships. Towards the end of last year, with no sponsorship money in sight (!), we engaged a professional group, DVA-Navion, for six months to seek appropriate sponsors. Fortunately, this move has resulted in some success – $40K from CSIRO (to match $60K which had already been provided in kind), $10K plus $20K (in kind) from Connell Wagner, and more recent grants of $50K and $100K from the Australian Federal Government's Innovation and Access Programme (International Science and Technology). ICMS took over the sponsorship search after the contract with DVA-Navion ended. One of the government grants has presented us with a further challenge, because it involves adding to our Astro Expo an 'Australia Pavilion' containing exhibits showcasing Australian industry. This is now being put together by ICMS.

The bottom line

You can read all about the program on the General Assembly website at (*www.astronomy2003.com*) and its various links. Information can also be found in the IAU Information Bulletins IB 91, 92 and 93. After reviewing all the meetings and their programs, there is no way a reader could fail to be impressed with the efforts made by many people all over the world to make this meeting one of the best. Of course, with a meeting of this complexity, there are sure to be glitches during the meeting, and I hope that they will be minor and will not detract from your enjoyment of the meeting.

In retrospect, it is unfortunate that an NOC cannot have a 'dry run' at organizing a large meeting of this sort, because there occur many unforeseen problems that would not be repeated. How were we to know that our on-line registration system, at which we worked so hard to make failsafe, would overload the ICMS computing system in the final hours of early registration? Or that our great abstract review system would fail us because of long computer access times as the number of submissions increased. Or that, for one reason or another, submitted registrations would go missing. On behalf of the organizers I apologize for these problems; we were not impressed when our system failed us, and we endeavoured to put things right as quickly as possible. When this meeting is over I will write a report of the meeting, and hopefully the organizers of the next General Assembly will be able to learn from our mistakes and avoid them.

In conclusion, have a great meeting!

John Whiteoak, ATNF Honorary Fellow & Co-Chair, National Organizing Committee (John.Whiteoak@csiro.au)

New ARC-CSIRO postdoctoral fellowships announced

The results for the inaugural round of Linkage-Australian Postdoctoral Fellowships (CSIRO) were announced in April. The fellowships are co-funded by the ARC and CSIRO. Ten of these new fellowships were awarded, their purpose being to promote increased collaboration between CSIRO and Universities. We were indeed fortunate that two astronomy applicants, Virginia Kilborn and Tony Wong were among the successful candidates. We congratulate them, and the associated chief investigators, for their fine achievement!

Dr Tony Wong's project is entitled "Star Formation at Millimetre Wavelengths with the CSIRO Australia Telescope" and was proposed by Dr Michael Burton (UNSW) and Prof Ray Norris (ATNF). Tony has been a Bolton Fellow at ATNF headquarters near Epping since the beginning of 2001. Prior to that he was a PhD student at the University of California at Berkeley working on observations of CO in galaxies with the BIMA millimetre array. A major portion of Tony's work at ATNF has been directed toward developing and utilising the 3-mm system at the Compact Array. As an ARC/CSIRO fellow, he will continue to be involved in the ATCA mm-upgrade, using it to image star-forming regions in our Galaxy and the LMC at high angular resolution. He will also help promote the CSIRO-UNSW collaboration in millimetre astronomy with the Mopra 22-m telescope, helping to develop new mapping techniques and commission the broadband correlator expected for completion in 2004. Finally, Tony will continue to pursue long-standing research interests in the interstellar medium and star-formation in nearby galaxies. He will be dividing his time roughly equally between ATNF and UNSW starting in August 2003.

Dr Virginia Kilborn's project is "The Evolution of Gas in Galaxy Groups" and was proposed by Dr Duncan Forbes (Swinburne) and Dr Baerbel Koribalski (ATNF) together with partner investigators Dr Steve Tingay and Dr Brad Gibson (Swinburne) and Prof Ken Freeman (RSAA, ANU). Virginia has just completed a postdoctoral fellowship at Jodrell Bank (University of Manchester) and is well known to the Australian community, having previously completed a HIPASS PhD at the University of Melbourne. The aim of Virginia's project is to define the gaseous, stellar and dark matter content of galaxy groups and, in combination with simulations, help understand the evolutionary processes involved in group formation. Virginia will be using Parkes HI and ATCA HI and mm observations for her project. She will be based at Swinburne University, though will regularly visit the ATNF. Virginia will commence her appointment in August 2003.

The ARC selection report is publicly listed at: *www.arc.gov.au/htm/selection_report_L-APDC.htm*. We hope that this scheme will continue next year. These are joint University-CSIRO positions, and candidates can request to be hosted at a University or at the ATNF.

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

ATNF synthesis imaging workshop 2003

The ATNF held its 6th synthesis imaging workshop from 12 – 16 May 2003 at the Compact Array near Narrabri. Although it's been less than two years since the last workshop, we felt it would be timely to better educate our users on the use of the new high-frequency capabilities at the Compact Array. We therefore placed greater stress on millimetre astronomy and techniques than in previous workshops, although we preserved most of the "traditional" material on synthesis imaging. In total there were 33 lectures, covering topics from interferometry theory and practice to some of the science drivers for the millimetre upgrade. We also conducted an afternoon tour of the observatory facilities, and held "practical sessions" where participants could get hands-on experience using the telescope or reducing data in small groups. Finally, Brian Schmidt (RSAA, ANU), current chair of the Time Assignment Committee, led a proposal-writing discussion and workshop that was perhaps the most "practical" session of all!

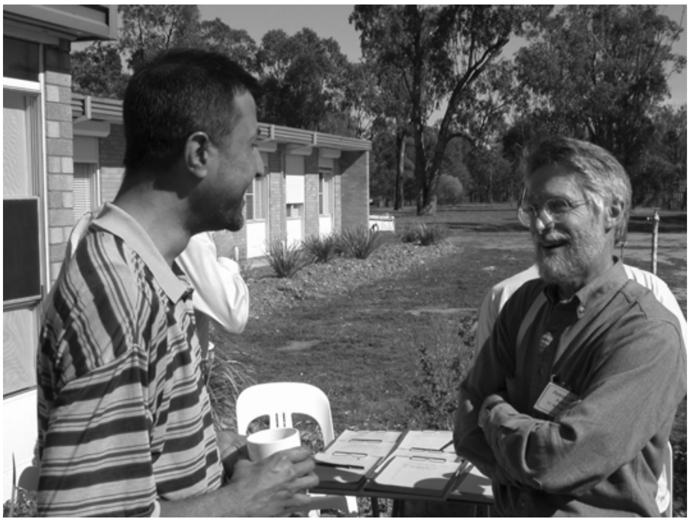


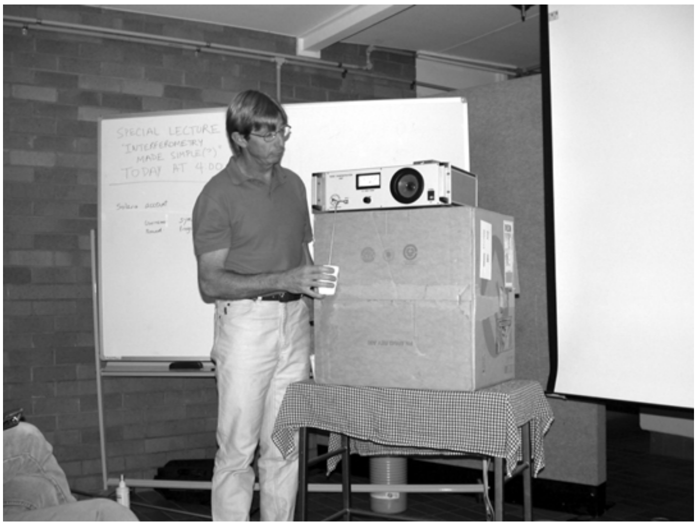
Figure 1: Ravi Subrahmanyan and Rick Forster

The workshop was attended by about 70 participants, of whom about half were presenters. Among those invited to lecture on millimetre-wave astronomy were Rick Forster, research astronomer at the Hat Creek Radio Observatory in California (site of the BIMA array) and former Project Scientist for the Australia Telescope. Of the non-presenters, about two-thirds were postgraduate or undergraduate students, and roughly half had no previous experience with radio astronomy or reducing synthesis data. Attendees hailed from five states (NSW, ACT, VIC, QLD, TAS) with some coming from as far away as Ireland and Chile. As in the past, we were able to subsidise travel and accommodation for many of the student participants thanks to financial support from the Donovan Astronomical Trust.

Indications from the post-workshop feedback are that the workshop went extremely well. We ended early on Friday so that many of the participants could enjoy some recreational activities, such as a bushwalk in Mt Kaputar National Park or joyriding in a small plane flown by David McConnell. Most participants seemed to endorse the idea of holding future workshops at the observatory, although the current lack of a proper lecture hall is a drawback.

All of the speakers and organisers, and especially the Narrabri staff, should be congratulated for pulling off a terrific workshop!

Figure 2: Students Ilana Klamer, Sebastian Gurovich, Antoine Bouchard and Kelly Kranz during morning tea.



For further information about the workshop, including electronic copies of the presentation materials, see *www.atnf.csiro.au/whats_on/workshops/synthesis2003*.

Tony Wong
(Tony.Wong@csiro.au)

Figure 3: Graeme Carrad demonstrating the principle of noise temperature.

Strange road to astronomy

Editors note: One night at the synthesis workshop, Jessica Chapman and Marianne Doyle got talking about how they became interested in astronomy. Here is Marianne's story.

From a very young age I wanted to be an astronomer, but I come from a working class family that did not even consider the possibility of a university education. Every primary school talk I gave during the mid-to-late sixties was about our solar system. I knew about every planet, their moons, their rotation and revolution periods – the lot. I left school at the end of 1973 having completed junior school to a very high standard. My future, as far as I could see, lay in working in offices with the dream of becoming an astronomer being just that – a dream.

After many years and many experiences – a divorce, working overseas, travel, single parenthood and working with disabled children in preschools – the event which came to determine my fate occurred while I was flying a $2 kite with my son in the back yard on a winter's morning. The kite was heading towards a tree and to save it I jumped over the back fence, landed in a hole, and heard a snap. I had broken my leg. It turned out to be the best thing that had happened in years.

Having to slow down for the first time and spend six weeks with my leg in a cast, I had plenty of time to think about where my future lay. Working with children and being a single parent sounded like a sure way to end up in one of those jackets where you get to hug yourself. Hmm… astronomy! I began to seriously consider it and one day I happened to mention it to a friend. She said, "Go for it! The local high school does adult external education, so why not contact them and see what you can do?"

I looked into it further. It turned out I needed to complete junior science, which I had never done in high school, and senior english, physics, chemistry and maths in order to qualify for university. My son was starting school the following year so it seemed to be the right time to try it.

The plan went something like this: "I want to do a PhD in astronomy but I have lots of hurdles to jump. First junior science and senior english… Wow, I passed with flying colours! Oh well, onto the next challenge: senior physics, maths and chemistry… Wow, a rank well within the required level for university! Okay I will try to get a place at university… Wow, I did it! Hmm… now to complete undergraduate." Within seven weeks of starting university, I was struggling so much that I saw a career counsellor for help. He stared at me in disbelief and said, "You are a single parent and doing how many credit points? Many single people still living at home with mum and dad find university study a struggle. Cut down your work load." It was the best advice I was to receive. I completed my undergraduate course in four years instead of three. The plan continued. "Well I did it, but will I get into honours?" To get into honours I needed to achieve a GPA … and blah blah blah. To my amazement, I did. "Now I have to get *through* honours." It was *SO HARD!* It took 18 months to complete, and included a broken rib and the untimely and unexpected death of my project supervisor, who was both my friend and mentor on my journey to becoming an astrophysicist. Then - “Wow, how did I manage to get first class honours? Oh, but will I get a PhD scholarship?” Getting a scholarship was crucial as I could not afford to continue my studies without financial assistance and I couldn’t bear to see my career come to an end when I was so close. And I did get it. I am now doing a PhD in astrophysics, with a scholarship, which makes me feel like a millionaire in comparison to the last 14 years.

Sometimes when I am working, I stop and sit back and drink it all in; I realise that I have finally gotten to exactly where I always wanted to be. My project looks at star formation efficiency in galaxies in the local universe. My supervisor, Dr Michael Drinkwater, is a renowned scientist and a great inspiration. My scholarship provides me with the income I need to live well and give my wonderful, though typical (read strong-willed, determined and argumentative), 14 year old son the kind of life he deserves. There are times I would have just given up without his encouragement and support, and that of my wonderful partner. I even have the chance to use the Narrabri array in August, and will attend the two-week International Astronomical Union conference in Sydney in July. My life is becoming full and wonderful!

The road to astronomy has been long and twisting, but it’s been well worth every tear, scream, smile, tantrum and stressed moment! Where to from here? Well, I have to get through my PhD first!

Marianne Doyle, University of Queensland Astrophysics group
(mtdoyle@physics.uq.edu.au)

New antenna control computers for the Compact Array

History

The ATOMS (Australia Telescope Observatory Management System) project was proposed in 1995 as an upgrade path for the observatory control/ management software and hardware. A specific aim of the project was to replace the aging PDP-11 based antenna control computers (ACCs) with Intel PC-based hardware to provide a continued maintenance path. The old ACCs were proving increasingly more difficult and expensive to maintain.

Initial efforts went into a software development framework based on the ATOMS web server. In keeping with the times, most software was to use an object-oriented design. The platform independent and object-oriented java language was chosen as a base for all high level software. This decision was based mainly on its perceived status as a clean object-oriented language with good prospects for future support, without the baggage of old features carried by languages like C++. The lower level C and C++ code running the new ACCs was developed for the pSOS operating system, mainly because the Epping electronics group was already using this product. We later came to regret this decision, but it is not clear a superior alternative existed at the time.

In the early days the project was carried by David (aka George) Loone. (While at Narrabri, George was forced to take on his middle name due to an excess of Daves confusing all conversations.) His efforts were instrumental in getting the project underway and we are still rediscovering useful software in the far corners of the ATOMS library. He was responsible for the design of the ATOMS software environment, major parts of the infrastructure software (e.g. message logging) and the java interface to the new ACC’s servo control system. The servo system is the software that controls the motion of the antenna as it slews to and tracks sources. Wim Brouw implemented the pSOS servo code during 1998/1999 and initial tests were done towards the end of that time using antenna 6 and the Mopra antenna.

Early in 2000 David Loone announced his imminent departure to the private sector and I was approached to take over the project to complete the ACC transition. Foolishly I accepted and began work on an interface to the current VMS software, to enable a transitional phase where we could drive the new ACCs from the existing software. During a few feverish months before David Loone’s departure, two Daves (McConnell and Loone) created a design for a major missing component: Cycle. This component takes care of all 'cycling' interfaces in the antenna (i.e. devices that need to know about the integration cycle) and precisely timed monitoring of things like total power and sampler statistics. It was then up to Scott Cunningham, who had been working on the pSOS dataset interface software until then, to implement this component.

From David Loone's departure until the arrival of a new Dave, Dave Brodrick, we were down to two active developers and progress slowed. With the arrival of Dave Brodrick, we gained a developer who was not afraid of hardware and low-level pSOS software (unlike me) and also spoke java. Things started speeding up again and Scott's pSOS knowledge was rapidly transferred to Dave. This turned out to be very timely since Scott was soon to move on as well, leaving Dave and me to hold the fort. By this stage the software was far enough advanced that all major components had been tested on the antenna, and, we naively thought, only minor problems remained. Meanwhile Dave McConnell found some spare time to design and help with work on the initial version of the new monitoring system which was used to display data from the new mm-receivers on the web.

But the bugs continued to bite. Once we were able to drive the antennas and control the various devices we thought we were close to the final switchover, especially after we obtained our first fringes with the new system on 14 March 2002. However, pSOS had some surprises in store for us in the form of intermittent faults. There were several network related problems, some of which were resolved with a vendor supplied patch, but others plague us to this day. We also ran into problems with the floating-point libraries, forcing us to write our own square-root routine and other math functions. David managed to find paths around the various problems, and eventually the ACCs were booting stand-alone from FlashMemory (i.e. a memory card used in digital cameras). After a few more trial runs with friendly observers we switched over for what will hopefully turn out to be the last time in early May 2003.

Current status and plans

The new ACCs have now been running the array for several weeks. Some observers have been lucky to encounter no problems, while others have had more trouble. The main failure mode of the new ACCs is related to the creation of new network connections, so failures tend to occur at program change-over, especially remote observing start and finish. Recovery is generally quick, via remote reset. We expect to iron out most problems over the coming weeks, but may be stuck with the network problem for longer, since it may originate in proprietary pSOS code. In the longer term we may wish to migrate away from pSOS and use Linux instead.

At present the new ACCs do not provide much extra functionality to the observer, but this will change with time. The main thing observers will notice is the DriveMon window, providing fast graphical monitoring of the antenna tracking errors (and other drive information). It has already uncovered a number of previously unknown tracking problems and drive oscillations and will be a valuable tool in improving the millimetre pointing performance. The monitoring system is the next big change in the pipeline. We currently have an industrial experience student, Le Cuong Nguyen, working with us for six months and making good progress. The new system will move away from the CAMON displays and provide more flexible graphical monitoring tools and watchdogs to keep an eye on array performance and system health. It will include more sources of monitoring and be a lot more flexible, e.g. monitoring intervals are adjustable per item from 0.1 second to minutes or hours, and trends can be graphically explored by viewing monitor point values against time. We aim to provide on-line access to an archive of monitor data going back at least one year.

With the new software comes increased flexibility – we will be able to control the subreflectors to improve system performance at high frequency (pending hardware fixes) and accommodate requests for unusual observing modes. We could, e.g. use continuously scanning mosaics instead of individual pointings or scan the dishes in a circle around your source to reduce pointing errors.

If you are thinking about novel ways to use the Compact Array antennas or would just like some specific information about the new system, feel free to contact David (David.Brodrick@csiro.au) or myself (Mark.Wieringa@csiro.au).

Mark Wieringa
(Mark.Wieringa@csiro.au)

ATNF graduate student program

It's a pleasure to welcome three students into the ATNF co-supervision program:

- Vicky Safouris (RSAA, ANU) will study "Environmental influence on the evolution of radio jets from AGN" with supervisors Geoff Bicknell (RSAA, ANU) and Ravi Subrahmanyan (ATNF).
- Ilana Klamer (University of Sydney) will study "CO in high-redshift galaxies" with supervisors Elaine Sadler (University of Sydney), Dick Hunstead (University of Sydney) and Ron Ekers (ATNF).
- Jamie McCallum (University of Tasmania) will undertake a study "A study of water megamasers in AGN" with supervisors Simon Ellingsen (University of Tasmania) and Jim Lovell (ATNF).

As mentioned in the last newsletter (issue 49, February 2003), Ilana and Jamie are also the 2003 recipients of CSIRO/ATNF scholarships.

Congratulations, and best wishes for the future, to Scott Gordon who has been awarded a PhD by the University of Queensland on "Radio Studies of Southern Interacting Galaxies". Many Universities issue awards for PhD theses of exceptional quality, and we would appreciate hearing about those where the student has had an association with the ATNF. Prof John Dickey reports that the University of Minnesota has just awarded its Best Dissertation Award in Physical Sciences and Engineering for 2001 – 2003 to Naomi McClure-Griffiths, who is now a Bolton Fellow at the ATNF.

Finally, Monday, 2 June saw the ATNF Annual Student Symposium for 2003 (see *www.atnf.csiro.au/research/conferences/student_symposia/ASS2003*). We had an excellent set of 10 presentations from students affiliated, or associated in some way, with the ATNF and covering a wide range of topics, including astronomy, visualization and low-frequency dynamic range studies. We thank Rachel Deacon, Daniel Mitchell, Erik Muller and Jess O'Brien for organizing the event this year.

Lister Staveley-Smith
Graduate Student Coordinator
(*Lister.Staveley-Smith@csiro.au*)

Australia Telescope Users Committee report

The last ATUC meeting was held on 3 – 4 March 2003. The committee thanked retiring members, Simon Ellingsen, David Barnes, Dion Lewis and Martin Meyer who have completed their terms on ATUC. The committee extended special thanks to Professor Ron Ekers as he stands down as ATNF Director, for his service to the ATNF user community.

As in all ATUC meetings, observatory reports were presented by each Officer-in-Charge. There was some discussion on the scheduling and remote observing options during the period of the IAU General Assembly (*www.astronomy2003.com*) as well as the over-subscription of mm-observing time coupled with a shortage of suitable cm-swap projects. In presenting the Parkes report, John Reynolds discussed the impact of the NASA Mars tracking project and receiver upgrade options. Tasso Tziouomis presented a VLBI update and also outlined the "Radio Quiet Zones" initiative.

A report on the Compact Array's online archive project was presented by Robin Wark. This is progressing well; all 1.5 Terrabytes of data are now on disk in Canberra, thanks to sterling work by Prue Sutton during her summer vacation. Rob Power (CSIRO division of Computing, Mathematics & Information Systems) is now creating a set of user interfaces and converting the data to a format compatible with the emerging VOTable format (*vizier.u-strasbg.fr/doc/VOTable*).

Jess O'Brien presented the latest revision of the Compact Array Users Guide. This now requires input from Compact Array users, particularly for specialized observations.

Michelle Storey gave a review of the highly successful visit of the LOFAR siting committee with an update on current time scales and possible options for Australian participation. Ron Ekers presented his last report as ATNF Director and an update on the ATNF SKA-demonstrator options and developments.

As a result of further discussions, ATUC undertook to compile a report on the required upgrades for single-dish spectral-line software for ATNF telescopes. This should be available shortly, from the ATUC homepage (*www.atnf.csiro.au/management/atuc*).

Vince McIntyre and Carole Jackson
(Vince.McIntyre@csiro.au)
(*Carole.Jackson@csiro.au*)

New ATNF pulsar catalogue released

The pulsar group at ATNF has just released a new pulsar catalogue. This catalogue, which is designed to be of use to both pulsar experts and more general users, currently contains the main observational parameters for 1,300 pulsars. A new web interface (Figure 1) allows interrogation of the catalogue, with both tabular and graphical outputs. For the expert user, the catalogue can also be accessed directly from Linux and Unix systems. Data can be selected in various ways, either by pulsar name (with wildcards), by logical conditions on parameter expressions or by distance from a nominated position. Several forms of tabular output are available, giving lists of nominated parameters with varying amounts of information or complete listings for a particular pulsar. Custom variables can be created from parameter expressions and either listed or plotted. Both X-Y plots and histograms are supported, with zoom facilities and the ability to list pulsars within a given area or to identify a particular pulsar on the plot (Figure 2).

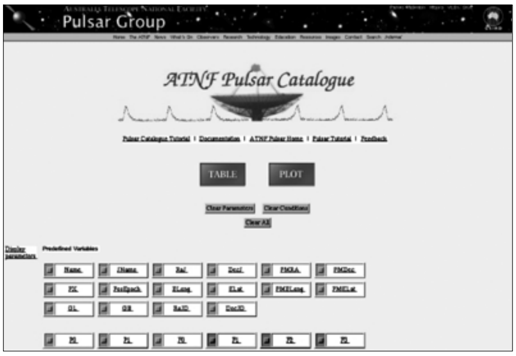


Figure 1: The ATNF pulsar catalogue web interface.

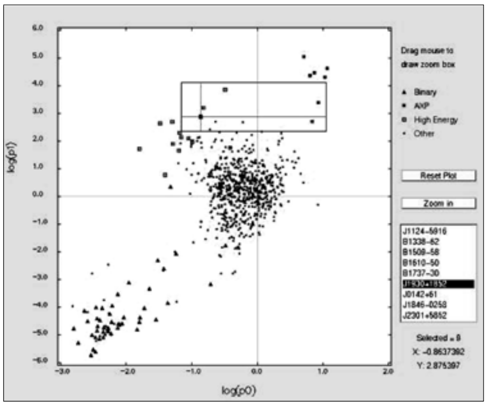


Figure 2: An example of an x-y plot showing an identified pulsar.

The catalogue is based on one, that has been maintained and developed for over 30 years by various members of the pulsar community. With help from Maryam Hobbs, we have undertaken an extensive search of the recent pulsar literature to bring the database up to date. The catalogue includes information on Anomalous X-ray Pulsars (AXPs) as well as spin-powered pulsars. The web interface was designed and constructed by Albert Teoh, a Summer Vacation Scholar at the ATNF this past summer.

The catalogue may be accessed at *www.atnf.csiro.au/research/pulsar/psrcat*. We encourage you to try it out and send us your comments.

Dick Manchester and George Hobbs (Dick.Manchester@csiro.au, George.Hobbs@csiro.au)

ATNF outreach

New outreach positions

One of the strategic objectives of the ATNF is to conduct an effective outreach program. Astronomy generates a high level of public interest and is ideally suited to promoting science and to encouraging the next generation of students towards a science-based career. The ATNF is fortunate to have high public profile in Australia, in particular for the Parkes radio telescope, which since the release in October 2000 of the movie *The Dish*, has had an almost iconic status. The primary Public Outreach goals for the ATNF are to attract young people into science; to raise the profile of science in Australia and to maintain and foster good relations with our local communities. The ATNF's public outreach program is wide-ranging and includes the operation of Visitors Centres at the Parkes and Narrabri Observatories, educational programs, publications and promotional materials, public talks and media interviews, and special events such as Open Days in Sydney and at the Observatories.

Following discussions with the user community and the ATNF Steering Committee, we are currently expanding our outreach activities. Two outreach positions have recently been advertised. One is for an Education Officer who will develop and support educational resources and outreach programs in astronomy and associated technologies, in particular for high-school students and teachers. This position will be based at the ATNF headquarters in Marsfield, Sydney. The second position is for a Centre Manager at the Parkes Visitors Centre, with a coordination role between the Parkes and Narrabri Visitors Centres. The number of visitors to Parkes has risen dramatically in recent years from approximately 55,000 in 1999 to 135,000 in 2002. We aim to improve the facilities provided to our visitors at both our Visitors Centres and to improve the coordination between outreach activities at our different sites. Both the new outreach positions attracted an excellent response, with many applications. We look forward to announcing the new appointments in the near future and to starting some new outreach initiatives.

Jessica Chapman (Jessica.Chapman@csiro.au)

New results from an old friend – the Vela pulsar

There are many known pulsars, currently around 1,700 have been identified, and this multitude has made many contributions to our understanding of their average properties. There are, however, a few that have provided the bulk of the insights into the structure and environment of pulsars. Vela could well claim pre-eminence amongst these. The Vela pulsar was the first discovered in the southern hemisphere (Large et al., 1968) and in an exciting rush of papers was shown to be slowing down, having a polarization sweep across the pulse and to glitch (Radhakrishnan et al., 1969; Radhakrishnan and Manchester, 1969) confirming the rotating solid body as suggested by Gold (1968), and most importantly, identifying the emission regions as the magnetic poles (Radhakrishnan and Cooke, 1969), as opposed to the pulsating-star model.

This old friend has recently provided us with even more information, with observations from a selection of Australian, and orbital, telescopes. This current series of observations was sparked by the dedicated pulsar telescope operated by the University of Tasmania for over twenty years now. Following the last glitch (January 2000, Dodson et al., 2002) Chandra produced a stunning high-resolution image of the local X-ray emission (Pavlov et al., 2000; Helfand et al., 2001) showing a double cross-bow structure that many authors have modelled (Helfand et al., 2001; Radhakrishnan and Deshpande, 2001). Whilst the Vela X nebula had been imaged in great detail at 20 cm by Bock et al. (1998; 2002) and the VLA had imaged the region around the pulsar at 6 cm (Bietenholz et al., 1991) no arcsecond observations close to Vela had been undertaken at the ATCA. Therefore we observed at 6 cm and 3 cm using the pulsar-binning mode, with the pulsar as our phase reference.

With improved low surface-brightness sensitivity, higher frequency and longer integration times, we uncovered the radio shell around the X-ray structure as shown in Figure 1. The X-ray emission (data for which was downloaded from the Chandra archives) in grey-scale is overlaid with the 5-GHz radio contours. This highly polarized emission has a bright northern lobe (as seen by Bietenholz et al., 1991) and a weaker, more diffuse southern lobe.

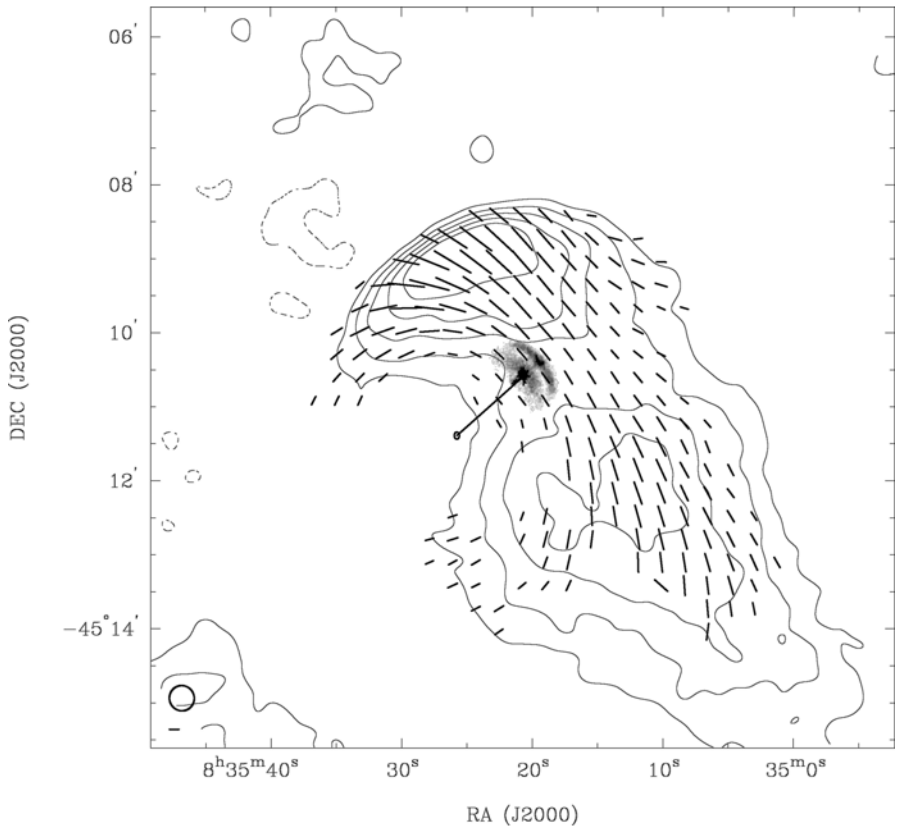


Figure 1: The Chandra observation of the Vela pulsar-wind nebula (grey-scale) and the 5-GHz radio contours (-1,1,2,3,4,5 mJy/beam with 20-arcsecond beam). The de-rotated magnetic field lines are overlaid, with a 1-mJy bar at the bottom left, below the restoring-beam size. The proper motion vector shows the distance travelled in 1000 years, and ends with the 3-sigma error ellipse.

With the ATCA high-quality polarization measurements were possible. These provide the best evidence that the two lobes are related, as the de-rotated polarization angles are smooth and symmetrical around the pulsar. More details can be found in Dodson et al., (2003b).

In the 1.4-GHz observations of Bock et al. (1998) these lobes are visible, as are many other features in the region. However the polarized emission shows a similar termination to the south. We have shown that this is not due to RM depolarization, and appears to be a genuine termination, as opposed to those associated with the filaments (Bock et al., 2002).

It is worth noting that this is not a very luminous object, possibly explaining the small numbers of pulsar-wind nebulae found in various searches (e.g. Stappers et al., 1999).

Finally the LBA observations of the Vela parallax have been completed (Legge, 2002; Dodson et al., 2003a). The proper motion agrees with that of Bailes et al. (1989) and the parallax with that of Caraveo et al. (2001), with significantly reduced errors. The proper motion vector is shown overlaid in Figure 1, with the extent representing the distance travelled in the last 1000 years. The interest lies in the alignment of the projection of the proper-motion vector with the spin axis deduced from X-ray nebula. This is of great theoretical significance as several authors (e.g. Spruit and Phinney, 1998) predict just such an alignment if the initial impulse of the supernova was averaged over many rotations of the progenitor star. The alignment is very good, but not perfect, allowing the estimation of the duration of the supernova impulse.

Further LBA observations of several other pulsars, using the pulsar-binning mode, are being made. These, we hope, will be able to tell us as much as our all time favourite astronomical object.

References

Bailes, M., Manchester, R. N., Kesteven, M. J., Norris, R. P., and Reynolds, J., 1989, ApJL 343, L53

Bietenholz, M. F., Frail, D. A., and Hankins, T. H., 1991, ApJL 376, L41

Bock, D. C.-J., Frail, D. A., Sault, R. J., Green, A. J., and Milne, D. K., 1998, Memorie della Societa Astronomica Italiana 69, 919

Bock, D. C.-J., Sault, R. J., Milne, D. K., and Green, A. J., 2002, in "Neutron Stars in Supernova Remnants" (ASP Conference Proceedings), p197

Caraveo, P. A., De Luca, A., Mignani, R. P., and Bignami, G. F., 2001, ApJ 561, 930

Dodson, R., Legge, D., Reynolds, J., and McCulloch, P., 2003a, ApJ, submitted

Dodson, R., Lewis, D., McConnell, D., and Deshpande, A., 2003b, MNRAS, in press

Dodson, R. G., McCulloch, P. M., and Lewis, D. R., 2002, ApJL 564, L85

Gold, T., 1968, Nature 218, 731

Helfand, D. J., Gotthelf, E. V., and Halpern, J. P., 2001, ApJ 556, 380

Large, M., Vaughan, A., and Mills, B., 1968, Nature 220, 340

Legge, D., 2002, PhD thesis, University of Tasmania

Pavlov, G. G., Sanwal, D., Garmire, G. P., Zavlin, V.E., Burwitz, V., and Dodson, R. G., 2000, American Astronomical Society Meeting 196, 37.04

Radhakrishnan, V. and Cooke, D. J., 1969, ApJL 3, 225

Radhakrishnan, V., Cooke, D. J., Komesaroff, M., and Morris, D., 1969, Nature 221, 443

Radhakrishnan, V. and Deshpande, A. A., 2001, A & A 379, 551

Radhakrishnan, V. and Manchester, R., 1969, Nature 222, 228

Spruit, H. C. and Phinney, E. S., 1998, Nature 393, 139

Stappers, B. W., Gaensler, B. M., and Johnston, S., 1999, MNRAS 308, 609

D. Legge, D. Lewis, A. A. Deshpande, R.. Dodson, J. Reynolds, D. McConnell and P. McCulloch
(*rdodson@kerr.phys.utas.edu.au*)

OH masers, planetary nebulae and butterfly wings

Planetary nebulae are the remnants of low-to-middle mass stars. When stars, like our own sun, run out of core-burning hydrogen, they go through a sequence of structural changes. The outer layers greatly expand while the stellar cores decrease in size and become hotter. In the asymptotic giant branch (AGB) stage most stars shed a large fraction of their mass through slow, dense stellar winds. After most of the outer layers of gas have blown away, stars change from losing mass in slow dense winds to losing mass in much hotter, faster winds. The hot winds sweep up the remaining material surrounding the stars and the swept-up shells may then be seen as glowing ionised nebulae. Stars in this stage are known as planetary nebulae.

Planetary nebulae can be spectacularly beautiful and reveal many different forms. While some appear circular, others have the shapes of butterfly wings, or show elliptical or bipolar shapes; in some cases with complex, filamentary structures. The causes for this proliferation of geometries are not yet known, but several different theories are being debated. One possible explanation is that magnetic fields from the stars constrain the stellar winds to flow in some directions only. Alternatively, companion stars or planets may exert gravitational effects, or rotation of the central stars may be important.

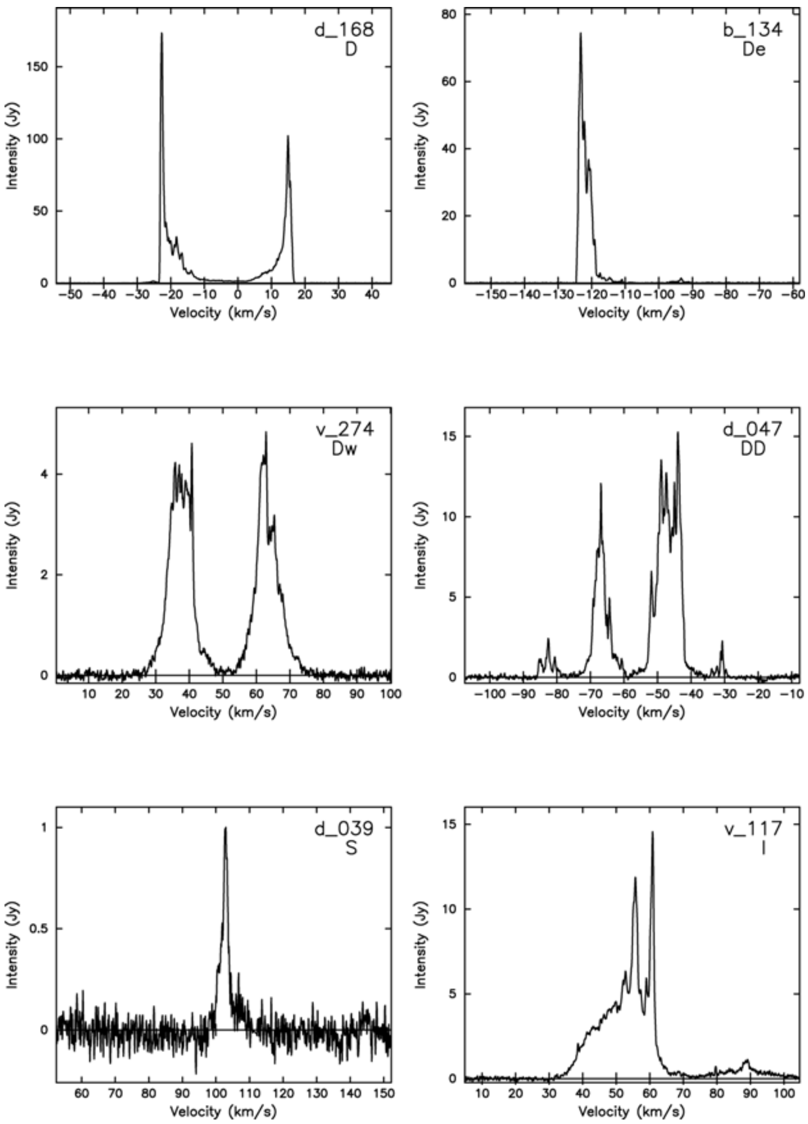


Figure 1: Some examples of OH 1612-MHz spectra of post-AGB stars, obtained from data taken with the Parkes radio telescope in September 2002. The catalogue name of each star is given in the top right-hand corner with a category type given below the name. The 85 stars in this study have been classified into six different types depending on whether the OH maser profiles are double (D, De, Dw and DD-types), single (S-type) or irregular (I-type).

We are studying a sample of stars that are the immediate precursors to planetary nebulae. These so-called post-AGB stars are in an intermediate stage of evolution between the AGB and planetary nebulae. The different geometries seen in planetary nebulae are also evident in post-AGB stars and it seems likely that the shaping of non-spherical planetary nebulae winds begins early in the post-AGB phase of stellar evolution. By studying the post-AGB stars we may be able to determine what causes the complicated structures seen in some planetary nebulae.

To investigate this question, we have selected a well-defined sample of 86 post-AGB stars from a previous study of OH 1612-MHz maser sources in the Galactic plane (Sevenster et al., 1997; 2001). For this sample, we are observing radio emission from hydroxyl (OH), water (H_2O) and silicon-monoxide (SiO) molecules that are located in the outflowing stellar winds. Each molecule requires different physical conditions to exist and the different molecules together probe a range of locations within the circumstellar winds. The molecular radiation is produced by a maser effect – the microwave equivalent of lasers. Maser spectra provide information on the wind velocities, and on whether the winds are likely to be spherically symmetrical or distorted.

So far we have observed 85 of the 86 sources in our sample in the four ground-state OH maser transitions at 1612, 1665, 1667 and 1720 MHz. The data were taken using the Parkes radio telescope in several observing sessions between September 2002 and February 2003. All observations were made with the H-OH receiver, with the multibeam correlator backend configured with 8192 channels and one beam. A linear feed with a radio frequency hybrid was used to generate two circular polarizations. A bandwidth of 4 MHz was used for all observations. After Hanning smoothing, the final velocity resolution of the spectra was 0.18 km/s per channel.

Figure 1 shows examples of OH 1612-MHz maser spectra for sources in our sample. We have classified the OH spectra using six different categories, depending on the shape of the spectral profiles. Of the 85 sources, 57 exhibit a classic double-peaked spectrum ("D-type") at 1612 MHz, with steep outer edges and sloping inner edges between the two peaks. This spectral profile is characteristic of an expanding spherical shell, with the two peaks being emitted from small "caps" on the front and rear of the shell. In our sample we see several variations on the classic double-peaked profiles: The "De" spectra have one emission peak which is very much stronger than the other – this shows that the maser emission is much stronger on one side of the star than on the other. The "Dw" stars have OH 1612-MHz spectra with sloping outer edges as well as sloping inner edges. These are expected to be stars with bipolar shells. More unusual is the "DD" source with four emission peaks. Only one other source with this characteristic is known. We also find a small number of "S-type" sources. These show only a single peak of maser emission, but otherwise have characteristics in common with AGB and post-AGB stars. Finally the "I" or irregular spectra have multiple emission peaks and a larger-than-usual velocity range. Post-AGB stars with irregular spectra have previously been associated with exotic envelope geometries.

From our Parkes data we have also detected 1720-MHz maser emission towards several sources. Higher resolution follow-up observations are needed to determine whether these are associated with the stars or the interstellar medium. OH 1720-MHz maser emission has so far been confirmed for only one post-AGB star (Sevenster and Chapman 2001).

Category	1612 MHz	1665 MHz	1667 MHz
D	57	5	24
Dw	7	1	1
De	4	0	2
DD	1	0	0
I	11	14	8
S	5	2	6
Total	**85**	**22**	**41**

Table 1: Spectral classifications and number of detections of OH 1612, 1665 and 1667-MHz maser emission from a sample of 85 likely post-AGB stars

Table 1 lists the number of sources detected in the OH 1612, 1665 and 1667-MHz lines, for each category. The fraction of sources detected at the 1665 and 1667-MHz lines are around 25% and 50% respectively. (As this is an OH 1612-MHz selected sample, all sources have 1612-MHz emission). A significant result is that of the 1665-MHz detections, 64% are classified as irregular, in contrast to the OH 1612 and 1667-MHz spectra where 13% and 29% of maser spectra are found to be irregular.

Sevenster (2002a,b) has recently discussed the far-infrared properties of a group of evolved stars referred to as the 'LI' sources. These are thought to be unusually massive stars and the precursors to the more extreme bipolar planetary nebulae. From our OH data we find that none of the LI objects was detected at 1665 MHz, with only a few detections at 1667 MHz.

As future work, we plan further observations to obtain spectra of the H_2O and SiO maser lines, and high-resolution OH-polarization imaging for some of the more unusual sources.

References

Sevenster, M. N., Chapman, J., Habing, H., Killeen, N., Lindquist, M., 1997, A&AS, 124, 509
Sevenster, M. N., Van Langevelde, H., Chapman, J., Habing, H., Killeen, N., 2001, A&A, 366, 481
Sevenster, M. N. and Chapman, J. M., 2001, ApJ, 546, L119.
Sevenster M. N., 2002a, AJ, 123, 2772
Sevenster M. N., 2002b, AJ, 123, 2788

Rachel Deacon, Jessica Chapman and Anne Green
(Rachel.Deacon@.csiro.au)

Monitoring the Circinus galaxy H_2O megamasers from Tidbinbilla

The Circinus galaxy is the closest Seyfert galaxy and also hosts the closest nuclear H_2O megamasers (Gardner and Whiteoak, 1982). A typical spectrum (such as Figure 1) shows the classic triple-peaked spectrum, which is associated with masers located in a circumnuclear disk (e.g. NGC 4258, Nakai et al., 1993). VLBI imaging of the emission has revealed this to be the case, together with emission from other masers located in a nuclear outflow, with the maser spots spread out over a region about 70 milliarcseconds across (Greenhill et al., 2003).

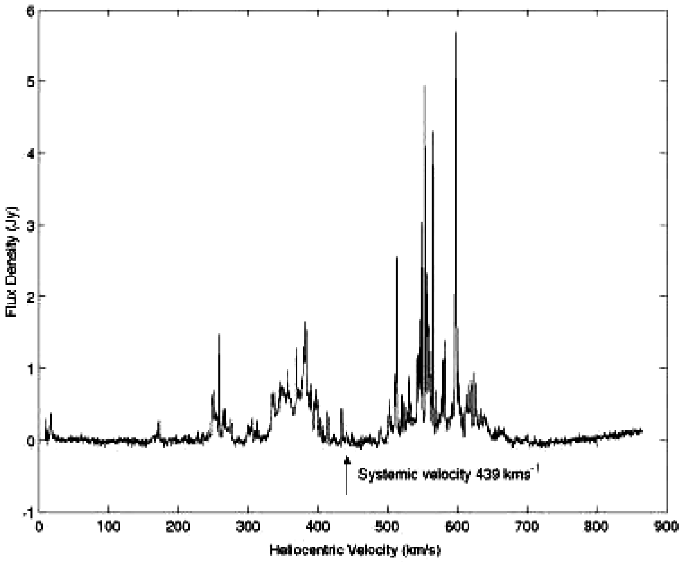


Figure 1: Average spectrum of Circinus on 28, April 2003.

The Circinus galaxy megamasers are known to be variable on timescales of weeks and months with individual maser features having a lifetime of around one year. However, a far more rapid form of variability was first noted by Greenhill et al. (1997). Most of the masers observed showed some degree of variability over an hour while one feature displayed a doubling of its flux density over about 10 minutes. They examined three possible extrinsic mechanisms, interstellar scintillation (ISS) in the turbulent ISM, variability of background emission, or variability of a radiative pump. At the AGN Variability Workshop in 2001, Maloney argued that the rapid variations were caused by ISS. If the variability of the background emission were the cause, then the masers would need to be unsaturated, which is not believed to be the case, while radiative pump variability was considered unlikely because the lines were believed to be collisionally pumped (Maloney 2002). This left ISS as the default explanation.

Since then our understanding of ISS has increased dramatically, mostly because of the discovery that rapid intra-day variability (IDV) at cm wavelengths of distant quasars is principally caused by ISS. (e.g. PKS 0405-385 (Kedziora-Chudczer et al., 1997), J1819+385 (Dennett-Thorpe and de Bruyn, 2000), PKS 1257-326 (Bignall, et al., 2003)). Two definitive tests of scintillation have been found – the presence of an annual cycle in the characteristic timescale of the variations and the detection of a time delay in the variability pattern recorded at two, widely separated telescopes. If either of these is detected, then it is an unequivocal result that the variability is due to ISS. This has been beautifully demonstrated in the case of the quasar PKS 1257-326, as described in the ATNF News from October 2002; a more detailed discussion of the observed time-delay and annual-cycle evidence can be found in Jauncey et al. (2003).

The possible scintillation of the Circinus megamasers is interesting for several reasons. Firstly, the scintillation is linked to their microarcsecond structure and observations could reveal differences between the size and evolution of the disk and outflow masers. Secondly, having a number of these near point-sources gives multiple lines-of-sight through the ISM over a small region, which could provide a way of probing the small-scale structure of the ISM.

To establish the nature of the variability, we have started a program of regular observations of the Circinus megamasers, using the Tidbinbilla 70-m antenna under a service-observing proposal. By measuring the characteristic timescale of individual features throughout the year, we are searching for annual cycles. This requires high time-resolution, high sensitivity observations with high spectral resolution, a combination that is presently only achievable using the Tidbinbilla antenna. At 22 GHz, it is roughly an order-of-magnitude more sensitive than the Parkes antenna. This is especially important, as currently the maser spectrum is significantly weaker than in previous observations. In observations last year, the strongest feature had a mean flux density of about 30 Jy. Now the strongest feature is a factor of five less, increasing our need for a highly sensitive antenna.

In our observations we are using a 64-MHz bandwidth divided into 2048 channels to cover all of the emission. To maximise the time spent in continuous observation of the Circinus megamasers, we have adopted an observing scheme that alternates 5-minute observations of a reference position with 30-minute observations of Circinus. This allows for good sampling of data combined with reliable bandpass calibration.

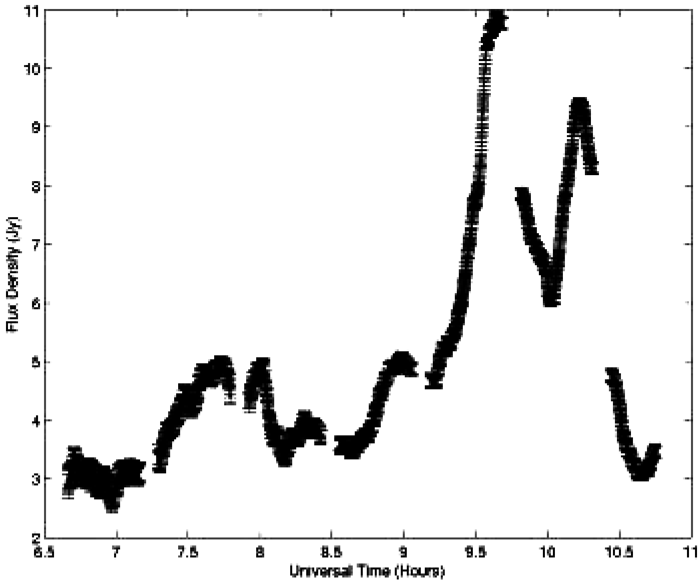


Figure 2: An extreme scattering event? Light curve of the feature at v = 553 kms^{-1}

The observing program began on day 86 of 2003 and observations are to be made every month. Using archival data collected previously reveals that the characteristic timescale has obviously changed between these epochs although the sampling is still too sparse to make any definitive claims as to the cyclical nature. Also, the individual maser features do not all have the same characteristic timescales, suggesting that if scintillation is responsible, we are probably seeing some variability in the microarcsecond structure of the masers. For example, observations made on day 124 of 1996 revealed the most rapid variations yet with a peak-to-peak timescale of about 20 minutes while in Figure 2, a light-curve recorded on day 118, the timescale is closer to about 45 minutes.

Several dramatic examples of large and sudden variations have been observed such as shown in Figure 2. The amplitude of this feature rose by a factor of about 2.5 over half-an-hour, followed by another rapid inflection. The amplitude of these changes is unusual when compared with the other recorded data that displays relatively smooth and low amplitude variation. The observations did not show such an outburst in any of the other maser features. From our observations to date, it appears that the variations differ in each maser feature, suggesting that each feature differs in size and structure, or that each maser feature is probing an independent line of sight through the scattering medium.

If annual cycles are detected then we will have the unparalleled opportunity to study multiple lines of sight through the interstellar medium within a small area. If the nature of the variability is shown to be due to diffractive scintillations, then this will be the first detection for a non-pulsar source.

References

Bignall, H. et al., 2003, ApJ 585, 653
Dennett-Thorpe, J., de Bruyn, A., 2000, ApJ 529, L65
Gardner, F. and Whiteoak, J., 1982, MNRAS 201, 13
Greenhill, L. et al., 1997, ApJ 474, L103
Greenhill, L. et al., 2003, ApJ 590. Preprint at arXiv: astro-ph/0302533
Jauncey, D. et al., in 'Radio-astronomy at the Fringe' 2003, eds J. Anton Zensus, Marshall H Cohen, H. and Eduaro Ros, ASP conference series 300, 199
Kedziora-Chudczer, L. et al., 1997, ApJ 490, L9
Maloney, P., 2002, PASA 19, 88
Nakai, N., Inoue, M., Miyoshi, M., 1993, Nature 373, 127

Jamie McCallum, University Of Tasmania / ATNF (jmccallu@utas.edu.au)
Jim Lovell, ATNF (Jim.Lovell@csiro.au)
Simon Ellingsen, University Of Tasmania (Simon.Ellingsen@utas.edu.au)
Dave Jauncey, ATNF (Dave.Jauncey@csiro.au)

3 and 12-mm Compact Array observations of masers in star-forming regions and exoplanetary systems

Astrophysical masers have been widely studied in recent years and have been shown to be invaluable probes of the details of the environment in which they are found. Masers arise from various astronomical regions such as star-forming regions, circumstellar envelopes of AGB stars, comets, proto-planetary nebulae, starburst galaxies and AGNs. In this newsletter, we present very recent Australia Telescope Compact Array (ATCA) observations of 3-mm methanol masers in G345.01+1.79, an exceptional massive star-forming region, as well as the attempt to detect water-vapour masers in exoplanetary systems with the fully upgraded array at 12 mm.

6.7 and 12.2-GHz methanol masers are now recognized as excellent tracers of the physical conditions in massive star-forming regions, at scales from 1 to 1000 AU (1 milliarcsecond to 1 arcsecond at 1 kpc). VLBI observations have shown, for instance, that 6.7 and 12.2-GHz methanol masers arise within 3000 AU around the massive stellar object (Minier et al., 2001) and that the masing regions have linear dimension from 1 to 100 AU (Minier et al., 2002). As masers require very specific density and temperature to switch on, their observation at high resolution would reveal the nature of the physical conditions in the inner part of the protostellar envelope.

Methanol masers also exist at higher frequencies in the 3-mm range. They were predicted by Sobolev et al., (1997) and were observed at 85.5, 86.6, 86.9, 107.0 and 108.8 GHz (e.g. Cragg et al., 2001; Minier and Booth, 2002). In the southern hemisphere G345.01+1.79, a massive star-forming region, exhibits strong methanol emission at 6.7, 12.2, 85.5, 86.6, 86.9, 107.0, 108.8 and 156.6 GHz. The millimetre emission lines have been interpreted as maser features based on their narrow line-widths, their velocity coincidence with the 6.7 and 12.2-GHz maser features and their LSR velocities distinct from that of the quasi-thermal emission seen at 108.8 GHz (Cragg et al., 2001). Ellingsen et al. (2003) have recently combined the multi-frequency maser observations with the Sobolev maser-model and proposed to constrain density, dust and gas temperatures of the masing medium.

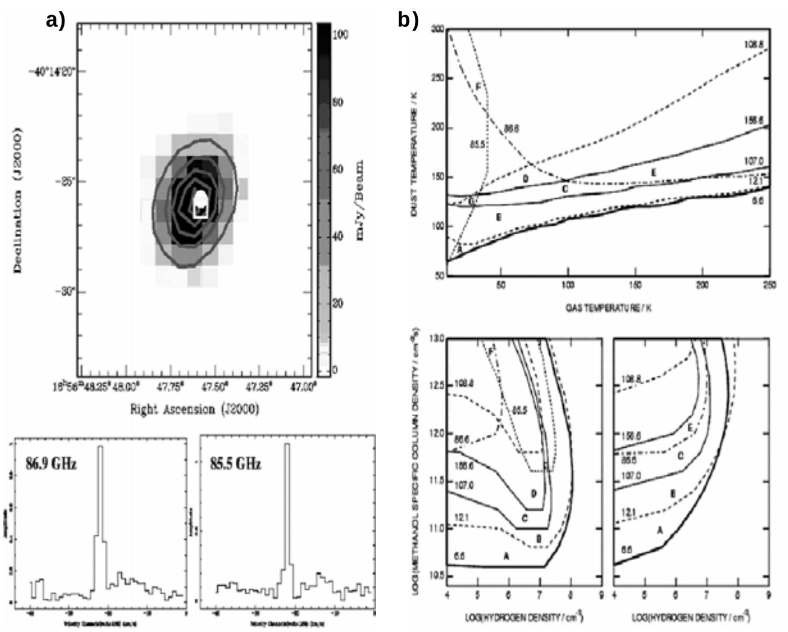


Figure 1: Methanol masers in G345.01+1.79. (a) Positions of the 6.7 and 12.2-GHz masers (white circle) and of the 85.5 and 86.9-GHz methanol masers (square) overlaid on the radio continuum emission (grey scale and contours). The ATCA 3-mm maser spectra are shown at the bottom of the figure. (b) Modelling of the maser suitable conditions (Ellingsen et al., 2003). The contour diagrams show where methanol masers become active as function of density and temperature. Contours are labelled with the maser frequency in GHz and represent a brightness temperature threshold of 10^6 K. For instance, all masers are quenched for hydrogen densities greater than 10^8 cm^{-3}. G345.01+1.79 corresponds to point F in the diagram for which all transitions could be detected.

We observed 85.5 and 86.9-GHz methanol masers in G345.01+1.79 with the ATCA in October 2002. Three antennas were used in the 750A configuration. 85.5 and 86.9-GHz masers were easily detected at the same velocity as the 6.7 and 12.2-GHz masers (Figure 1a). Surprisingly, the 3-mm masers coincide in velocity and position with the cm masers, and hence

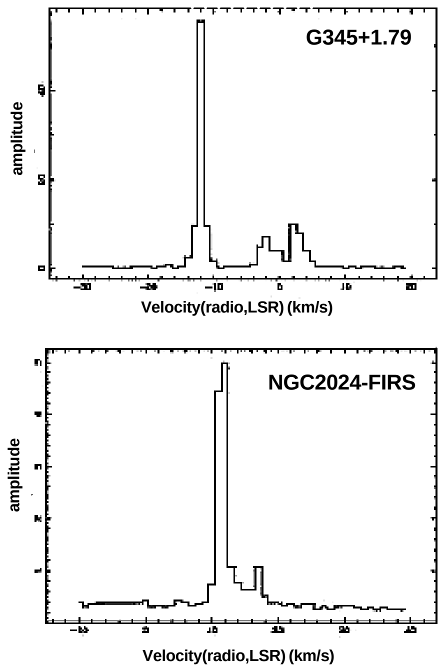


Figure 2: Examples of water-vapour maser spectra in G345.01+1.79, a massive star-forming region and in NGC 2024-FIR5, a low-mass class 0 object in the Orion B region. The spectra were obtained with the fully upgraded ATCA at 22 GHz after averaging all baseline data.

coincide in space in G345.01+1.79. This is only possible for a narrow range of physical conditions according to the maser model (Figure 1b). Figure 1b suggests that the environment of the masing medium in G345.01+1.79 contains warm dust (250 K), cool gas (40 K) and a large methanol column-density.

Water masers are also found in star-forming regions (Figure 2), but in this newsletter we present a search for water-vapour masers in a new class of astronomical objects, the extra-solar systems.

Water is the most common triatomic molecule in the universe and the basis of life on Earth. Doppler radial-velocity surveys have detected about 100 planets orbiting nearby solar-type stars including 12 planetary systems. The proximity and availability of water on or near these exoplanets is an important piece of our emerging picture of how our Solar System compares to these newly detected planetary systems, and more speculatively what the prospects for water-based life are.

22-GHz water-maser emission has been reported coming from Jupiter induced by the Shoemaker-Levy comet collision (Cosmovici et al., 1996) and more recently from several exoplanet host stars (Cosmovici et al., 2002). However, null results have also been reported for five exoplanet host stars (Greenhill, IAU circular 7985), of which Upsilon Andromedae and Epsilon Eridani were thought to emit water-maser emission.

The mechanisms that might generate 22-GHz water-maser emission include (but are not limited to) cometary impacts in atmospheres of giant planets, particularly in younger stellar systems in which much more massive and frequent impacts are expected. Whether the required conditions (column density, temperature...) are present to produce water masing is unknown or unlikely, but seven years ago, the presence of hot Jupiter-like planets around nearby stars also seemed unlikely.

Observations of water masers from exoplanetary systems would give us a new detailed window through which to explore them. Details extractable from maser detection include answers to the following questions: what is the velocity of the masing source (e.g. planets or comets)? Which part of the planetary system is compatible with the column densities of water, a pumping mechanism and a lack of collisional thermalization that would otherwise quench the maser? By combining observations and models, the physical conditions of the exoplanetary systems may be probed.

The possible detections of water masers by Cosmovici et al. in Upsilon Andromedae and Epsilon Eridani were made with a single-dish telescope (Medicina-32m) whose primary beam was equal to 100 arcsecond at 22 GHz. This is considerably larger than the diameter of planet orbits (typically a few AU) for planetary systems at 10 to 100 parsec.

In April 2003, we used the newly upgraded ATCA system at 12 mm in the EW352-baseline configuration and with antenna 6. Twenty exoplanetary systems were searched for water masers down to sensitivity of 20 – 30 mJy/beam (rms). An angular resolution of about 10 arcseconds was obtained, allowing us to probe the inner part of the planetary systems. Such a small beam would clearly establish the connection between water maser and exoplanets in case of detection. In addition, the high sensitivity of ATCA at 12 mm allows us to reach rms of 20 mJy/beam in 30 minutes. This is important since masers from a planetary atmosphere would be highly variable as the planet rotates (only 10-hour sidereal period for Jovian planets).

A 3-σ detection was made toward HD47536, a K1III giant star located at 123 pc, which is probably orbited by a giant planet (Setiawan et al., 2003). The detected line is narrow and peaks at a radial velocity of –37 km/s, which would correspond to nearly the maximum Keplerian velocity of the candidate planet around HD47356 (Figure 3). Interestingly, the line varies in velocity and intensity during the 30-minute observing scan. The line was not re-detected with Tidbinbilla in May 2003. Given the potential variability of such a line, it is not surprising. No obvious detection was made toward the other exoplanets although a few marginal detections would need further analysis.

Our observations have confirmed that water masers in planetary systems are rare phenomena and would require constant monitoring to be able to model their origin.

With ATCA at 3 and 12 mm, we are now able to probe the conditions in various astronomical objects in the southern sky with the help of maser phenomena. Future research in relation with H_2O, CH_3OH masers, but also with 24-GHz NH_3 masers and 86-GHz SiO masers will make full use of the newly upgraded ATCA.

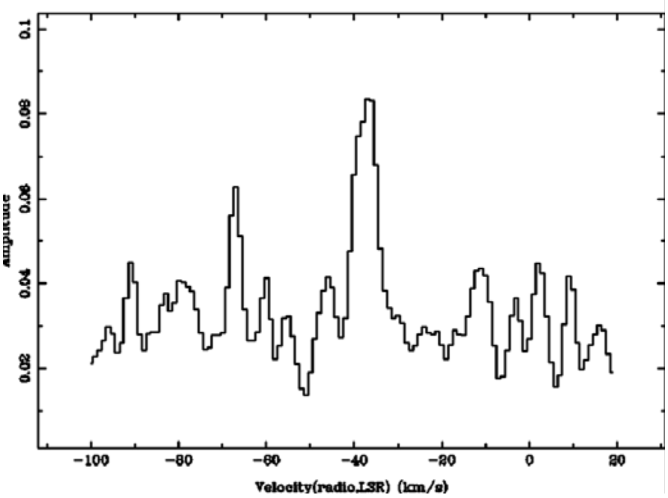


Figure 3: Possible detection of a 22.2-GHz water-vapour maser in HD47536, a K giant star with a 5 – 9 M_J companion. The spectrum has been generated by averaging the data taken on all the baselines over 18 minutes.

References

Cosmovici, C. B. et al., 1996, P&SS, 44, 735
Cosmovici, C. B. et al., 2002, 2nd European workshop on Exo/Astrobiology, Graz
Cragg, D. M. et al., 2001, MNRAS, 323, 939
Ellingsen, S. P. et al., 2003, MNRAS, in press
Minier, V. et al., 2001, A&A, 369, 278
Minier, V. et al., 2002, A&A, 383, 614
Minier, V. and Booth, R. S., 2002, A&A, 387, 179
Setiawan, J. et al., 2003, A&A, 398, L19
Sobolev, A. M. et al., 1997, A&A, 324, 211

Vincent Minier in collaboration with Simon Ellingsen, Cormac Purcell, Michael Burton, Tony Wong, Dinah Cragg, Andrej Sobolev (methanol masers) and Charley Lineweaver and Ray Norris (water masers).
(vminier@bat.phys.unsw.edu.au)

Regular items

SKA program report

Submission of SKA and LOFAR proposals

Figure 1: Aerial view towards the Reola homestead in New South Wales, The radio frequency test site can be seen in the bottom left corner.

On 31 May 2003 the initial Australian SKA-siting proposal and the two updated Australian SKA-concept proposal whitepapers were submitted to the International SKA Steering Committee (ISSC). The SKA-siting proposal suggests three primary candidate SKA sites, Mileura in Western Australia (WA), Murnpeowie in South Australia (SA) and Reola in New South Wales (NSW), and a representative secondary candidate SKA site at Parkes in NSW. All the primary sites are remote, extremely 'quiet' at radio frequencies and have had their radio frequency environment measured. The secondary site is indicative of a typical Australian site that is closer to major infrastructure but is still radio quiet by world standards. The updated SKA-concept proposal whitepapers respond to both scientific and technical questions posed by the ISSC on the Luneberg Lens and Cylindrical Reflector Australian SKA concepts. A one-day SKA science workshop was held at the end of April to clarify the key science drivers for the concepts.

These substantial proposals followed closely after the submission of another major proposal on 15 May 2003 – the submission of the LOFAR siting proposal to the LOFAR International Steering Committee. The LOFAR proposal was jointly prepared by CSIRO-ATNF and the Western Australia Government Office of Science and Innovation. It puts forth a site centred on Mileura (WA), with a data processing centre in Geraldton, as an ideal combination for the LOFAR telescope.

NSW SKA site characterization field tests

Ron Beresford and two contractors from Compucat Pty Ltd visited the remote Reola station (see picture above) in early May to characterize its radio-frequency environment. Early results indicate that Reola is an extremely radio-quiet site. This work was jointly funded by the ATNF and the NSW Department of State and Regional Development.

Dielectrics materials and the prototype Luneberg Lens

Exciting results have been obtained with new dielectric material being produced for the prototype Luneberg Lens. Materials have been produced with a dielectric constant of 1.7 and loss tangent less than 0.0001, corresponding to a noise loading less than 6 K per GHz. This dielectric constant exceeds that required by the Luneberg Lens specifications; while the loss is so low that operation of the lens may be possible above the initial 10-GHz estimate. The patent for the new material has been finalized and will be submitted soon. A one-metre diameter lens is due to be constructed from the new material by mid-year. Good progress is being made with the lens-feed translator system, with the system also expected to be operational by mid-year.

Digital phased array, radio-on-chip and MMIC work

Work has commenced on the digital phased array and radio-on-chip technology projects with collaborations being formed between ATNF, Macquarie University and CISCO Systems to pursue research in this area. Suzy Jackson, from the ATNF, has commenced a PhD project in this field. Phased arrays are being explored as an alternative multibeaming antenna solution for the SKA. They are highly competitive below 1.5 GHz, but do not replace Luneberg lenses in the 1 – 10 GHz range. The concept of using a phased array in the focal plane of a concentrating antenna, such as Parkes or a Luneberg lens, is also being explored. A major new collaborative project between ATNF, ASTRON and the CEA phased-array radar company has been formed to evaluate the Luneberg lens and focal-plane array combination as a basis for larger-scale prototyping. Meanwhile, a European company has expressed interest in the broadband 2 – 8 GHz LNA MMIC that Aaron Chippendale has been working on.

IAU and SKA 2003 international meetings

Planning logistics as well as science and engineering contributions for the IAU and SKA 2003 international meetings are becoming important. There will be several stands at the IAU focussing on SKA activities. The Australian SKA Consortium will host a stand covering Australian SKA work including the Luneberg Lens and Cylindrical Reflector Australian SKA-concept proposals, proposed Australian SKA sites, SKA simulation work, outreach activities and industry involvement. The SKA 2003 international meeting in Geraldton promises to be a stimulating event with over 100 participants already registered. Major discussions will be held on the scientific and technological potentials of the various SKA concepts and several working groups will discuss specific components of the SKA system design. More details can be found on the meeting website at *www.atnf.csiro.au/projects/ska/events/geraldton/*.

Directions

Looking to the future, the ATNF group is aiming to continue to have a major impact on world SKA directions with a high, and increasing, emphasis on SKA siting. A convergence of the form of the MNRF SKA demonstrator will take place as the various technology options are evaluated. The demonstrator may involve international links with, for example, ASTRON. Meanwhile the group will be involved in assisting with the commercialization of the new dielectric materials and Luneberg lenses regardless of whether lenses are eventually used in the SKA application.

Finally, on personnel matters, Dr George “Nyima” Warr has joined us on a 12-month appointment as an SKA/LOFAR strategic support scientist, while Adam Deller, an industrial based learning student from Swinburne University of Technology, is with us until the end of July. Adam is working on the motion control system for a prototype Luneberg lens antenna.

George “Nyima” Warr (Strategic Support Scientist) and Peter Hall (SKA Program Leader) (George.Warr@csiro.au, Peter.Hall@csiro.au)

Compact Array and Mopra report

12-mm upgrade

Since the last newsletter, we have had two 10-day shutdowns at the Compact Array. While there were many jobs done during these shutdowns, the most notable is the near-completion of the 12-mm upgrade.

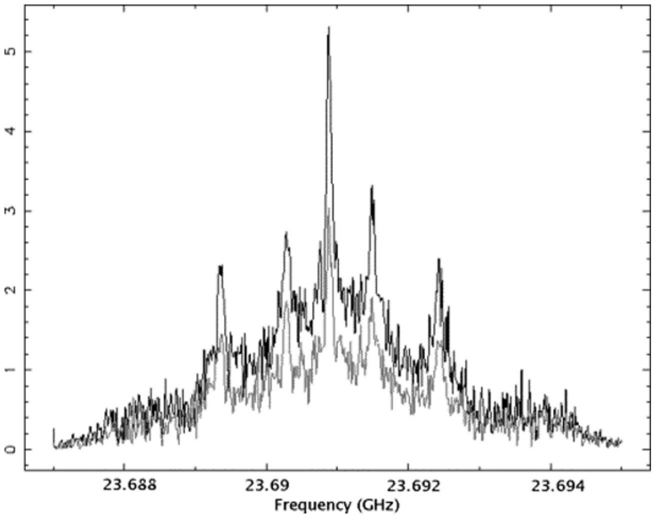


Figure 1: A spectrum of the NH_3 1-1 transition in Orion.

During the first two weeks of April, 12-mm receivers were installed in antennas 1, 5 and 6, and the 12/3-mm receiver package in antenna 4 underwent a major overhaul. Unallocated time in the following week was used for further system integration and commissioning work. At 4.01 p.m. on 16 April, for the first time we measured fringes to all six antennas simultaneously. John Whiteoak snuck in to make the first 12-mm astronomy observation with the full system, observing Sagittarius B2. Dick Manchester followed shortly afterwards observing SN1987A. On 23 April, the receivers were re-tuned to allow observations at the ammonia lines. Figure 1 shows one of the first ammonia spectra with the full 12-mm system.

A shutdown during 26 May – 5 June essentially completes the 12-mm upgrade. After this shutdown it is intended that full automatic tuning across the 12-mm band will be possible, and the module swaps needed at 12- and 3-mm will no longer be required. A restriction on the final system will be that, when observing at two frequencies, the band centres cannot differ by more than about 1 to 2 GHz. An integral part of the wideband tuning is a major upgrade of the local oscillator system. The local oscillator upgrade is now complete. With the exception of the primary monitor system (which is still on copper), all communications and data paths between control building and antennas is now on single-mode fibre.

Although there are still some rough edges to the 12-mm system, observing at 12 mm is proving to be only little more difficult than at 3 cm, and so it promises to be a very popular use for the Compact Array.

Other developments

The shutdowns in April and May/June were used for a broad range of activities in addition to the 12-mm upgrade. These include:

- New antenna control computers (see page 8).
- Antenna holography and panel adjustment:
  At high frequencies, surface irregularities in the Compact Array dishes significantly affect the overall efficiency. Using the new 30-GHz holography system, antenna 2 was surveyed in December 2002, and the panels adjusted in late April. During the May/June shutdown, all antennas except 2 and 6 were surveyed and adjusted. The rms surface accuracy is 150 to 180 µm. Figure 2 shows an image of the alignment error on antenna 3.

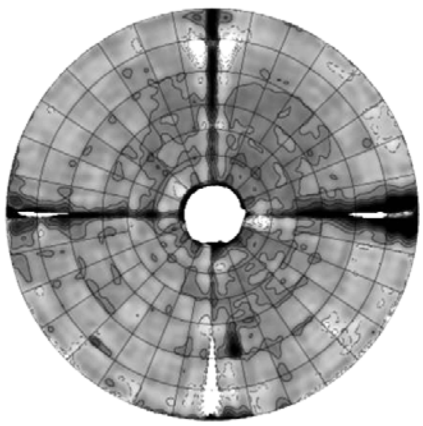


Figure 2: A roughness image of the surface of CA03. The contour levels show deviations from the ideal dish surface of ± 200, 400, 600 and 800 µm.

- Each Compact Array antenna has four gearboxes – two each in azimuth and elevation. Over the last 10 months (and mainly during the two shutdowns) the elevation gearboxes on each antenna were removed, stripped down and cleaned, and some components replaced.
- Structural repairs:
  A small crack on two gussets on five of the six antennas became apparent during structural inspections in March. Following advice from structural engineers, the gussets have been welded and strengthened on all antennas.

Figure 3: Ray Norris with Science Minister Peter McGauran at the Narrabri Visitors Centre.

Staff, visitors and special events

After six years of sterling work, Margaret Guest, our weekend cook, has retired. We have recently welcomed three new staff members to Narrabri: Maxim Voronkov, Stuart Robertson and Donna Brennan. Maxim joins us as a postdoc, and will work on SKA simulation and imaging studies (page 3). Stuart's background is in space physics, and he is in the final stages of completing his PhD. His work with us will revolve around the operation and upgrade of Mopra. Donna will be familiar to a number of our visitors as she has acted as a casual cook at Narrabri for nearly two years. Following Margaret Guest's retirement, Donna is now taking on the role of weekend cook.

The highly successful synthesis imaging workshop was held at Narrabri during the week of 12 – 16 May (page 6).

On 20 February the federal Minister for Science, Peter McGauran, and his group of staff, visited the observatory (Figure 3). The minister toured an antenna, the Visitors Centre and control building, and talked with the team observing at the array at the time. In addition the minister also met with some students from Narrabri High School working with the SEARFE project (a radio-spectrum measurement project). At the end of May, we hosted a visit by chiefs from three CSIRO divisions (Telecommunications and Industrial Physics, Mathematics and Information Science, and Molecular Science), along with some of their staff. After an antenna and control building tour, the chiefs enjoyed a campfire dinner during a mild Narrabri evening.

Operations

The pie-chart shown in Figure 4 gives statistics for the use of the Compact Array during the 2003 January to April term. The amount of time allocated for observations was slightly lower than usual to allow time for the installation and commissioning of the new 12-mm systems. The downtime during observations was also a little higher than usual, largely due to a nearby lightning strike on 22 February, a disk crash on the correlator control computer, and unusually windy weather. The old antenna control computers remain our single-biggest "non-weather" source of lost time.

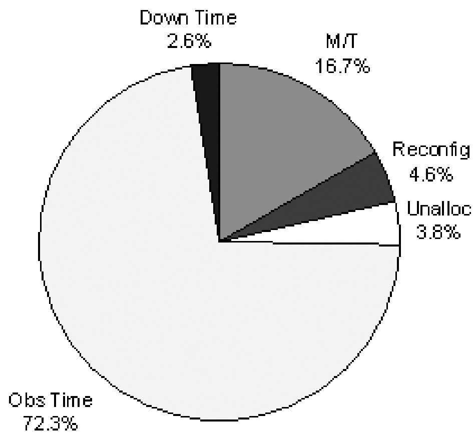


Figure 4: Compact Array use from January to April 2003.

Figure 5: One of the old Culgoora heliograph dishes. This is one of an array of 96, 13.7-m dishes that circled the present location of the Compact Array. The heliograph array imaged the Sun at 80 and 160 MHz with several discoveries to its credit.

Outreach

On 2 May, one of the old Culgoora heliograph dishes was reborn, when St Columba High School in the Blue Mountains officially "opened" a refurbished dish (Figure 5). The restoration of the antenna was funded through the school's Parents and Friends Association, and involved the hard work of the students, teachers and parents to bring it to a conclusion. The project required the persistence of these people since the project started in August 1997. The antenna has been used to detect the sun and thunderstorms as well as a range of man-made emission.

Mopra

Following a failure in the HALCA spacecraft, use of Mopra in conjunction with this space-VLBI mission was suspended in February. Control of the spacecraft was recovered in early June. From February until May 2003, Mopra was used mainly for three VLBI sessions.

Recognizing the UNSW astronomy group's financial commitment to Mopra, both in the panel upgrade some years ago, and in the coming wideband correlator upgrade, UNSW has been allocated six weeks of Mopra time during the winter (May to August) term. In addition to this, a similar amount of "National Facility" 3-mm time and one week of VLBI has been scheduled.

In readiness for the winter season, the 3-mm SIS receiver used at Mopra underwent maintenance at Marsfield during April and was reinstalled at Mopra on 19 May. In addition during the lead-up to the season, the subreflector was adjusted to reduce the telescope coma lobe (see Figure 6), and some software/communication problems in the 3-mm tuning system were resolved. To introduce new observers to the telescope, and to aid the interaction between the engineers and observers, a "Mopra indoctrination" workshop was held at the Mopra site on 1 – 2 June. Twelve people attended this workshop, seven being University of NSW students and astronomers. The workshop was very successful, despite uncharacteristically heavy rain!

During the coming months, we plan a round of panel adjustments to improve the surface accuracy of the Mopra telescope. The rms surface accuracy is currently about 260 μm while experience at the Compact Array suggests we should be able to improve this to 160 μm. We also intend to install a new antenna control computer and a prototype of the wideband correlator.

Bob Sault
Officer-in-Charge, Narrabri
(Bob.Sault@csiro.au)

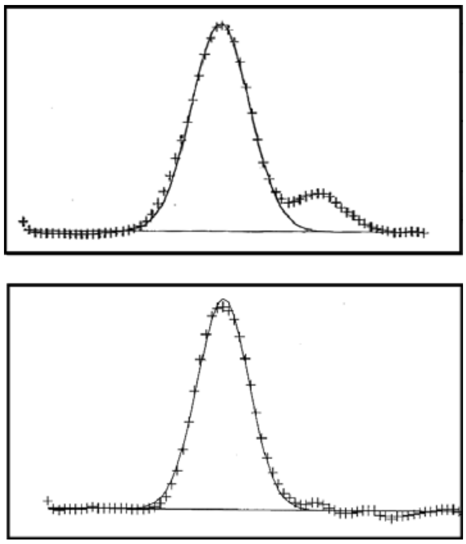


Figure 6: Beam shape of Mopra before (upper panel) and after (lower panel) subreflector adjustment. The decrease in the coma lobe on the right shoulder of the beam is very evident (the horizontal scales of the two plots are slightly different).

Parkes observatory report

Staff

Mal Smith (RF Systems engineer) and Rick Twardy (Visitors Centre Manager) have both taken extended periods of leave. Laurelle Price is now Acting Manager of the Visitors Centre and is doing a truly outstanding job coping with the ever-growing activity there.

The *dish cafe*

'First coffee' in the new *dish cafe* was achieved on Wednesday, 9 April. For pictures of the cafe, and of Ron Ekers mastering the art of making a cappuccino, go to *www.parkes.atnf.csiro.au/people/jsarkiss/dish_cafe/*

Although Ron makes a mean cup you are more likely to find Andrea or one of her staff behind the espresso machine and manning the kitchen. The cafe is open for the same hours as the Visitors Centre (8.30 a.m. – 4.30 p.m., seven days a week) so try it out the next time you are at Parkes.

22 May saw the first evening function at the cafe. Andrew Hunt, Gina Spratt, Rick Twardy and the cafe staff ensured that the event was a great success and the forty visiting Local Government IT Managers had a night to remember.

Visitors Centre record

Easter is always a busy time at the Visitors Centre and with the new cafe up and running this year we were hoping for a good turnout. The result was even better than we had hoped for with an overall increase of 12 percent in sales over the four-day break and a comparable increase in visitor numbers. In the week following Easter the record for the highest sales, excluding the Open Days in November 2001, was exceeded twice!

NASA 8-GHz upgrade

The upgrade of the telescope surface for the NASA tracking of Mars spacecraft in late 2003 – early 2004 has been completed. 180 new perforated aluminium panels have replaced 360 of the original open steel mesh panels extending the perforated surface to a diameter of 54 m. Holography at 12 GHz has revealed that the preliminary adjustment of the surface has already achieved an rms surface accuracy of 0.7 mm over the 54-m diameter, sufficient to achieve the specifications required by the NASA contract and probably slightly better than the 44-m perforated surface prior to the upgrade. A little further tweaking will be performed in the coming weeks. The successful outcome of this project is a tribute to the many who contributed, particularly Barry Parsons and Mike Kesteven from Marsfield, Barry Turner and Tom Lees from Parkes, and the Sydney Engineering team led by Ken Skinner. George Graves, Michael Dahlem, Peter Axtens were all key players in the success of the holography and panel adjustment.

A new high performance 8-GHz receiver being built by the Marsfield receiver group will be delivered to the observatory in July.

Tracking support for NASA starts in earnest in September, rapidly ramping up to around eight hours a day, seven days a week until the end of February, 2004.

The panel upgrade and the new receiver and feed will double the current sensitivity of Parkes at 8.4 GHz. Significant extra performance will also be obtained up to 26 GHz, though the existing feedhorns at the higher frequencies will have to be redesigned to exploit the new surface fully.

Operations news

The breakdown of the El-Nino weather pattern appears to have returned more moderate wind conditions, and a consequent reduction in the fraction of scheduled time lost due to high winds. While 165 hours were lost to high wind in January and February, only 30 hours have been lost in the last two months.

Some niggling questions over the Telescope's drive systems following the major work last September – October on the elevation drive have been resolved, and a number of further improvements made to other areas of the drive system including interlocking and braking systems.

Operational developments

Since the last newsletter, a major project has begun to upgrade the rather ancient voice and data cabling across almost the entire observatory site. After careful measurements by Mal Smith and Brett Preisig showed that unshielded Cat-5 cabling radiated measurable interference, a hybrid network of shielded copper and optical fibre was chosen. This huge task has been managed by Brett Preisig and tackled with unfailing good humour by up to six staff from Allied Technologies, the prime contractors, working 11 – 12 hour days, six days a week. The challenges of installing structured cabling throughout the telescope as far as the focus cabin have both frustrated and excited those involved. All agree it is a far cry from cabling the standard office block. The project has been made possible by CSIRO's corporately funded Cable Upgrade Program with tremendous support from Shaun Wilson of CSIRO's IT Services.

Both the wideband (1 GHz) correlator and CPSR2 baseband recorder continue to be used successfully with a steady stream of minor refinements being made to both.

Two new receiver systems are due for delivery around mid-year: the Mars 8-GHz receiver (see above), and the 10/50-cm concentric receiver, specifically designed for pulsar observing. The new receiver, the wideband correlator and CPSR2 will ensure that Parkes remains at the forefront of pulsar research for some time.

The 21-cm multibeam receiver continues to show signs of age, which is hardly surprising given it has performed in-situ and uninterrupted for more than six years. One channel is completely dead (10A), several others have high Tsys or unstable gains. It is planned to remove this receiver in late September or October for a major refurbishment, and to install the 10/50-cm receiver in its place during this work. The 21-cm multibeam receiver will then be returned, probably early in 2004.

A significant refurbishment of the observatory's online computing systems is underway, with several new Sun and Linux machines either installed or on order to replace some rather old machines such as Sun Ultra 1's.

John Reynolds
Parkes Officer-in-Charge
(John.Reynolds@csiro.au)

Time assignment information

Compact Array information

In 2003SEPT we will be offering the array configurations H214, EW352, 750B, 1.5D and 6A. The term will also start with EW367. Note that the hybrid array H214 is offered for the first time. This array provides almost complete u-v coverage for baselines up to 214 m. Observers are invited to propose projects using any of these configurations.
In addition to the standard 20, 13, 6 and 3-cm systems, all six antennas will be available for 12-mm observations. The frequency range of the 12-mm systems has been extended and is now 16.0 – 25.0 GHz (when using two simultaneous frequency settings, these cannot differ by more than about 2.5 GHz).

Three antennas will be available with 3-mm systems from the start of the term until late October, with the frequency range limited to two sub-bands of 84.9 – 87.3 GHz and 88.5 – 91.3 GHz. Proposals for 3-mm observing time must include an observer who has had previous experience with the ATCA 3-mm systems. EW367 and 750B will be offered in shuffled states to optimize Fourier coverage for the three-antenna system.

Swaps at 3-mm and service observing

To provide some robustness against poor weather for 3-mm observers, "swaps" between 3-mm and longer wavelength observations will continue to be offered. In this mode of flexible observing, a 3-mm and a partnering centimetre proposal (using identical LST ranges) are scheduled a few days apart. At the 3-mm observers initiative, the order of observing the partnering projects can be swapped, to give the 3-mm observation a better chance at good weather. To help develop a sizeable pool of centimetre swap proposals, we are offering service observing to projects that can be used as swap partners. In service mode, an operator will take the observations. Service observing will be restricted to those projects that can be swaps.

Future array configurations

The Compact Array configurations to be scheduled in 2004 – 2005 have now been announced, see Table 1. The hybrid-array configurations in the winter of 2005 remain undetermined as we are still evaluating the level of requests for these arrays.

	2003	2004			2005		
	SepT	JanT	MayT	SepT	JanT	MayT	SepT
6A	•		•		•		•
6B		•				•	
6C				•			
6D					•		
1.5A		•				•	
1.5B			•				•
1.5C				•			
1.5D	•				•		
750A		•				•	
750B	•				•		
750C				•			
750D			•				•
EW367	•	•		•		•	
EW352	•		•		•		•
EW214				•		•	
H214	•					Not Determined	
H168			•				
H75				•			

Table 1: Compact Array configurations for 2003 – 2005.

Mopra information

Mopra will not be scheduled in 2003SEPT, except for VLBI and some "overflow" 3-mm observations.

Bob Sault
(Bob.Sault@csiro.au)

ATNF publications list

Publication lists for papers that include ATNF data are available on the Web at: *http://www.atnf.csiro.au/research/publications*. Please email any corrections or additions to Christine van der Leeuw *(Christine.vanderleeuw@csiro.au)*. This list includes published refereed articles and conference papers, including ATNF data, compiled since the February 2003 newsletter. Papers including one or more ATNF authors are indicated by an asterisk

*ANDERNACH, H., SLEE, O.B., ROY, A.L. & EHLE, M. "Extreme relic radio sources in four southern clusters". In: IAU 199: The Universe at Low Radio Frequencies, Pune, India, Nov/Dec 1999, 153-156 (2002).

BARDELLI, S., ZUCCA, E., VENTURI, T., DE GRANDI, S. & MOLENDI, S. "Merging clusters in the Shapley Concentration". In: Tracing Cosmic Evolution with Galaxy Clusters, Sesto Pusteria, 2-7 July 2000, ASP Conf. Ser., 268, 143 (2002).

*BEASLEY, A.J., STAVELEY-SMITH, L., MARVEL, K.B., CLAUSSEN, M.J. & BOBOLTZ, D. "ATCA observations of water masers in the Magellanic Clouds". American Astronomical Society Meeting, no. 201 (2002).

*BIGNALL, H.E., JAUNCEY, D.L., LOVELL, J.E.J., TZIOUMIS, A.K., KEDZIORA-CHUDCZER, L., MACQUART, J.-P., TINGAY, S.J., RAYNER, D.P. & CLAY, R.W. "Rapid variability and annual cycles in the characteristic timescale of the scintillating source PKS 1257-326". ApJ, 585, 653-664 (2003)

BIRKINSHAW, M., WORRALL, D.M. & HARDCASTLE, M.J. "The X-ray jet and halo of PKS 0521-365". MNRAS, 335, 142-150 (2002).

*BOCK, D.C.J., SAULT, R.J., MILNE, D.K. & GREEN, A.J. "High-resolution radio polarimetry of Vela X". In: Neutron Stars in Supernova Remnants, Boston, Mass., 14-17 August 2001, ASP Conf. Ser., 271, 187 (2002).

*BOLTON, S.J. et al. & SAULT, R.J. "Cassini and VLA observations of synchrotron emission from Jupiter's radiation belts". Nature, 415, 987-991 (2002).

BRACEWELL, R.N. "The discovery of strong extragalactic polarization using the Parkes Radio Telescope". J. Astron. History & Heritage, 5, 107-114 (2002).

*BRUNS, C., KERP, J. & STAVELEY-SMITH, L. "The Parkes narrow-band H I survey of the Magellanic System". In: Seeing Through the Dust: The Detection of HI and the Exploration of the ISM in Galaxies, Penticton, B.C., 20-25 October 2001, ASP Conf. Ser., 276, 365 (2002).

BRUSCOLI, M., TUCCI, M., NATALE, V., CARRETTI, E., FABBRI, R., SBARRA, C. & CORTIGLIONI, S. "The power-law behaviours of angular spectra of polarized Galactic synchrotron". New Astronomy, 7, 171-183 (2002).

*BURGAY, M., BURDERI, L., POSSENTI, A., D'AMICO, N., MANCHESTER, R.N., LYNE, A.G., CAMILO, F. & CAMPANA, S. "A search for pulsars in quiescent soft X-ray transients". I. ApJ, 589, 902-910 (2003).

*CALABRETTA, M.R. & GREISEN, E.W. "Representations of celestial coordinates in FITS". A&A, 395, 1077-1122 (2002).

*CAPPA, C., NIEMELA, V.S. & McCLURE-GRIFFITHS, N.M. "Neutral gas bubbles surrounding southern optical ring nebulae: Anon (WR 23) and RCW 52". Winds, Bubbles, and Explosions: a conference to honour John Dyson. In: RevMexAA, 15, 47 (2003).

*CASWELL, J.L. "Spectra of OH masers at 6035 MHz and 6030 MHz". MNRAS, 341, 551-568 (2003)

*CASWELL, J.L. "Star formation: relationship between the maser species". In: IAU 206: Cosmic Masers: From Protostars to Black Holes, Rio de Janeiro, 4-11 March, 2001, 1-13 (2002).

*CHAPMAN, J.M. & SEVENSTER, M. "The ATCA/VLA OH 1612-MHz Survey: identification of post-AGB stars". In IAU 206: Cosmic Masers: From Protostars to Black Holes, Rio de Janeiro, 4-11 March, 2001, 331-334 (2002).

*CHIPPENDALE, A.P. "SiGe LNA noise temperature projections for the Square Kilometre Array". In: URSI XXVIIth General Assembly, Maastricht, 17-24 August, 2002, (2002).

*CHIPPENDALE, A.P. "Technology issues for SKA receiver design". In: Workshop on Applications of Radio Science (WARS 2002), Leura, 20-22 February, 2002, (2002).

*COHEN, M., STAVELEY-SMITH, L. & GREEN, A. "Interacting supergiant shells in the Large Magellanic Cloud". MNRAS, 340, 275-283 (2003).

COMASTRI, A., BRUSA, M., CILIEGI, P., MIGNOLI, M., VIGNALI, C., SEVERGNINI, P., MAIOLINO, R., FIORE, F., LA FRANCA, F., MATT, G., PEROLA, G.C., BALDI, A. & MOLENDI, S. "X-ray bright optically quiet galaxies: the case of P3". In: Issues in Unification of Active Galactic Nuclei, Marciana Marina, Italy, May, ASP Conf. Ser., 258, 199 (2002).

COMASTRI, A., MIGNOLI, M., CILIEGI, P., SEVERGNINI, P., MAIOLINO, R., BRUSA, M., FIORE, F., BALDI, A., MOLENDI, S., MORGANTI, R., VIGNALI, C., LA FRANCA, F., MATT, G. & PEROLA, G.C. "The HELLAS2XMM survey. II. Multiwavelength observations of P3: an X-ray bright, optically inactive galaxy." ApJ, 571, 771-778 (2002).

*CORBEL, S., FENDER, R.P., TZIOUMIS, A.K., TOMSICK, J.A., OROSZ, J.A., MILLER, J.M., WIJNANDS, R. & KAARET, P. "Large-scale, decelerating relativistic X-ray jets from the microquasar XTE J1550-564". Science, 298, 196-199 (2002).

*CORBEL, S., NOWAK, M.A., FENDER, R.P., TZIOUMIS, A.K. & MARKOFF, S. "Radio/X-ray correlation in the low/hard state of GX 339-4". A&A, 400, 1007-1012 (2003)

*CORBETT, E.A., KEWLEY, L., APPLETON, P.N., CHARMANDARIS, V., DOPITA, M.A., HEISLER, C.A., NORRIS, R.P. ZEZAS, A. & MARSTON, A. "COLA. II. Radio and spectroscopic diagnostics of nuclear activity in galaxies". ApJ, 583, 670-688 (2003)

*CRAWFORD, F., GAENSLER, B.M., KASPI, V.M., MANCHESTER, R.N., CAMILO, F., LYNE, A.G. & PIVOVAROFF, M.J. "SNR G292.2-0.5: a radio supernova remnant associated with the young pulsar J1119-6127". In: Neutron Stars in Supernova Remnants, Boston, Mass., 14-17 August 2001, ASP Conf. Ser., 271, 41 (2002).

*CRAWFORD, F., PIVOVAROFF, M.J., KASPI, V.M & MANCHESTER, R.N. "A sensitive targeted search campaign at Parkes to find young radio pulsars at 20 cm.". In: Neutron Stars in Supernova Remnants, Boston, Mass., 14-17 August 2001, ASP Conf. Ser., 271, 37-40 (2002).

CURRAN, S.J., MURPHY, M.T., WEBB, J.K. & PIHLSTROM, Y.M. "A 22-GHz search for molecular absorption at z similar to 3 with the upgraded ATCA". MNRAS, 340, 139-142 (2003)

CURRAN, S.J., WEBB, J.K., MURPHY, M.T., BANDIERA, R., CORBELLI, E. & FLAMBAUM, V.V. "A catalogue of damped Lyman alpha absorption systems and radio flux densities of the background quasars". PASA, 19, 455-474 (2002).

*DE BLOK, W.J.G., BOSMA, A. & McGAUGH, S. "Simulating observations of dark matter dominated galaxies: towards the optimal halo profile". MNRAS, 340, 657-678 (2003).

DE HEIJ, V., BRAUN, R. & BURTON, W.B. "An all-sky study of compact, isolated high-velocity clouds". A&A, 392, 417-451 (2002).

*DICKEL, J. R., MULLIGAN, M.C., KLINGER, R.J., GAENSLER, B.M., MILNE, D.K., MANCHESTER, R.N., STAVELEY-SMITH, L., KESTEVEN, M.J. & GALLANT, Y. "Radio observations of the composite SNR B0540-693". In: Neutron Stars in Supernova Remnants, Boston, Mass., 14-17 August 2001, ASP Conf. Ser., 271, 195 (2002).

*DICKEY, J.M., McCLURE-GRIFFITHS, N.M., GAENSLER, B.M. & GREEN, A.J. "Fitting together the HI absorption and emission in the Southern Galactic Plane Survey". ApJ, 585, 801-822 (2003)

DOHERTY, M., JOHNSTON, S., GREEN, A.J., ROBERTS, M.S.E., ROMANI, R.W., GAENSLER, B.M. & CRAWFORD, F. "A search for the radio counterpart of the unidentified γ-ray source 3EG J1410-6147". MNRAS, 339, 1048-1056 (2003).

DRINKWATER, M.J. "The 2001 Australian Galaxy Cluster Workshop". PASA, 19, 265-276 (2002).

DUBNER, G., GIACANI, E., GAENSLER, B.M., GOSS, W.M. & GREEN, A. "Environs of bilateral supernova remnants with neutron stars". In: Neutron Stars in Supernova Remnants, Boston, Mass., 14-17 August 2001, ASP Conf. Ser., 271, 415 (2002).

*EKERS, R.D. "Observational advances in radio astronomy". In: Seeing Through the Dust: The Detection of HI and the Exploration of the ISM in Galaxies, Penticton, B.C., 20-25 October 2001, ASP Conf. Ser., 276, 37 (2002).

*EKERS, R.D. & BELL, J.F. "Radio frequency interference". In: IAU 199: The Universe at Low Radio Frequencies, Pune, India, Nov/Dec 1999, 498-505 (2002).

*EKERS, R.D., CULLERS, D.K., BILLINGHAM, J. & SCHEFFER, L.K. (eds.) SETI 2020: A Roadmap for the Search for Extraterrestrial Intelligence. (2002).

*ENGLISH, J., NORRIS, R.P., FREEMAN, K.C. & BOOTH, R.S. "NGC 3256 : kinematic anatomy of a merger". AJ, 125, 1134-1149 (2003)

*FENDER, R.P., CORBEL, S., TZIOUMIS, A.K., TINGAY, S.J., BROCKSOPP, C. & GALLO, E. "The recent evolution of radio emission from GX 339-4". Astronomer's Telegram, no. 107, (2002).

FILIPOVIC, M.D., JONES, P.A. & WHITE, G.L. "SNRs in the Magellanic Clouds". In: Neutron Stars in Supernova Remnants, Boston, Mass., 14-17 August 2001, ASP Conf. Ser., 271, 395 (2002).

FILIPOVIC, M.D., STUPAR, M., JONES, P.A. & WHITE, G.L. "Galactic SNRs in the PMN Survey". In: Neutron Stars in Supernova Remnants, Boston, Mass., 14-17 August 2001, ASP Conf. Ser., 271, 387 (2002).

*FRAIL, D.A., KULKARNI, S.R., BERGER, E. & WIERINGA, M.H. "A complete catalog of radio afterglows: the first five years". AJ, 125, 2299-2306 (2003).

*FREIRE, P.C., CAMILO, F., KRAMER, M., LORIMER, D.R., LYNE, A.G., MANCHESTER, R.N. & D'AMICO, N. "Further results from the timing of the millisecond pulsars in 47 Tucanae". MNRAS, 340, 1359-1374 (2003).

*GAENSLER, B.M, McCLURE-GRIFFITHS, N.M., DICKEY, J.M., & GREEN, A.J. "New views of the Southern Galaxy". In: URSI XXVIIth General Assembly, Maastricht, 17-24 August, 2002, (2002).

*GARAY, G., BROOKS, K.J., MARDONES, D. & NORRIS, R.P. "A triple radio continuum source associated with IRAS 16547-4247: a collimated stellar wind emanating from a massive protostar". ApJ, 587, 739-747 (2003).

GIARDINO, G., BANDAY, A.J., GORSKI, K.M., BENNETT, K., JONAS, J.L. & TAUBER, J. "Towards a model of full-sky Galactic synchrotron intensity and linear polarisation: a re-analysis of the Parkes data". A&A, 387, 82-97 (2002).

*GRANET, C., JAMES, G.L., BOLTON, R.J. & MOOREY, G.G. "Smooth-walled spline-profile millimetre-wave horn for radio astronomy". In: JINA 2002, Nice, France, 2002, 375-378 (2002).

*GREENHILL, L.J., BOOTH, R.S., ELLINGSEN, S.P., HERRNSTEIN, J.R., JAUNCEY, D.L., McCULLOCH, P.M., MORAN, J.M., NORRIS, R.P., REYNOLDS, J.E. & TZIOUMIS, A.K. "A warped accretion disk and wide-angle outflow in the inner parsec of the Circinus galaxy". ApJ, 590, 162-173 (2003).

*GREISEN, E.W. & CALABRETTA, M.R. "Representations of world coordinates in FITS". A&A, 395, 1061-1075 (2002).

"GUROVICH, S., FREEMAN, K., JERJEN, H., DE BLOK, E. & STAVELEY-SMITH, L. "Investigating the Baryonic Tully-Fisher Law with a HIPASS sample". In: The Dynamics, Structure & History of Galaxies: a Workshop in Honour of Professor Ken Freeman, ASP Conf. Ser., 273, 357 (2002).

*HALL, P.J. "The Square Kilometre Array - Australian directions". In: Workshop on Applications of Radio Science (WARS 2002), Leura, 20-22 February, 2002, (2002).

HOPKINS, A.M., AFONSO, J., CHAN, B., CRAM, L.E., GEORGAKAKIS, A. & MOBASHER, B. "The Phoenix Deep Survey: the 1.4 GHz microjansky catalog". AJ, 125, 465-477 (2003)

HOSOKAWA, M., JAUNCEY, D., REYNOLDS, J., TZIOUMIS, A., OHNISHI, K. & FUKUSHIMA, T. "Possible fluctuation of the position of Sgr A relative to extragalactic radio sources". ApJ, 580, L43-L46 (2002).

JACKSON, C.A., WALL, J.V., SHAVER, P.A., KELLERMANN, K.I., HOOK, I.M. & HAWKINS, M.R.S. "The Parkes quarter-Jansky flat-spectrum sample. I. Sample selection and source identifications". A&A, 386, 97-113 (2002).

*JAUNCEY, D.L., KEDZIORA-CHUDCZER, L., LOVELL, J.E.J., MACQUART, J.-P., NICOLSON, G.D., PERLEY, R.A., REYNOLDS, J.E., TZIOUMIS, A.K., WIERINGA, M.A. & BIGNALL, H.E. "Intra-day variability, origins and implications". In: Particles and Fields in Radio Galaxies: proceedings of the Oxford Radio Galaxy Workshop, Oxford, 3-5 August 2000, ASP Conf. Ser., 250, 123-127 (2002).

JIN, S., WAITE-JONES, C.G., KEOHANE, J.W., OLBERT, C.M., GAENSLER, B.M. & WALLACE, B.J. "A morphological analysis of the supernova remnant G292.0+1.8 with Chandra and ATCA". In: The High Energy Universe at Sharp Focus: Chandra Science, ASP Conf. Ser., 262, 343 (2002).

JOHNSTON, S. "Radio observations of two isolated neutron stars: RX J0720.4-3125 and RX J0806.4-4132". MNRAS, 340, L43-L46 (2003).

JOHNSTON, S., DOHERTY, M., GREEN, A., ROBERTS, M., ROMANI, R., GAENSLER, B.M. & CRAWFORD, F. "Radio and X-ray imaging of two EGRET sources near l=312 degrees". In: Neutron Stars in Supernova Remnants, Boston, Mass., 14-17 August 2001, ASP Conf. Ser., 271, 209 (2002).

*JOHNSTON, S., KORIBALSKI, B.S., WILSON, W. & WALKER, M. "Multi-epoch H I line measurements of four southern pulsars". MNRAS, 341, 941-947 (2003)

JOHNSTON, S. & ROMANI, R. "A search for giant pulses in Vela-like pulsars". MNRAS, 332, 109-115 (2002).

*JOHNSTON-HOLLITT, M., CLAY, R.W., EKERS, R.D., WIERINGA, M.H. & HUNSTEAD, R.W. "The dual radio relics of A3667". In: IAU 199: The Universe at Low Radio Frequencies, Pune, India, Nov/Dec 1999, 157-158 (2002).

*JOHNSTON-HOLLITT, M., EKERS, R.D. & HUNSTEAD, R.W. "The cluster environment of Abell 3667". In: Particles and Fields in Radio Galaxies: proceedings of the Oxford Radio Galaxy Workshop, Oxford, 3-5 August 2000, ASP Conf. Ser., 250, 432-436 (2002).

*JOSHI, B.C., BURGAY, M., LYNE, A.G., MANCHESTER, R.N., POSSENTI, A., D'AMICO, N., KRAMER, M. & CAMILO, F. "A high Galactic latitude search for pulsars". Proc. Astron. Soc. India, 30, 687 (2002).

KAARET, P., CORBEL, S., PRESTWICH, A.H. & ZEZAS, A. "Radio emission from an ultraluminous X-ray source". Science, 299, 365-368 (2003).

KARACHENTSEV, I.D. & SMIRNOVA, A.A. "Flat galaxies of the RFGC catalog detected in the HIPASS survey". Astrophys., 45, 448-457 (2002).

*KARLSSON, R., SJOUWERMAN, L.O., SANDQVIST, Aa. & WHITEOAK, J.B. "18-cm VLA observations of OH towards the Galactic centre". A&A, 403, 1011-1021 (2003).

*KEDZIORA-CHUDCZER, L., JAUNCEY, D.L., LOVELL, J.E.J., WALKER, M.A., MACQUART, J.-P., WIERINGA, M.H., TZIOUMIS, A.K., PERLEY, R.A. & REYNOLDS, J.E. "Long term monitoring of the extreme intraday variable quasar PKS 0405-385". In: Particles and Fields in Radio Galaxies: proceedings of the Oxford Radio Galaxy Workshop, Oxford, 3-5 August 2000, ASP Conf. Ser., 250, 128-132 (2002).

*KLINGER, R.J, DICKEL, J. R., FIELDS, B.D. & MILNE, D.K. "A peculiar linear radio feature in the supernova remnant N206". In: Neutron Stars in Supernova Remnants, Boston, Mass., 14-17 August 2001, ASP Conf. Ser., 271, 419 (2002).

KONTINEN, S., HARJU, J., CASELLI, P., HEIKKILA, A. & WALMSLEY, M. "Dust and molecules in the Corona Australis cloud". In SFChem 2002: Chemistry as a Diagnostic of Star Formation, Waterloo, Ont., 21-23 August, 2002, 59 (2002).

*KORIBALSKI, B.S. "The HI Parkes All-Sky Survey (HIPASS)". In: Seeing Through the Dust: The Detection of HI and the Exploration of the ISM in Galaxies, ASP Conf. Ser., 276, 72 (2002).

*KORIBALSKI, B.S., GORDON, S. & JONES, K. "ATCA H I observations of the peculiar galaxy IC 2554". MNRAS, 339, 1203-1222 (2003)

KRAMER, M., JOHNSTON, S. & VAN STRATEN, W. "High resolution single pulse studies of the Vela Pulsar". MNRAS, 334, 523-532 (2002).

LEHTINEN, K., HARJU, J., KONTINEN, S. & HIGDON, J.L. "Centimetre continuum emission from young stellar objects in Cederblad 110". A&A, 401, 1017-1022 (2003).

*LEHTINEN, K & HIGDON, J. L. "Centimeter wavelength continuum observations of young stellar objects in the dark cloud DC 303.8-14.2". A&A, 398, 583-587 (2003)

*MACQUART, J.-P., KEDZIORA-CHUDCZER, L., JAUNCEY, D.L., SAULT, R. & RAYNER, D.P. "Circular polarization in scintillating sources". In: Particles and Fields in Radio Galaxies: proceedings of the Oxford Radio Galaxy Workshop, Oxford, 3-5 August 2000, ASP Conf. Ser., 250, 137-141 (2002).

*MACQUART, J.-P., WU, K., SAULT, R.J. & HANNIKAINEN, D.C. "Rapidly evolving circularly polarized emission during the 1994 outburst of GRO J1655-40". A&A, 396, 615-621 (2002).

*MACQUART, J.-P., WU, K., SAULT, R.J. & HANNIKAINEN, D.C. "Circular polarization in GRO J1655-40". In: New Views on Microquasars: 4th Microquasars Workshop, 2002, 224 (2002).

*MANCHESTER, R.N. "Pulsars: an observational overview". In: IAU 199: The Universe at Low Radio Frequencies, Pune, India, Nov/Dec 1999, 355-362 (2002).

*MANCHESTER, R.N., BELL, J.F., CAMILO, F., KRAMER, M.I., LYNE, A.G., HOBBS, G.B., JOSHI, B.C., CRAWFORD, F., D'AMICO, N., POSSENTI, A., KASPI, V.M. & STAIRS, I.H. "Young pulsars from the Parkes Multibeam Pulsar Survey and their associations". In: Neutron Stars in Supernova Remnants, Boston, Mass., 14-17 August 2001, ASP Conf. Ser., 271, 31-36 (2002).

MARKOFF, S., NOWAK, M., CORBEL, S., FENDER, R. & FALCKE, H. "Exploring the role of jets in the radio/X-ray correlations of GX 339-4". A&A, 397, 645-658 (2003).

*McCLURE-GRIFFITHS, N.M. "The Southern Galactic Plane Survey ". In: Seeing Through the Dust: The Detection of HI and the Exploration of the ISM in Galaxies, ASP Conf. Ser., 276, 58 (2002).

*McCLURE-GRIFFITHS, N.M., DICKEY, J.M., GAENSLER, B.M. & GREEN, A.J. "Shells, bubbles, and chimneys in the Southern Galactic Plane Survey". Winds, Bubbles, and Explosions: a conference to honour John Dyson. In: RevMexAA, 15, 287 (2003).

*McCLURE-GRIFFITHS, N.M., STANIMIROVIC, S., DICKEY, J.M., GAENSLER, B.M. & GREEN, A.J. "Wide-field HI imaging with the Australia Telescope". In: URSI XXVIIth General Assembly, Maastricht, 17-24 August, 2002, (2002).

*McGAUGH, S.S., BARKER, M.K. & DE BLOK, W.J.G. "A limit on the cosmological mass density and power spectrum from the rotation curves of low surface brightness galaxies". ApJ, 584, 566-576 (2003)

*MINIER, V., ELLINGSEN, S.P., NORRIS, R.P. & BOOTH, R.S. "The protostellar mass limit for 6.7 GHz methanol masers. I. A low-mass YSO survey". A&A, 403, 1095-1100 (2003).

MOFFETT, D., GAENSLER, B.M., GREEN, A., SLANE, P., HARRUS, I. & DODSON, R. "Powered by a pulsar? G291.0-0.1". In: Neutron Stars in Supernova Remnants, Boston, Mass., 14-17 August 2001, ASP Conf. Ser., 271, 221 (2002).

*MORGANTI, R., OOSTERLOO, T., VAN MOORSEL, G., TADHUNTER, C. & KILLEEN, N. "HI absorption in radio galaxies". In: IAU 199: The Universe at Low Radio Frequencies, Pune, India, Nov/Dec 1999, 118-121 (2002).

*MULLER, E., STAVELEY-SMITH, L. & ZEALEY, W.J. "Detection of carbon monoxide within the Magellanic Bridge". MNRAS, 338, 609-615 (2003).

*MULLER, E., STAVELEY-SMITH, L., ZEALEY, W. & STANIMIROVIC, S. "High-resolution HI observations of the western Magellanic Bridge". MNRAS, 339, 105-124 (2003)

*MURGIA, M., PARMA, P., FANTI, R., DE RUITER, H.R., EKERS, R.D. & FOMALONT, E.B. "A multi-frequency study of the radio galaxy NGC 326". In: Particles and Fields in Radio Galaxies: proceedings of the Oxford Radio Galaxy Workshop, Oxford, 3-5 August 2000, ASP Conf. Ser., 250, 380-383 (2002).

*ORCHISTON, W. "Tebbutt vs Russell: passion, power and politics in nineteenth century Australian astronomy". History of Oriental Astronomy: proc. Joint Discussion-17, 23rd General Assembly, IAU, Kyoto, 25-26 August, 1997, 169-202 (2002).

*ORCHISTON, W. "J.F. Skjellerup: a forgotten name in South African cometary astronomy". Mon. Not. Astron. Soc. Sth. Africa, 62 (3&4), 54-73 (2003).

*ORCHISTON, W. & SLEE, O.B. "The Australasian discovery of solar radio emission". Anglo-Australian Observatory Newsletter, November, 25-27 (2002).

*PISANO, D.J. & WILCOTS, E.M. "The state of galaxy formation in the local universe". ApJ, 584, 228 (2003).

*PUTMAN, M.E., STAVELEY-SMITH, L., FREEMAN, K.C., GIBSON, B.K. & BARNES, D.G. "The Magellanic Stream, high-velocity clouds, and the Sculptor Group". ApJ, 586, 170-194 (2003)

RICKETT, B. “The role of interstellar scintillation in intra-day variations at centimeter wavelengths”: Elizabeth and Frederick White Workshop on AGN Variability Across the Electromagnetic Spectrum, CSIRO ATNF, 25-29 June 2001, PASA, 19 (1), 100-105 (2002).

SADLER, E.M., OOSTERLOO, T. & MORGANTI, R. “HI in elliptical galaxies”. In: The Dynamics, Structure & History of Galaxies: a Workshop in Honour of Professor Ken Freeman, ASP Conf. Ser., 273, 215 (2002).

*SANWAL, D., PAVLOV, G.G., KARGALTSEV, O.Y., GARMIRE, G.P., ZAVLIN, V.E., BURWITZ, V., MANCHESTER, R.N. & DODSON, R. “X-ray spectrum and pulsations of the Vela pulsar”. In: Neutron Stars in Supernova Remnants, Boston, Mass., 14-17 August 2001, ASP Conf. Ser., 271, 353-356 (2002).

*SARIPALLI, L., SUBRAHMANYAN, R. & SHANKAR, N. U. “Renewed activity in the radio galaxy PKS B1545-321: twin edge-brightened beams within diffuse radio lobes”. ApJ, 590, 181-191 (2003).

*SAULT, R.J. “Low frequency planetary radio astronomy”. In: IAU 199: The Universe at Low Radio Frequencies, Pune, India, Nov/Dec 1999, 407-411 (2002).

*SAULT, R.J. “Wide field imaging at low frequencies”. In: IAU 199: The Universe at Low Radio Frequencies, Pune, India, Nov/Dec 1999, 508-511 (2002).

*SAULT, R.J. “Image restoration: maximum entropy methods”. In: Encyclopedia of Physical Science and Technology, 7, 631-644 (2002).

*SCHWARTZ, D.A., MARSHALL, H.L., MILLER, B.P., WORRALL, D.M., BIRKINSHAW, M., LOVELL, J.E.J., JAUNCEY, D.L., PERLMAN, E.S., MURPHY, D.W. & PRESTON, R.A. “Results from a complete Chandra survey of radio jets”. In: Active Galactic Nuclei: From Central Engine to Host Galaxy, Meudon, France, 23-27 July, 2002, ASP Conf. Ser., 290, 45-46 (2002).

SNELLEN, I.A.G., LEHNERT, M.D., BREMER, M.N. & SCHILIZZI, R.T. “A Parkes half-Jansky sample of GHz peaked spectrum galaxies”. MNRAS, 337, 981-992 (2002).

*SOBOLEV, A.M., OSTROVSKII, A.B., MALYSHEV, A.V., CRAGG, D.M., GODREY, P.D., SUTTON, E.C., WATSON, W.D., ELLINGSEN, S.P. & CASWELL, J.L. “Models of class II methanol masers. In: IAU 206: Cosmic Masers”: From Protostars to Black Holes, Rio de Janeiro, 4-11 March, 2001, 179-182 (2002).

*STAVELEY-SMITH, L. “The large scale structure of the Large Magellanic Cloud”. In: Seeing Through the Dust: the Detection of HI and the Exploration of the ISM in Galaxies, Penticton, B.C., 20-25 October 2001, ASP Conf. Ser., 276, 391 (2002).

*STAVELEY-SMITH, L., KIM, S., CALABRETTA, M.R., HAYNES, R.F. & KESTEVEN, M.J. “A new look at the large-scale HI structure of the Large Magellanic Cloud”. MNRAS, 339, 87-104 (2003).

*SUBRAHMANYAN, R. “Cosmic microwave background at low frequencies”. In: IAU 199: The Universe at Low Radio Frequencies, Pune, India, Nov/Dec 1999, 58-65 (2002).

*SUBRAHMANYAN, R. “Cross-talk in close packed interferometer arrays”. In: The 2K1BC Workshop on Experimental Cosmology at Millimeter Wavelengths, Breuil-Cervinia, Valle d’Aosta, Italy, 9-13 July, 2001, AIP Conf. Ser., 616, 102-106 (2002).

*SUBRAHMANYAN, R. “ATCA and CMB anisotropies”. In: AMiBA 2001: High-z Clusters, Missing Baryons, and CMB Polarization, ASP Conf. Ser., 257, 289 (2002).

*SUBRAHMANYAN, R. “Observing the CMB with the AMiBA”. In: AMiBA 2001: High-z Clusters, Missing Baryons, and CMB Polarization, ASP Conf. Ser., 257, 251 (2002).

*SUBRAHMANYAN, R., BEASLEY, A.J., GOSS, W.M., GOLAP, K. & HUNSTEAD, R.W. “PKS B1400-33: an unusual radio relic in a poor cluster”. AJ, 125, 1095-1106 (2003)

*TAYLOR, A.R., STIL, J., DICKEY, J., McCLURE-GRIFFITHS, N.M., MARTIN, P., ROTHWELL, T. & LOCKMAN, F.J. “The VLA Galactic Plane Survey”. In: Seeing Through the Dust: The Detection of HI and the Exploration of the ISM in Galaxies, ASP Conf. Ser., 276, 68 (2002).

*TINGAY, S.J. & EDWARDS, P.G. “ATCA monitoring observations of 202 compact radio sources in support of the VSOP AGN survey”. PASJ, 55, 351-384 (2003).

TORRES, D.F. & NUZA, S.E. “Possible new γ-ray pulsar detections by the AGILE and GLAST missions: an outer gap model look at the Parkes pulsar catalog”. ApJ, 583, L25-L29 (2003).

*VENTURI, T., BARDELLI, S., DALLACASA, D., HUNSTEAD, R.W., MORGANTI, R. & TZIOUMIS, A.K. “Active galaxies and candidate remnants in the core of the Shapley Concentration”. In: IAU 199: The Universe at Low Radio Frequencies, Pune, India, Nov/Dec 1999, 161-162 (2002).

VENTURI, T., BARDELLI, S., HUNSTEAD, R.W. & MORGANTI, R. “The effects of cluster mergers on the properties of radio galaxies”. Presented at: Cluster Mergers and their Connection to Radio Sources: 24th meeting of the IAU, Joint Discussion 10, 7- 18 August 2000, Manchester, England. In: Highlights of Astronomy, 12, 536 (2002).

VENTURI, T., BARDELLI, S., ZAGARIA, M., PRANDONI, I. & MORGANTI, R. “Radio emission from the A3571 cluster complex in the Shapley Concentration”. In: Tracing Cosmic Evolution with Galaxy Clusters, Sesto Pusteria, 2-7 July 2000, ASP Conf. Ser., 268, 455 (2002).

VENTURI, T., PELLEGRINI, S., COMASTRI, A., MORGANTI, R. & VIGNALI, C. “The accretion process in the nucleus of the radio galaxy PKS1333-33”. In: Proceedings of the 6th European VLBI Network Symposium, 165 (2002).

*WARR, G.B., BUNTON, J.D., CAMPBELL-WILSON, D., CRAM, L.E., DAVISON, R.G., GREEN, A.J., HUNSTEAD, R.W., MITCHELL, D.A., PARFITT, A.J. & SADLER, E.M. “Prototyping SKA technologies at the Molonglo radio telescope”. In: Workshop on Applications of Radio Science (WARS 2002), Leura, 20-22 February, 2002, (2002).

*WELDRAKE, D.T.F., DE BLOK, W.J.G. & WALTER, F. “A high-resolution rotation curve of NGC 6822: a test-case for cold dark matter”. MNRAS, 340, 12-28 (2003)

*WINN, J.N., KOCHANEK, C.S., KEETON, C.R. & LOVELL, J.E.J. “The quintuple quasar: radio and optical observations”. ApJ, 590, 26-38 (2003).

*ZWAAN, M.A., STAVELEY-SMITH, L., KORIBALSKI, B.S., HENNING, P.A., KILBORN, V.A., RYDER, S.D., BARNES, D.G., BHATHAL, R., BOYCE, P.J., DE BLOK, W.J.G., DISNEY, M.J., DRINKWATER, M.J., EKERS, R.D., FREEMAN, K.C., GIBSON, B.K. et al. “The 1000 brightest HIPASS galaxies: The HI mass function and Ω_{HI}”. AJ, 125, 2842-2858 (2003)

*ZWAAN, M.A., STAVELEY-SMITH, L., MEYER, M.J., WEBSTER, R.L. & HIPASS Team “The cosmological mass density of neutral gas from HIPASS”. American Astronomical Society Meeting, no. 201 (2002).

Contact information

CSIRO Australia Telescope National Facility

PO Box 76
Epping NSW 1710
Australia
(Cnr Vimiera & Pembroke Roads
Marsfield NSW 2122)

Ph: +61 2 9372 4100
Fx: +61 2 9372 4310
atnf@atnf.csiro.au
www.atnf.csiro.au
ftp.atnf.csiro.au

Parkes Observatory

PO Box 276
Parkes NSW 2870
Australia

Ph: +61 2 6861 1700
Fx: +61 2 6861 1730
parkes@atnf.csiro.au
www.parkes.atnf.csiro.au

Paul Wild Observatory, Narrabri

Locked Bag 194
Narrabri NSW 2390
Australia

Ph: +61 2 6790 4000
Fx: +61 2 6790 4090
narrabri@atnf.csiro.au
www.narrabri.atnf.csiro.au

Mopra Observatory, Coonabarabran

See Paul Wild Observatory

ATNF News On-line

http://www.atnf.csiro.au/news/newsletter