ATNF News

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FEATURES IN THIS ISSUE

Compact Array millimetre images of disks around the young stars TW Hya and HD 100546

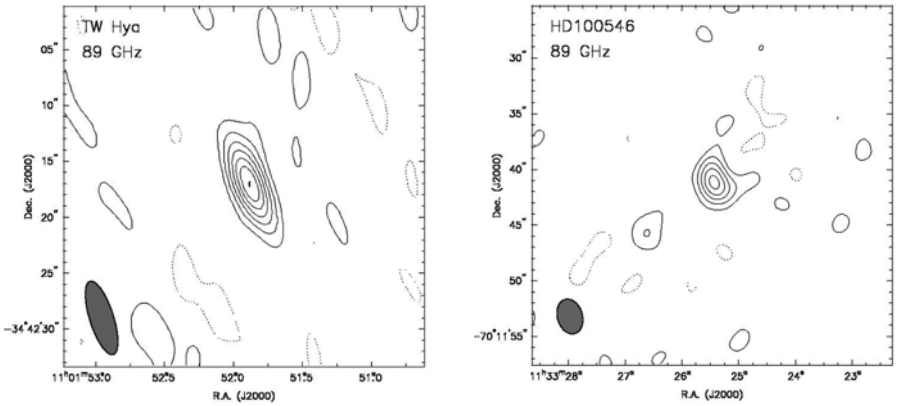

Figure 1: *Left* – TW Hya continuum emission at 89 GHz. The contour levels are ±2, 4, 6,...× 2.5 mJy. *Right* – HD 100546 continuum emission at 89 GHz. The contour levels are ±2, 4, 6,...× 3.1 mJy. The ellipse in the lower left corner of each figure represents the synthesized beam. The beam size in the left figure is 6.9 × 2.1 arcsecond² and in the right, 3.2 × 2.2 arcsecond². Images were made using natural weighting to obtain best sensitivity. Negative contours are dotted.

Many young stars exhibit emission from circumstellar dust particles distributed in disks with properties similar to the early Solar System, and much activity is currently devoted to characterizing the physical properties of these disks to extract information on planet formation. Observations at millimetre wavelengths are especially important because the disk material beyond a few stellar radii is at temperatures from a few hundreds to a few tens of degrees Kelvin, and the physical and chemical conditions can be probed in detail in this part of the spectrum.

During the 2002 ATCA millimetre season we observed the dust continuum and HCO^+ J = 1–0 line emission from two southern disk targets: (1) TW Hya, the closest known classical T Tauri star, and (2) HD 100546, a nearby Herbig Be star whose infrared spectrum shows crystalline silicates, indicative of comet-like dust. We observed both stars at 89 GHz (3.4 mm) using two compact array configurations of three antennas, resulting in a resolution of about 2 arcseconds.

At a distance of 56 ± 7 pc, TW Hya is almost three times closer than the classical T Tauri stars associated with nearby dark clouds like Taurus, which makes it an especially attractive target for observations with high angular resolution. TW Hya retains a face-on molecular disk visible in scattered light that extends to a radius of at least 3.5 arcseconds (200 AU). This disk has been detected in a suite of molecular species (CO, HCN, CN, and HCO^+) at sub-millimetre wavelengths using single-dish telescopes (Kastner et al.,1997; van Zadelhoff et al., 2001). At an age of about 10 million years, the TW Hya disk appears to be substantially evolved, with significant grain growth and indications of a cleared inner hole, perhaps related to planet formation.

HD 100546 is among the nearest Herbig Ae/Be stars at 103 ± 6 pc, and shows a disk-like scattered light distribution of substantial size, about 8 arcseconds (8000 AU), as well as strong millimetre emission from dust. Mid-infrared spectroscopy from ISO shows remarkably strong crystalline silicate bands, similar to those observed in comet Hale-Bopp and indicative of substantial processing of the dust within the disk.

Figure 1, shows the 89-GHz continuum

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Editorial

Welcome to the February 2003 issue of ATNF News.

The ATNF is going through a period of considerable changes in its senior management. After 37 years with CSIRO, the Assistant Director John Brooks leaves the ATNF in February 2003 for long service leave and retirement. John joined CSIRO in 1965 as an apprentice. His remarkable career, recently recognized with an award for lifetime achievement, is described briefly on page 3.

Professor Ron Ekers, the ATNF Director since 1988, stands down as Director in March 2003 to take up a prestigious and well-funded research position as a Federation Fellow. Under the terms of this appointment Professor Ekers will cease to hold management responsibilities. ATNF and CSIRO processes to appoint a new Director for the ATNF are well underway. Until a new appointment is made, Professor Ray Norris will head the ATNF as acting Director.

Change always presents some threats as well as new challenges and opportunities. The ATNF has had the benefit of a long period of stability under the strong leadership of Ron Ekers and this has allowed the organization to develop well-defined goals, with a focus on radio astronomy and associated technologies, and a clear vision for the future. Overall, the ATNF has a high level of staff satisfaction and a research environment that is characterised by excellence, creativity and cooperation. These characteristics should serve the ATNF well through the present transition period.

This is our first issue of ATNF News with Lakshmi Saripalli as editor. As always, we welcome contributions to the newsletter.

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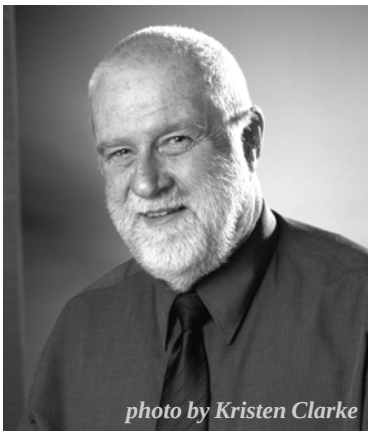
John Brooks awarded CSIRO Lifetime Achievement Medal

John Brooks, the Assistant Director and Engineering Manager of the Australia Telescope National Facility, has been awarded a CSIRO Lifetime Achievement Medal for his many contributions to the ATNF. The Lifetime Achievement Medal is a new CSIRO award and was given at a ceremony held in Parliament House, Canberra on 10 December 2002.



John Brooks as a young engineer in 1967 (left) and as ATNF Assistant Director in 2002 (right).

John joined CSIRO in 1965. As a young engineer he worked on equipment for the Parkes radio telescope. In 1982 the (then) Director of CSIRO Radiophysics, Bob Frater, had the daunting task of building the Australia Telescope Compact Array. This was an ambitious project, with the aim of building a world-class array with 80 per cent Australian content. Bob selected John Brooks as the man who could make this happen and appointed him as Project Manager. Under John's leadership, this goal was achieved, culminating in the opening of the Compact Array in 1988.

During the last decade, John has had many roles as Assistant Director and Engineering Manager of the ATNF. As Engineering Manager he has ensured that the Compact Array and Parkes radio telescope have continued to provide astronomers with world-class facilities. Over the years, John has built up a network of international linkages through exchange programs and has negotiated and managed millions of dollars worth of contracts involving the telescopes. As Assistant Director, John has become increasingly involved in CSIRO corporate issues, especially in Human Resources and has provided strong support to the Director in maintaining a high level of staff satisfaction within the ATNF. John has always led by example, making the tough decisions when they have to be made, providing guidance and encouragement to staff and always giving credit to colleagues.

For 37 years John has shown what 'service to science' means. He leaves the ATNF in February 2003 for long service leave and retirement. He will be greatly missed. We wish John and his family many years of happiness in the next stage of their lives.

CSIRO medal for ATNF and CTIP staff

Several ATNF and CSIRO Telecommunications and Industrial Physics staff were also honoured at the CSIRO annual awards on 10 December 2002. The ATNF/CTIP MMIC team, John Archer, Mal Sinclair, Russell Gough, Paul Roberts and Oya Sevimli, was honoured with a Medal for Scientific Achievement for their work in designing advanced indium phosphide Monolithic Microwave Integrated Circuits (MMICS) for radio astronomy and telecommunications. The MMIC project was funded under the CSIRO Executive Special Projects program, initiated in 1987 by Dr Malcolm McIntosh. The circuit designs were developed within ATNF and CTIP and fabricated in the USA by a foundry of TRW. The design of the MMICs had to be proven to have practical applications. For this, Henry Kanoniuk's work on the package design, assembly and testing of the final devices was critical. His unique technical expertise and finesse ensured high quality and reliable assemblies. The indium phosphide MMICs are internationally recognized as setting new performance benchmarks at millimeter-wave frequencies and are an essential component in the millimeter receivers for the high-frequency upgrade of the Compact Array.

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Workshop report: ATCA millimetre science in 2002

Following the success of the 2001 Millimetre Science Workshop in Melbourne, we reconvened on 21 November 2002 at ATNF headquarters near Sydney to hear some results from the first full season of ATCA millimetre observations. Fifteen speakers presented talks on ATCA as well as Mopra observations (in this summary we focus on the ATCA results). As with the 2001 workshop, we have placed the talks from the meeting on the ATNF website; the address is *www.atnf.csiro.au/whats_on/workshops/mm_science2002*.

The workshop began with presentations of results from the 12-mm system. Perhaps the most ambitious project was a pilot survey of about 1200 square degrees of the radio sky at 16 – 20 GHz, making use of the single-baseline analogue wideband correlator (see article in the October 2002 issue of ATNF News). Such a blind search, aimed at characterizing the high-frequency spectra of known radio sources and possibly discovering new source populations, had never been attempted at so high a frequency. Of the 574 candidate sources identified, 226 distinct sources were confirmed (with fluxes ≥ 60 mJy) in follow-up observations using the ATCA correlator and all three 12-mm baselines. Two source populations, one associated with the Galactic plane and LMC (presumably HII regions and planetary nebulae) and the other extragalactic, could be distinguished. All of the extragalactic sources could be identified in the 843-MHz SUMSS catalogue, with most also having bright optical counterparts (mainly QSOs). Thus, there is no evidence to date of a new, high-frequency source population.

Other 12-mm projects included a search for water masers in the Magellanic Clouds, which yielded nine new detections (seven associated with HII regions and two with oxygen-rich AGB stars), continued observations of the SNR 1987A, which suggest a possible increase in the 17 – 19 GHz flux over the past year, and an unsuccessful search for redshifted HCO^+ absorption in z ~3 damped Lyman-alpha absorbers. The workshop antendees were encouraged by the current plan to equip by June all six ATCA antennas with 12-mm receivers, with an expanded tuning range of 16 – 26 GHz (including many of the ammonia transitions).

Some of the first images from the 3-mm system were also presented. A project to detect continuum emission from disks around the young stars TW Hya and HD 100546 was a success on both counts, with fluxes that were consistent with extrapolations from lower frequencies (see accompanying article). Moreover, HCO^+ line emission was detected from TW Hya, with a very narrow velocity width (consistent with a face-on disk). A project to image the LMC molecular cloud near N113 in HCO^+ was also successful, revealing a heavily resolved source (Figure 1) with FWHM of about 5 arcseconds (1.5 pc). Even this only accounts for about 13% of the single-dish flux, suggesting that most of the HCO^+ is in relatively diffuse gas associated with a photon-dominated region (PDR). In contrast, the HCN emission from the carbon star R Scl is very compact, with baselines of a few hundred meters required to significantly resolve it (Figure 2). No evidence is seen for the expanding spherical gas shell of radius 10 arcseconds inferred from single-dish CO observations, perhaps because HCN is quickly dissociated to form CN.

Massive star-forming regions are natural targets for ATCA, as they tend to be found in the inner Galactic plane, which is best studied from the southern hemisphere. Widespread HCN and HCO^+ emission was observed towards G291.3-0.7, although mapping was hindered somewhat by the complex source structure and limited coverage of the Fourier plane. Similarly, a plethora of molecular species (HCN, HCO^+, HC_3N, and CH_3OH) was detected towards G318.9-0.17, revealing a dense core spatially coincident with the 6.7-GHz methanol maser. By comparing the observed molecular abundances with chemical models, it should be possible to determine the evolutionary state of the core.

One of the most exciting applications for the large collecting area afforded by ATCA is the search for

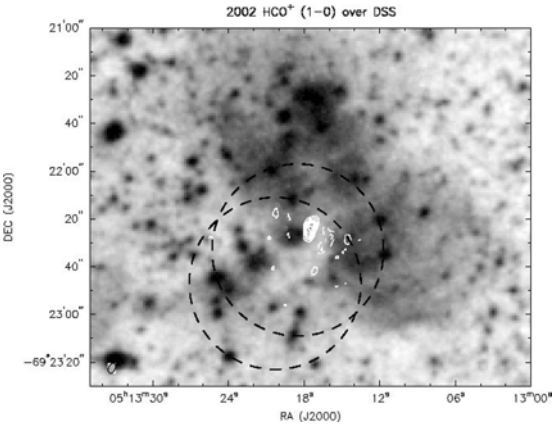

Figure 1: HCO^+ intensity image (contours) for the dense molecular cloud associated with the N113 HII region in the LMC. The diffuse emission seen in the greyscale is Hα emission contributing to this R-band DSS image. The molecular cloud appears to be near the end of a dust lane obscuring the HII region. Dashed lines indicate the positions of the two pointing centres. The beam size is 4.7 × 2.8 arcsecond².

biogenic molecules. Among the most interesting are glycine, one of the simplest amino acids, and propylene oxide, one of the simplest chiral molecules. Searches for these molecules conducted towards two molecule-rich sources in 2002 proved negative, although one of them, Sgr B2, shows a large number of unidentified lines. Thus, careful laboratory measurements to determine precise rest frequencies are essential to this effort, and have been undertaken by researchers at Monash University.

Unfortunately, completion of the 3-mm systems has been delayed until at least 2004, due to problems obtaining the necessary LO chain components. Nonetheless, the potential for useful observations has been demonstrated already, especially when data from several configurations can be combined. We look forward to being able to broaden the user community for both the 3-mm and 12-mm systems this year, in anticipation of an even more fruitful workshop in late 2003.

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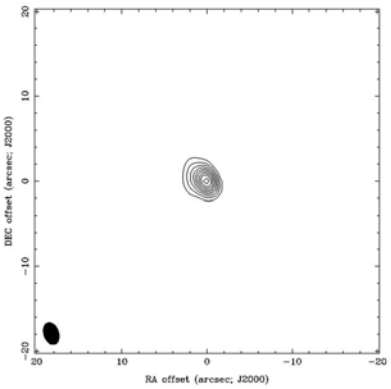

Figure 2: Integrated HCN intensity image for R Scl. The contour levels are integer multiples of 2 Jy beam^{-1}km s^{-1}. The beam size is 2.7 × 1.8 arcsecond^2.

The first Bolton Symposium

On 11 December 2002 ATNF hosted the first one-day Bolton Symposium. The symposium was originated to highlight the research efforts of the many ATNF affiliated post-docs. In total ten post-docs (or very recently post-docs) and one student gave talks about their research. The day was kicked off with a rousing talk by Prof. Ron Ekers on "John Bolton: Who he was and what he stood for?" Ron told us about John Bolton's contributions to a wide range of scientific projects, including the discovery of the first quasar, the long held record for the most distant radio galaxy and work on the polarization of Jupiter.

John's standards of research were clearly high; he expected his PhD students to really *earn* their PhDs stating, that, "anybody could get a PhD with Parkes". The list of John's former students is impressive, including the likes of Barry Clarke, Ken Kellerman and even Ron himself. After Ron set the stage for the quality and breadth of research expected of the Bolton name, we heard from all of the Bolton Post-doctoral fellows and several other ATNF post-docs about the research they are currently conducting.

Our post-doctoral fellows are involved in a broad range of research projects ranging from galaxy formation, to interstellar medium, to pulsars, star formation and public outreach. The most senior Bolton Fellow, Steven Tingay, talked about his research exploring absorption mechanisms in the closest Gigaherz-Peaked Spectrum source, 1718-649. Another senior post-doc (actually former post-doc), Jim Lovell spoke about his research over the past year on mega-masers, the MASIV survey and X-ray jets. Mark Walker gave the only purely theoretical talk on Microsheared Nano-lensing.

Tony Wong spoke about his research on the CO and HI correlation in the edge-on galaxy NGC 891. We heard from D.J. Pisano on his current research on galaxy assembly, featuring Parkes observations of loose galaxy groups. I presented a talk on the large-scale structure of hydrogen in the Milky Way, in particular the observed corrugations of the HI disk. George Warr told us about the public outreach work he has been doing as part of the SKAMP SKA prototype. The newest Bolton Fellows, Jürgen Ott, Chris Phillips and George Hobbs, have only been here for a short while, but are clearly off to a great start on their work at the ATNF. Jürgen showed impressive radio and Chandra images of massive superbubbles in the dwarf starburst galaxy, NGC 3077. George Hobbs talked about his work extracting proper motions for more than 200 pulsars from 30 years of archival timing data. Chris Phillips outlined the research that he will be undertaking on methanol masers. Finally, one PhD student, Natasa Vranesevic, joined the symposium to discuss her work on pulsar birthrates. All in all, the symposium was very well received and the audience seemed impressed with the calibre of research performed by our post-docs.

The symposium was an excellent opportunity for everyone to catch up on the research currently happening within the ATNF. This year's symposium was organized by George Hobbs and Naomi McClure-Griffiths, but couldn't have happened without the great contributions of the speakers, the help of Graeme Carrad on behalf of the staff club, Anne Barends, and many others. We hope the Bolton Symposium will continue as an annual opportunity to catch-up on local research.

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Australia Telescope Users Committee report

The second meeting of the Australia Telescope Users Committee (ATUC) for 2002 was held on 5 – 6 November 2002. There were 13 members in attendance and the meeting was chaired by Dr Carole Jackson. The committee recorded a warm vote of thanks to the previous chair, Dr Anne Green, for an excellent job. The committee welcomed the following new members: Prof Frank Briggs, Dr Maria Hunt, Dr Simon Johnston and Dr Naomi McClure-Griffiths, plus student representatives Mr Dion Lewis and Mr Martin Meyer.

In the open session on the morning of 5 November, status reports from the observatories were presented. There was also a presentation on the Very Long Baseline Array (VLBI) including usage, proposal statistics and staffing by Dr Tasso Tzioumis.

Dr Jessica Chapman presented data on the citation rates of ATNF publications and cross-CSIRO publications numbers. ATUC was asked to discuss the possibility of changing the AT observing terms from four to six months and Jessica gave a short overview of the likely impacts of this change. Warrick Wilson summarised the future development plans at ATNF.

The afternoon session was devoted to a status report on the Australian SKA and LOFAR efforts, arranged in conjunction with the Australian SKA Committee and convened by Drs Peter Hall, Carole Jackson and Elaine Sadler. Presentations at this session covered the recent SKA progress on the international front, focusing on the discussions at the meeting in July 2002 in Groningen and the status of MNRF2 developments. Interested readers are referred to *www.skatelescope.org/* where full information can be found about the international SKA effort. The submission by the Western Australian government as a potential LOFAR site was presented by Dr Michelle Storey. This prompted a LOFAR science workshop in January 2003 (*www.physics.usyd.edu.au/~simonj/lofar.html*).

The business session of ATUC was held on 6 November. Full details of deliberations can be found at the ATUC web page at *www.atnf.csiro.au/management/atuc/*.

The main issues were the request by ATUC that the "Future Developments" document be kept updated for both current and potential projects at the ATNF, as this is very useful for ATUC and the wider user community. ATUC expressed strong concerns regarding the slippage of the 3-mm system at the Compact Array.

ATUC suggested a strategy for the next mm-observing season, which has since been adopted. The committee discussed the merits of four or six-month observing terms. A majority agreed that the current four-month terms gave the best flexibility and planning options for observers.

The committee recommended that the 10/50-cm receiver be completed such that it might be operational during the NASA Mars tracking period. This matter will be reviewed at the next meeting. Potential users of this new receiver should convey their views to an ATUC member or come along to the next meeting. ATUC also recommended that paper copies of on-line journals could be terminated at the observatories (Narrabri, Parkes and Epping) to save money.

Carole Jackson
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ATNF visitor program

It's a pleasure to note the following distinguished visitors who are currently visiting the ATNF for a period of four to six months: John Dickey (University of Minnesota) and Don Melrose (University of Sydney), Arnold van Ardenne (ASTRON), Bill Imbriale (Jet Propulsion Laboratory). Arnold and Bill are also visiting CSIRO Telecommunications and Industrial Physics. Recently departed visitors include Dan Stinebring (Oberlin College) and Norikazu Mizuno (Nagoya University). We eagerly anticipate a visit to the ATNF in March by Esko Valtaoja (Tuorla Observatory), and a one-year visit to the ATNF and UNSW from Ned Ladd (Bucknell University) from mid-2003.

Over the period of the IAU General Assembly in Sydney, we will have a number of distinguished visitors who will stay for a few extra weeks to interact with ATNF staff. These include Joe Taylor (Princeton University), V. Radhakrishnan (Raman Research Institute), Ken Kellerman (NRAO) and S. Ananthakrishnan (GMRT). We encourage others wishing to spend additional time (a month or so) before or after the General Assembly to get in touch with an ATNF member of staff as soon as possible, as it will otherwise be difficult to help arrange accommodation. Support for visitors is provided by the distinguished visitors program and by Ron Eker's Federation Fellowship program.

Lister Staveley-Smith
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New research position at Narrabri

It is a pleasure to welcome Michael Dahlem to the Narrabri Observatory. Michael joined us in mid-January 2003 as a systems scientist, with his position giving him a mix of personal research time, and observatory systems issues. Michael, for example, will become involved at the systems end of a number of observatory developments (e.g. the two MNRF programs), the SKA and the observatory RFI environment.


Michael Dahlem

Michael completed his PhD at Bonn in 1990, with his thesis concentrating on the disk-halo interaction of spiral galaxies. Since then Michael has undertaken observing projects in a number of wavelength bands – centimetre and millimetre radio, optical and ultraviolet, as well as x-rays – in both continuum and spectral-line observing modes. In addition to a number of radio telescopes, Michael has used the VLT, HST, ROSAT and XMM. The institutes where he has worked also reflect this broad wavelength interest: Michael has worked at STScI, ESA (Noordwijk), Leiden and Paranal.

Michael's scientific interests centre on the interstellar medium in galaxies, star formation and its feedback into the ISM and disk/halo interaction. Michael also has a strong interest in communicating science to non-astronomers.

Bob Sault
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ATNF graduate student program

We welcome Aaron Chippendale and Jamie Stevens into the ATNF PhD co-supervision program. Aaron is a member of staff, and has now commenced a part-time PhD project on "High Dynamic Range Imaging with many Baseline Synthesis Interferometry". His supervisors are Anne Green (University of Sydney) and Mike Kesteven (ATNF). Jamie Stevens is undertaking a project entitled "The HI Properties of Galaxy Groups" with supervisors Rachel Webster and David Barnes (University of Melbourne), Michael Drinkwater (University of Queensland) and D.J. Pisano (ATNF).

We are also pleased to announce that the recipients of the prestigious 2003 CSIRO-ATNF postgraduate scholarships are Ilana Klamer (University of Sydney) and Jamie McCallum (University of Tasmania). Ilana and Jamie's PhD projects will be announced in a future newsletter. These scholarships are awarded annually to new students who should submit their applications by the same deadline as their APA applications. See *www.atnf.csiro.au/education/graduate* for more details.

Our congratulations for the official acceptance of their PhD theses go to: Paul Roberts for "Components for Wide Bandwidth Signal Processing in Radio Astronomy" (University of Sydney); Jasmina Lazendic for "Molecular Diagnostics of Supernova Remnant Shocks" (University of Sydney); Christian Bruens for "The Gaseous Arms of the Magellanic System and other High-Velocity Clouds" (Bonn University); and Martin Anderson for "A Radio Survey of Selected Fields from the ROSAT All Sky Survey" (University of Western Sydney).

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Eclipse in corner country

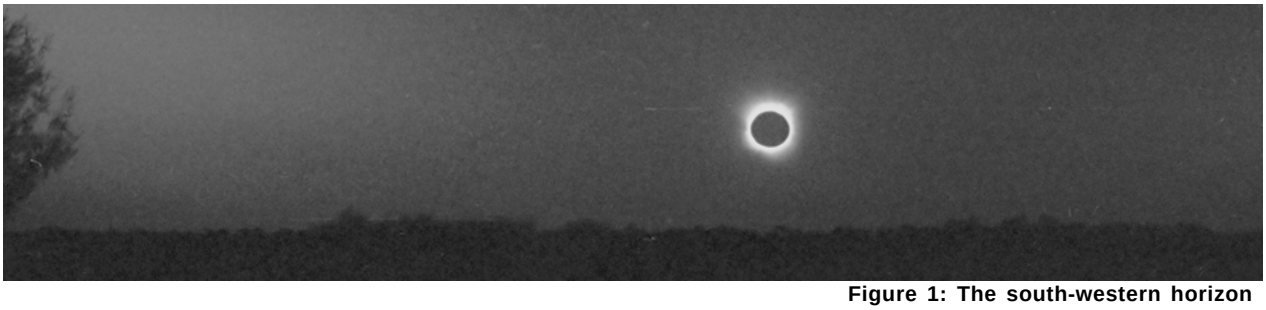

Figure 1: The south-western horizon

Having studied the solar corona and its radio emissions sunspot cycles ago, I was keen to verify its existence optically during the total solar eclipse of Wednesday, 4 December 2002, the first on Australian soil since 1976. The moon's shadow was to travel from the south-Atlantic west of The Congo, across southern Africa, the Indian Ocean and into the Great Australian Bight, finally making Australian landfall at Ceduna, South Australia (SA). The umbra was to move across south-east SA, clip the north-west corner of New South Wales ("corner country") and leave the Earth's limb west of Bulloo Downs in south-west Queensland. The favoured site to observe the eclipse was Ceduna. However, Ceduna is a longish drive (2200 km), whereas the New South Wales portion of the path is a mere 1300 km from the ATNF headquarters in Sydney.

Near the end of the track the eclipse path was just under 30 km wide, with Cameron Corner five km from its northern edge. The excellent publication by Fred Espenak and Jay Anderson (Total Solar Eclipse of 2002, 04 December 2001) told us that in this region the eclipse would be two degrees above the horizon and the duration of the total phase would be only 22 seconds on the centre line of the umbral path.

About three weeks before the eclipse date I approached my long-time friend and colleague, the incomparable Dr Jon Ables, with a view to forming an eclipse team. Just prior to departure at 11:30 on Monday, I was approached by Lister Staveley-Smith. He also intended to watch the eclipse. Did I know anything about getting to Cameron Corner? Lister decided to find a co-driver and leave Sydney early on Tuesday morning in time to meet us for the eclipse on Wednesday afternoon.

Figure 2: The team

On the first day, we covered mainly familiar country and made camp on the Mitchell Highway beyond Dubbo, between Trangie and Nevertire. The road is very straight with few bends on the 330 km from Narromine to Bourke. We arrived in Bourke at 10:30 the next day - the temperature was already 38 C. The road is sealed for about 10 km out of Bourke and the other 400 km is red sand, bull dust or gravel. The heat was hot, the sky overcast. We reached the Mt Wood camp ground in the SE corner of the Sturt National Park at about 18:30.

Overnight, on eclipse day, the weather changed. The sun appeared at sunrise but quickly passed behind the clouds that covered the eastern sky. During the morning the clouds thinned out and broke up. We drove 25 km to Tibooburra. Tibooburra is an aboriginal word for "heap of rocks" - an apt description. Cameron Corner is 140 km from Tibooburra. The country is surprisingly variable with gibber plains, "jump ups", clay pans and finally, beyond Waka, dunes of red sand. The road crosses the centre line of the umbral track just south of the Fortville Gate, 22 km east of the Corner. The gate is one of many allowing passage through the fence that runs around NSW along the SA and Qld borders. Evidently the fence was originally built to keep rabbits out of SA, but now keeps dingoes out of sheep grazing areas. It is said to be the world's longest fence – 5614 km.

In the area of the intersection between road and umbral centre-line we chose a tree that cast a shadow larger than us and our lunch. With the aid of Jon's GPS receiver, Fred's tables and my map of Sturt National Park, we calculated our location to be about 500 m south of the centre line. The sky became absolutely cloudless. The country here has series of parallel red sand dunes, arranged at an angle to the direction of the setting sun. The dunes are around 400 m apart. We had to choose a site with the western horizon unobscured by either

nearby scrub or by the next dune. We decided to select a position on the sunward side of a dune, out of the thicker scrub, and have our sight line across the clear inter-dune area, and still fairly distant from the ridge of the next dune. Lister and co-driver Jenn Donley joined us at about 16:30. Jenn is a Fullbright Scholar working at the ATNF with Lister and is studying galaxies behind the "Zone of Avoidance".

The eclipse shadow travelled from Ceduna to our location in 77 seconds, arriving at 09:11:29 UT (20:11:29 AEDT). First contact began just before 19:15. We had come prepared with "eclipse glasses" - sunglasses made from specially dense film and cardboard. I had also bought a sheet of "Baader film", a foil that transmits only 10^{-5} of the incident sunlight. Solar filters were made for camera and binocular lenses. With the help of Fred's tables I selected exposure settings for both the partial phase through the filter, and the total phase without the filter. The other important equipment we had was folding chairs. Being close to the horizon this was an armchair event.

We synchronised watches - with Jon's GPS receiver of course. We saw first contact within seconds of the predicted time. We watched as the moon glided upwards across the sun's face, starting just to the left of the lower limb. We had 57 minutes of partial phase giving plenty of time to take photos and check cameras. We noted the changes to shadows as the sun changed shape. We made a number of impromptu pin-hole cameras in a flurry of optical experimentation. As the sun slipped away the lighting took on that wierd quality only seen when it comes from a narrow crescent. The temperature had been 32 C all afternoon; we noticed a four-degree drop during the partial phase. Just minutes before totality "all the animals acted strange". Well, a pair of budgerigars flew by looking irritated, and the humans had been acting strangely all day.

We counted out the last few seconds, removed our eclipse glasses and filtered binoculars and there it was. **BRILLIANT!** No photographs prepare you for the sight of the solar corona. The range of brightness is far more than can be recorded on film - very bright close to the lunar limb and fading away but still visible at a great distance. I found the colour quite unexpected. Lister's description of pearly white is close. The brilliance and extent of the corona gave it a shimmering appearance. And then it passed.

We were all "first timers". We were all stoked. It was well worth the 1300 km drive for 22 seconds of one of nature's rarer displays. We slept under the stars. No dew, no insects, just thousands of stars. Around two in the morning the sky was dark, stars wheeled silently above and a desert thorn made its way through Jon's ground sheet and deflated his air mattress.

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LOFAR in Australia

The opportunity has arisen for Australia to participate in the LOFAR project (LOw Frequency ARray). The ATNF, in collaboration with the Office of Science and Innovation, Department of the Premier and Cabinet in the Government of Western Australia (WA), recently submitted a joint proposal to host LOFAR in the Mid West region of WA. The proposed site is one of three areas short-listed worldwide as a potential site for LOFAR. The advantages of the Australian site include superb radio-quietness, a Southern Hemisphere location, and excellent land accessibility leading to optimum placement of array-stations.

Growing interest in LOFAR science in Australia has led to two recent scientific meetings: *Detecting the Epoch of Re-ionization*, held at the ATNF on 18 December 2002, and *The Low Frequency Universe*, at the University of Sydney on 30 – 31 January 2003.

From 2 – 9 February 2003, a delegation from the LOFAR Consortium visited Australia to discuss possible collaborations and Australian involvement in LOFAR with Australian scientists, engineers and policy managers, and to visit the Western Australian potential site and discuss siting issues with the Western Australian Government. The ATNF and the WA Government are now preparing final siting proposal documentation. The LOFAR International Steering Committee plan to choose a site for LOFAR in May 2003 and the telescope is scheduled to begin initial operations in 2006. For further information on LOFAR see *www.lofar.org*.

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The LOFAR delegation at the Parkes Observatory.

And I thought I'd have quiet retirement!

The rude awakening

The telephone call from Dick Manchester came mid-morning on a beautiful day in March; Wallis Lake was blue, glassy and beckoning! Could I provide a little assistance with the organization of the IAU General Assembly to be held in Sydney this coming July, nothing too intrusive, say two days a week (ha, ha!)? With good Internet communications I would not need to go to Sydney too often, and transport could be provided for such a purpose.

When I retired from ATNF in February 2001, I seriously thought I'd be able to leave astronomy behind me forever. I'd quickly disposed of most of some 40 years of collected astronomy material. I'd disposed of my Wahroonga home and moved to a lakeside paradise some 300 km north of Sydney, absolutely sure that my geographic separation would protect me from any attempts to involve me in the organization of the IAU 25th General Assembly to be held in Sydney this year in the period 13 – 26 July.

How we humans can fool ourselves! After fourteen idyllic months in paradise, my way of life was rudely altered by Dick's call. Against my better judgment, against my wife's wishes, but at least relieving a nagging guilt, I agreed to become involved in the organization. However, I have to confess that the transition was not quite as traumatic as it sounds because several of my co-supervised PhD students were still around and I'd spent a considerable fraction of my retirement guiding them through the last stages of their thesis preparations etc. And as my reward they had 'dragged' me back (not exactly screaming!) into observing programs. My wife could well have told me to 'break a leg', the good luck comment used in the theatrical game, but she had to practice what she preached. Taking on both the General Assembly and a wife with a broken leg at the same time turned out to be a bit rough! In a way the two things were synchronized – as my wife's bones healed, GA organization became more intrusive; my 'retirement' is now on hold until August.

Organization of the IAU 25th GA

The IAU 25th GA will take place in the period 13 – 26 July 2003, at the Sydney Convention and Exhibition Centre (SCEC) in Darling Harbour. It is formally hosted by the National Committee for Astronomy (NCA) (of the Australian Academy of Science) in conjunction with the Astronomical Society of Australia. These committees established a National Organizing Committee (NOC) plus several related sub-committees. When I joined Harry Hyland of James Cook University as Co-Chair in March, the NOC had held twenty-one meetings; on 19 February the thirtieth meeting will be held. The NOC has a membership of 16 representing 13 different organizations, an Executive Committee of six members, a Finance Committee, and subcommittees: sponsorship and exhibition; website matters; media and newspaper matters; hospitality, accommodation and tours; associated promotional events; and program matters.

The current status of organization is reflected in the GA website (*www.astronomy2003.com*) and its various links. Information can also be found in the IAU Information Bulletins IB 91 and 92. We have contracted the services of a professional organizing group, ICMS Australasia Pty Ltd, which interfaces with the SCEC management, undertakes much of the practical side of organization, including marketing the event, and will process all registration and accommodation bookings.The estimated budget, assuming that 1500 people will register, is some two million dollars. Because of the significant costs associated with the use of the world-class convention facility, we have had to charge an early registration fee of $880 (including GST). This is significantly higher than the cost for the previous GA in Manchester, but for that meeting the use of many rooms was donated by the University of Manchester. We have heard that some overseas astronomers are unhappy about the cost of the GA, but the main reason for this must lie in the high airfare costs, an extra burden which Australians have grown to accept because they are associated with attendance at most international meetings. Even to keep the registration cost at the $880 level, sponsorships providing about $350 K in GA revenue will be needed to balance the budget, and a professional group, DVA-Navion, has been engaged to seek appropriate sponsors. ICMS will also assist in this. A selection of Australian students will be able to register for $220 by volunteering to provide assistance during the GA; details can be obtained from Jon Everett at UNSW (*email: jon@phys.unsw.edu.au*).

The Opening Ceremony and First Plenary Session of the GA will be held on 15 July in the Concert Hall of the Sydney Opera House. The program is currently being finalized; it will include the awarding of the Gruber Prize for Cosmology. These events will be

preceded by a Reception in the Opera House Foyer. The Closing Ceremony will take place at the Convention Centre on the afternoon of 24 July. The formal GA dinner will take place that evening. ICMS are organizing this event, and has promised us a spectacular cultural celebration!

The scientific and Commission meetings will take place between 14 – 25 July. Three Symposia with staggered starts will take place during the first week, the remaining three the second week. We have attempted to keep the weekend within this period as free as possible from formal meetings. The Symposia are:
•S216: Maps of the Cosmos
•S217: Recycling Intergalactic and Interstellar Matter
•S218: Young Neutron Stars and Their Environment
•S219: Stars as Suns: Activity, Evolution and Planets
•S220: Dark Matter in Galaxies
•S221: Star Formation at High Resolution.

The GA will provide something for everyone – checkout our website! In addition to the six Symposia, the meetings will include 21 Joint Discussions, several special sessions (on planetary exploration, astronomy in Antarctica, double-star classification, astronomy teaching) and substantial opportunity for the Commission and ad-hoc meetings. A Women's Networking Luncheon is being organized. The program will be complemented by a 'Festival of Astronomy' for the public. This will involve public talks, a Schools Day organized by UNSW, and other events. A major event will be an Astro Expo exhibition, to which the public will have a four-day access. This will be held in one of SCEC's large exhibition halls, which will also house the posters, Internet café, astronomer's coffee and lounge area, café, and small theatre. ICMS is currently very active chasing up the selling of exhibition spaces. A set of tours around Sydney and further afield has also been organized.

The website and linked sites provide all the most up-to-date information on meetings, meeting rooms, accommodation, tours etc. Further information on accommodation and associated transport, provision of childcare facilities, billeting possibilities etc will be added in the near future. Here you can use on-line forms to register for the Assembly, book accommodation and submit presentation abstracts, and can also download forms to apply for IAU Travel Grants as well as book various tours. It is also possible to download forms to book exhibition space if you're so inclined. An important section deals with obtaining visas – all visitors from overseas, other than Australian and New Zealand citizens, are required to have a valid visa for Australia. In principle, attendance at a GA is by invitation of the IAU President; IAU members are automatically invited. In practice, invitations can be given by national adhering organizations, Commission and Division Presidents, and Chairpersons of the various meetings. At a recent meeting of the American Astronomical Society in Seattle, Rachel Webster, President of the NCA (the Australian adhering group) offered to invite non-members who filled out the registration form and checked the 'Invited Participant' box.

Two important deadlines have just passed

•**February 15** was the deadline for submitting applications for IAU Travel Grants, and also the deadline for submitting any presentation abstracts suporting the grant applications.
•**March 1** was the official deadline for submission of other presentation abstracts, and it is gratifying that the total number submitted has exceeded 2300, although some are duplicates. It now appears that late abstracts will be accepted for some of the meetings, and the details will be listed on the General Assembly website.

Future deadlines to remember

•**30 April**: Deadline for early registration. Early registration is not only much cheaper, but your name will be included in a draw for a Sydney Harbour Bridge climb for two people, which I'm told is very exciting!
•**15 May**: The presenters selected by the organizing committees of the various meetings must have registered by this date for their abstracts to be included in the GA Abstracts Book.
•**11 July**: Closing date for pre-meeting registration.
•**13 July**: On-site registration begins.
•**14 July**: Meetings begin with three Symposia.

The bottom line

The GA organization is gaining momentum and slowly the threads of the various activities are being drawn together. We, who are organizing the meeting, believe that this meeting will be the best GA yet. Certainly the selection of the beautiful Darling harbour and SCEC for the meeting, in conjunction with the spectacular Opera House for the opening, support this. However, ultimate success will depend on having a large number of people coming to the meeting, so we encourage you to come and join us. I hope the interruption to my retirement has not been in vain!

John Whiteoak
ATNF Honorary Fellow and Co-Chair NOC for the IAU 25th General Assembly
(John.Whiteoak@csiro.au)

Using aips++ for ATNF data

Most ATNF users will have heard of the aips++ project to develop a new flexible package for radio astronomy data reduction and analysis. As a member of the Australian aips++ User Group (AAUG) I have spent some time evaluating how well aips++ handles data from the ATNF telescopes.

Formed in mid-2002, the AAUG has already made substantial progress in evaluating components of aips++ relevant to Australian users, with a report submitted to ATNF aips++ management in September 2002. At our last meeting, in December 2002, we noted the need for more regular users in the group and are pleased to welcome Chris Thom (Swinburne) and Chris Phillips (ATNF) as recent new members. In 2003, we will be undertaking a program that combines testing and routine use of aips++ to provide useful feedback to the aips++ development team. The AAUG also exists to encourage and promote the use of aips++ to the wider community.

Why use aips++? There are several reasons:

- it has capabilities that are not in other packages;
- you can script new functions by combining lower level tools in glish;
- it is likely to be the package for the new generation of radio telescopes, such as the GBT, LOFAR and ALMA; and
- it is designed to have at least the functionality of AIPS and Miriad.

aips++ comes with a great deal of web documentation which is mirrored to other sites in the consortium. For the local version of aips++ web pages see *www.atnf.csiro.au/computing/software/aips++/release/docs/aips++.html* and links from there. Two useful web references for reducing Compact Array data are:
(1) Getting Results with AIPS++, Volume 3 - Telescope Specific Processing, ATCA Reduction (Mark Wieringa)
www.atnf.csiro.au/computing/software/aips++/release/docs/ getting results/grvol3/node6.html; and
(2) Getting Results with AIPS++, Volume 2 Generic Processing (see Chapters 1 and 2)
www.atnf.csiro.au/computing/software/aips++/release/docs/getting results/grvol2/grvol2.html

Using aips++ with Compact Array data

To encourage ATNF users to use aips++, I outline here the steps taken in aips++ to calibrate and image Compact Array data for the 6-cm continuum emission and formaldehyde line absorption for the source G291.3-0.7 (project C1080). This source was observed with the EW367 array, using five antennas only. The main tools used were *atcafiller*, *msplot*, *calibrater*, *imager* and *image/viewer*. The data analysis steps are quite similar to AIPS or Miriad, so I give the Miriad equivalent tasks in brackets.

- The RPFITS data were loaded into aips++ and converted to a measurement-set (MS) with *atcafiller* (like Miriad atlod).
- The uv-data were plotted and examined with *msplot*. This is a very flexible tool to plot uv-coverage, or any two parameters (like uvplt and uvspec). I used this tool to flag the data (edit = T, when starting) by highlighting outlying bad data on the screen (like tvflag). One slight annoyance to me was that the data could be displayed as an average over channels, but could not be flagged in this mode. An alternative way to flag data is *flagger* by specifying the time, baseline etc (like uvflag).
- The calibration of the uv-data was done with the tool *calibrater*. This uses the formalism of Jones matrices (no relation) with calibration tables for bandpass (B), gain (G) and polarization leakages (D) determined from the calibrator data and applied to the other sources. This *calibrater* tool is equivalent to the Miriad tasks mfcal, gpcal, gpplt, gpboot and gpcopy, but applied with a sequence of functions within the tool. The *calibrater* task can also be used for self-calibration in conjunction with the task *imager*.
- The tool *imager* is used to make the images from the visibility data. The dirty image and beam (point spread function) can be made with the function *makeimage* (like Miriad invert). The image could be then deconvolved with the tool *deconvolver*, but it is easier to use *imager* functions, which integrate the inversion and deconvolution into one step. I used function *clean* (like Miriad invert, clean and restore). Parameters for the data selection and image are set with functions *setdata* and *setimage*. Other functions can be used to set weighting, tapering, clean regions etc.
- I used the function *view* in the tool *image* to display the images. This comes up with a default grey-scale image that can be manipulated in various ways, for example to show colour. I like to display contours on the grey-scale (Figure 1), so I added a contour overlay of the same data, with parameters specified in a second adjust window. This is all standard functionality (like kview or Miriad cgdisp) but works well. There is also a new stand-alone quick viewer, *qv*, that can be run outside aips++ (like kview), which should soon be available in the aips++ release.

So how good were the final images? For the C1080 data, the Stokes-I continuum image (33 channels over 128 MHz) is dynamic-range limited, with a peak flux density of 28 Jy, and lowest contours at around 1% of the peak (Figure 1). This image was cleaned without specifying cleaning boxes and probably could be improved. The Stokes Q, U and V images do not show any artefacts above the noise, which is a good sign that the calibration has worked. However, the same data reduced through Miriad gives an I image with better dynamic range, so it may be that I did not do as well in flagging and calibration in aips++ as I did in Miriad.

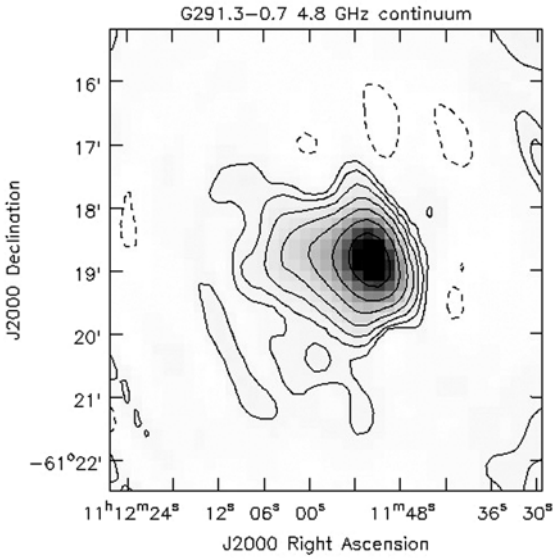

Figure 1: The ATCA 6-cm continuum Stokes-I image of G291.3-0.7 produced with aips++ end-to-end. The contours are -0.25, 0.25, 0.5, 1, 2, 4, 8, 16 Jy/beam.

I also made a data cube for the spectral-line data (513 channels over 8 MHz), selecting the central 64 channels including the formaldehyde absorption. The image planes, which can be displayed as a movie in *view*, looked very similar to Figure 1, confirming that the limit was dynamic range not sensitivity. The spectrum at the pixel near the continuum peak was plotted from the *profilefitter* tool. This line image is not continuum subtracted. Continuum subtraction can, at present, only be done in the image plane. For the spectral-line data, a significant limitation has been that I have been unable to apply Doppler corrections to the observed frequencies to obtain velocities in the local-standard-of-rest reference frame.

Conclusions

ATNF users may find aips++ useful for specific data applications that are not covered, or are not as easy to use, in other packages. At this stage, it appears that continuum ATCA data can be processed end-to-end in aips++ although some bugs may be encountered. Further tools are needed for complete spectral-line data reduction, in particular to convert frequencies into velocities.

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Symposia and workshops – March 2003 to July 2003

Event	Date	Location	Web Information / Contact
AAO/ATNF Joint Symposium	2 April	Mount Stromlo Observatory, Canberra	*www.aao.gov.au/jsymp2003/*
6th ATNF Synthesis Imaging Workshop	12 – 16 May	Narrabri	*www.atnf.csiro.au/synthesis/prog.html*
Modest 3 - Modeling Dense Stellar Systems	9 – 11 July	Monash University, Melbourne	*www.manybody.org/modest-3.html*
The 5th Workshop on Galactic Chemodynamics	9 – 11 July	Swinburne University, Melbourne	*www.astronomy.swin.edu.au/GCD/*
IAU General Assembly 2003	13 – 26 July	Sydney	

IAU General Assembly XXV Sydney 13 – 26 July 2003

For full details on Symposia, Special Sessions and Joint Discussions, please see the IAU website *www.astronomy2003.com*

IAU General Assembly **Symposia and Special Sessions**	**Date**	Information / Contact
S216: Maps of the Cosmos	14 – 17 July	*Lister Staveley-Smith, Lister.Staveley-Smith@csiro.au*
S 217: Recycling Intergalactic and Interstellar matter	14 – 17 July	*P.-A. Du, paduc@cea.fr*
S218: Young Neutron Stars and their Environments	14 – 17 July	*R.N. Manchester, iau218@csiro.au*
S219: Stars as Suns: Activity, Evolution and Planets	21 – 25 July	*A.O. Benz, benz@astro.phys.ethz.ch*
S220: Dark Matter in Galaxies	21 – 25 July	*M. Walker, mwalker@physics.usyd.edu.au*
S221 Star formation at High Angular Resolution	22 – 25 July	*M.Burton, mburton@unsw.edu.au*
SPS1: Recent Progress in Planetary Exploration	18 – 19 July	*D.P. Cruikshank, dcruikshank@mail.arc.nasa.gov*
SPS2: Astronomy in Antarctica	18 July	*M. Burton, mburton@unsw.edu.au*
SPS3: A New Classification Scheme for Double Stars	18 July	*B.D. Mason, bdm@draco.usno.navy.mil*
SPS4: Effective Teaching and Learning of Astronomy	24 – 25 July	*J.R. Percy, jpercy@utm.utoronto.ca*

Articles

ATCA imaging of clusters of galaxies found in the SUMSS

Introduction

Theoretical predictions suggest that there should be many clusters of galaxies at distances out to a redshift of z=1 (see Jenkins et al., 2001). However, comparatively few clusters have been found at this redshift. It is important to develop new methods for detecting clusters at high redshift. Traditional methods employed to find clusters involve searching for optical or IR overdensities of galaxies in a survey. However, when going to higher redshifts these methods suffer contamination from faint sources at lower redshift, as well as contrast problems with bright sources at lower redshift. X-ray and radio surveys will therefore be very important at finding high redshift clusters.

The new generations of X-ray satellites (XMM, Newton and Chandra) are expected to find many high-redshift clusters. The X-ray surveys detect the bremsstrahlung radiation from the cluster plasma. This emission is dependent on the density squared of the electrons in the plasma and is therefore biased to detecting high-density regions. The X-ray surveys are therefore likely to be biased towards finding relaxed clusters with a well-established cooling flow. For this reason it is important to find other selection techniques to complement the X-ray work.

Radio sources are widely regarded as tracers of high-density regions at high redshifts (e.g. Venemans et al. 2002). In the literature there are examples of clusters being found using deep imaging around a single radio source (e.g. Best 2000, Nakata et al., 2001). Also groupings of radio sources in the NRAO VLA Sky Survey (NVSS) have been used as tracers for clusters of galaxies (e.g. Croft et al., 2001, Cotter et al., 2002). These searches will only find a subset of the cluster population and as in the case of the X-ray surveys they will involve biases. Interactions between galaxies are thought to trigger radio sources (e.g. Best et al., 2002). It is therefore likely that the radio searches will be biased towards merging systems. This is complementary to the X-ray searches that may be biased towards relaxed systems.

Using the SUMSS catalogue to identify potential clusters

The Sydney University Molonglo Sky Survey (SUMSS) is a radio survey carried out using the Molonglo Observatory Synthesis Telescope (MOST). It is carried out at 843 MHz, with a resolution of 43 arcseconds, complete to about 6 mJy (Bock et al., 1999). It is very similar in frequency, resolution and completeness to the NVSS. Building on the success of the clusters found using the NVSS we have been using SUMSS to search for clusters in the Southern Hemisphere. We searched for groupings of 5 radio sources in a 7-arcminute-diameter circle in the SUMSS catalogue (Mauch et al., 2003).

This produced a list of 120 potential clusters. After examining SuperCOSMOS (Hambly et al., 2001) *R*-band images of these fields we were able to remove obvious chance alignments where several of the sources had clearly unrelated identifications, and some low-redshift clusters. This procedure left 60 candidates for clusters expected to lie at a redshift greater than $z \approx 0.3$ (beyond the SuperCOSMOS *R*-band plate limit for radio source host galaxies).

ATCA observations

All 60 of these candidates have been observed at 20 cm and 13 cm at ATCA using the 6-km array (Buttery et al., 2001). These observations were carried out with the goal of providing more accurate source positions to facilitate optical identifications. The observations have provided some very interesting results. About thirty percent of the cluster candidates showed some sources that were resolved out by the 6-km observations. We expected that this was diffuse emission, which is often associated with clusters (Buttery et al., 2002). Very little is known about this diffuse emission and only a few cases of it have been found to date (see e.g. Clarke and Enβlin 2000, Govoni et al., 2001, Thierbach et al., 2003). To determine whether this really was diffuse emission further observations were made with ATCA in November 2002 using the 1.5-km array (see Figure 1).

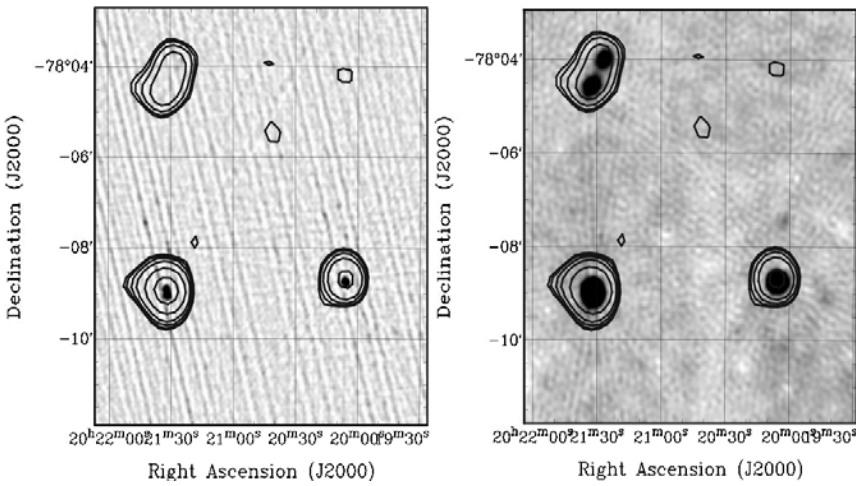

Figure 1: The left hand figure shows the ATCA 6-km array map at 20 cm in greyscale overlaid with the SUMSS contours at 5, 6, 8, 12, 24 and 48 mJy. The top left source is completely resolved out. The right hand figure shows the ATCA 1.5-km array in greyscale overlaid with the same SUMSS contours. The top left source is now apparent – confirming that it represents extended emission.

Optical and IR follow-up

In addition to the radio observations, 40 of the potential clusters have been imaged to *V*~23, *R*~23 and *I*~22 with the ANU 2.3-m telescope. These observations are designed to identify clusters out to a redshift of $z \approx 0.7$ and to make an estimate of the redshift for clusters below that redshift by locating the position of the 4000-Å break.

Clusters with no identifications out to a redshift of $z \approx 0.7$ are high-z candidates. A sample of these have been observed in service observations on IRIS2 on the Anglo-Australian Telescope as well as with SofI in December 2002 on ESO's New Technology Telescope at La Silla. This allows redshift estimation for clusters where the 4000-Å break lies between *R* and *J*.

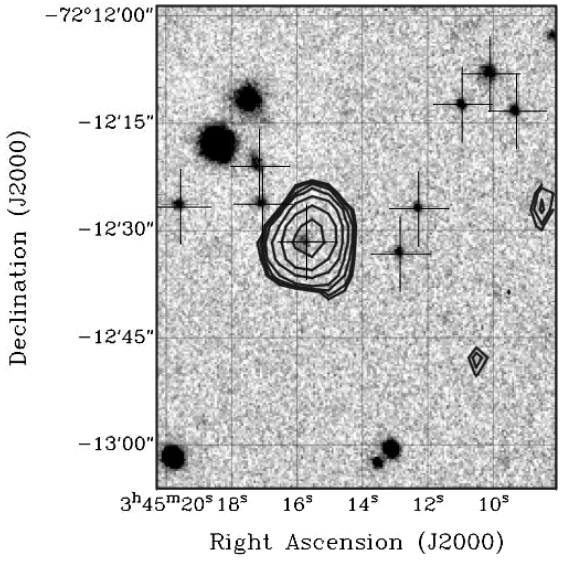

Figure 2: The figure shows a *J*-band image taken with the NTT showing numerous IR sources surrounding one of the radio sources, as well as a radio source identification. The sources labelled with crosses are not present (or only very faintly present) in the *R*-band image. This indicates that the 4000-Å break lies between *R* and *J* implying a redshift of $z \approx 1$. The figure has ATCA 20-cm contours at 0.5, 0.6, 0.8, 1.6, 3.2, 6.4 and 12 mJy overlaid.

The optical and IR follow-up of our cluster candidates is ongoing, but we have now found clear evidence that there are clusters associated with at least some of the radio sources in several of our candidate fields (Figure 2). Our programme will now advance to multi-object spectroscopy with Gemini-S and VLT, to identify the cluster members without doubt and to investigate their stellar populations and the dynamics of the clusters.

Conclusions

Our results give further evidence to indicate that radio sources trace high-density regions of the universe at high redshifts. We have also found a large number of examples of diffuse emission in clusters. This will contribute to the debate about the nature of these diffuse sources.

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The gravity deformations in the Compact Array antennas

The Compact Array at Narrabri is being upgraded to operate at millimetre wavelengths. As part of this upgrade, we have initiated an effort to understand the deformations, due to gravity, in the antenna structure with elevation. The plan is to measure the structural gravity deformations and relate these to the elevation dependence of the antenna gain and far-field beam patterns. We will then design and implement a scheme that will make elevation dependent corrections to the wave front and consequently recover the gain loss and avoid coma lobes.

After the first mm receivers were installed on Compact Array antennas, we began making measurements of the gain-elevation curves and of the antenna far-field beam patterns. It was soon clear that at 3 mm, the antenna forward gain dropped off at low elevations and also at high elevations. The beam patterns showed a pronounced coma lobe at low elevations and high side-lobes at high elevations. Gravity deformations were, clearly, degrading the antenna performance at elevations away from the intermediate values at which the optics had been aligned and the panels of the main reflector had been set.

In February 2002, Danny Brizzi and Harry Hanley from Vision Metrology Services Unit, University of Melbourne, brought a new measurement technique to Narrabri: they brought a V-STARS photogrammetry system consisting of retro-reflective targets, a high-resolution digital camera and a notebook computer with software. A total of about 600 targets were stuck on the Compact Array antenna CA02; they were placed over the main reflector, the sub-reflector, its support cage and quadripod structure, and on a frame fixed to the feed turret. With the antenna set at elevations 90, 75, 60, 45, 30 and 15 degrees, about 100 images were taken of the antenna from atop a Cherry-Picker while the antenna rotated in azimuth. The software then provided relative positions of all the targets, at each elevation, with 30 – 50 mm accuracy. Their measurement report is available as AT Technical report AT 39.3/109. Anyone who visited the Compact Array site at Narrabri after February 2002 might have noticed “spots”, which are the retro-reflectors, all over the main reflector and other structural members of CA02. If you have not done so already, go over to CA02 after dark and shine a torch or headlights at the antenna when it is tipped.

The gravity deformation of the main reflector surface was described using polynomial surfaces at the different survey elevations; the coefficients were obtained via fits to the deviations measured at the target locations. Viewed face-on, the deformation of the main reflector from the design shape is such that at low elevations, the outer panels at the top of the antenna deform forwards whereas at the bottom the surface is displaced backwards. This results in a large coma lobe to the south of the main lobe. At high elevations, the displacements are reversed and the top parts of the surface deform backwards while the bottom part deforms forwards. Higher-order deformations are also observed and are, presumably, related to the form of the backup structure. The gravity displacements perpendicular to the local surface are shown in Figure 1 as surface plots.

As the antenna tips to low elevations, the sub-reflector moves 0.3 mm axially away from the main reflector; it is displaced by 0.4 mm parallel to the aperture plane, towards the bottom of the antenna, and rotates through 0.03 degrees about an axis parallel to the elevation axis. The movements/rotations with elevation that we infer are tiny: as compared to the 7 m distance between the sub-reflector and main reflector, these movements are a few parts in 10^5 and are within the accuracy of the photogrammetry. We subtracted the measured displacements of the sub-reflector with respect to the main reflector from the displacements of the top of the quadripod to obtain the displacement of the sub-reflector with respect to the quadripod: this was independently measured with transducers and the concordance confirms the accuracy of the photogrammetry!

The displacement of the feed, as the antenna is tipped in elevation, is perpendicular to the elevation axis and downhill parallel to the antenna aperture plane: the total displacement is about 2.3 mm over the entire elevation range.

We have analyzed the effects of these deformations and displacements via geometric optics computations at 90 GHz. The dominant cause of gain loss is the gravity deformation of the main reflector; the measured movements of the sub-reflector and feed are, on their own, not expected to cause a gain loss exceeding 1%. Assuming that we align the optics and set the panels at 60-degrees elevation, the expected gain loss from all of the displacements and deformations together is about 7% at high elevations and 30% at low elevations; this is similar to the observed gain loss. The computations also predict a significant coma lobe at low elevations and high side-lobes at high elevations; these are also observed in measurements at 3 mm. The analysis is in AT 39.3/115.

A study of the effects of tilts and displacements in the feed and sub-reflector (AT 39.3/113) had related the movements to aperture-plane phase patterns. The gravity deformation is also essentially an error pattern in the aperture phase. Analysis (whose details are in AT 39.3/117) has found that the loss in power gain arising from gravity deformations may be recovered, to within 2 – 3% of the optimum value, by elevation dependent (1) axial repositioning of the sub-reflector or the feed, and (2) either one of the following: lateral displacement of the feed, lateral displacement of the sub-reflector, or a tilt to the sub-reflector.

We have decided to modify the sub-reflector support structure on the compact array antennas so that the sub-reflector may be tilted, through precise angles and under computer control, about an axis parallel to the elevation axis. We are implementing a scheme where a tilt of the sub-reflector together with an axial repositioning would correct for the gravity dependent optics deformations.

For those interested in details, the AT technical documents referred to herein are available on the web at *www.atnf.csiro.au/observers/memos/index.html*

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(Ravi.Subrahmanyan@csiro.au)

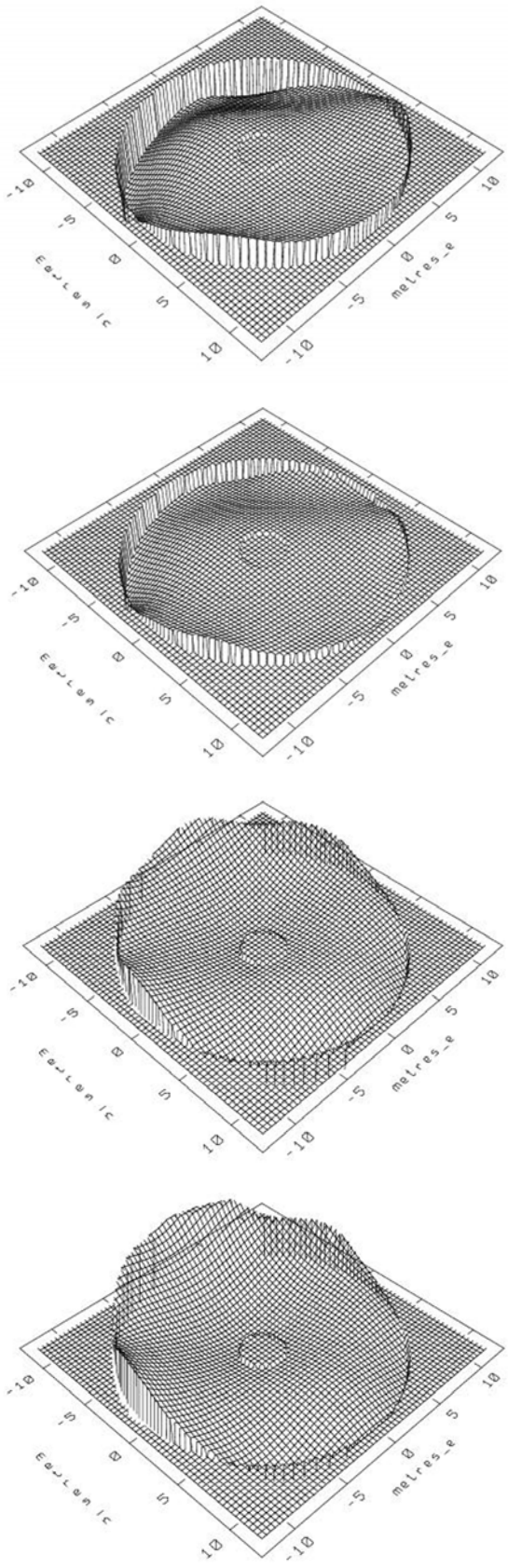

Figure 1: Gravity displacement perpendicular to the local surface. The antenna is viewed face-on in these plots and the top end of the antenna face is at the top of the plots. The panels are for elevations 90 (top), 75, 30 and 15 (bottom) degrees (60 degrees was selected as the reference elevation; the panels show the displacement relative to the 60 degree surface). The rms surface displacement is 0.4 mm at 90-degrees elevation and 0.5 mm at 15 degrees elevation.

Continued from page 1

Compact Array millimetre images of disks around the young stars TW Hya and HD 100546

emission detected from TW Hya and HD 100546. Gaussian fits to the visibilities gives a flux of 41 ± 4 mJy for TW Hya and 36 ± 3 mJy for HD 100546. TW Hya is unresolved, while HD 100546 shows a hint of extended emission to the south-east. For TW Hya this flux measurement agrees well with expectations from previously reported measurements at higher and lower radio frequencies (Weintraub et al., 1989; Wilner et al., 2000).

The spherical radiative transfer models of Henning et al., (1994) that reproduce the far-infrared emission from HD 100546 do not account for the observed millimetre flux, even with a population of "fluffy" dust grains, which suggests that a circumstellar disk component must be present in the system. The compact 89-GHz dust continuum emission detected in the ATCA observations provides direct evidence for this disk. Detailed modeling of the disk properties awaits additional ATCA mm observations with sufficient angular resolution to separate the disk and envelope components.

Figure 2 shows the TW Hya HCO^+ J = 1–0 line channel maps. A narrow line emission feature is clearly visible at the stellar position with a velocity and line width commensurate with previously reported molecular line detections. The line emission from the disk is clearly spatially resolved. A circular Gaussian fit to the visibilities in a 0.5 km s^{-1} bin gives a size of 3.2 ± 0.8 arcseconds (FWHM). Since the critical density of the HCO^+ J = 1–0 line for collisional excitation is about 6×10^4 cm^{-3}, the detection of extended emission indicates high densities must be present to large radii, independent of any detailed physical and chemical model for the disk. No HCO^+ J = 1–0 emission was detected toward HD 100546, a surprising result. CO is the most abundant tracer of H_2, and observations with the mm ATCA of ^{12}CO and ^{13}CO 1–0 at 115 and 110 GHz respectively are needed to understand this result.

The TW Hya disk structure and chemistry has been considered in detail by van Zadelhoff et al., (2001), whose model calculations suggest that species like CO and HCO^+ are depleted due to a combination of photo-dissociation in the warm surface layers and freezing-out in the cold parts of the disk shielded from stellar radiation and activity. The HCO^+ abundance generally follows the CO abundance in the disk, since its formation is primarily from CO reacting with H_3^+, with destruction by dissociative recombination with free electrons.

Figure 2 also shows visibility amplitudes derived from one of the favoured models of van Zadelhoff et al., (2001) compared to the visibility amplitude of the HCO^+ J = 1–0 emission from TW Hya as a function of baseline length; the amplitude falloff at longer baselines demonstrates that the emission region is resolved (with characteristic size about 3 arcseconds). This model is based on the radiatively heated disk structure of D'Alessio et al., (1999), in which HCO^+ is depleted by an overall factor of 100 with an additional order of magnitude jump when the temperature falls below 20 K.

This model shows very good agreement with the observations, for both the size scale and the absolute intensity of the HCO^+ line emission. While the model does not provide a unique best fit to the data, the high HCO^+ depletion factor is a robust feature. Similar high HCO^+ depletions have been inferred from millimetre imaging of the disks surrounding GG Tau and LkCa15, isolated pre-main-sequence stars located in holes of the Taurus dark cloud complex.

High resolution observations of the nearby young stars TW Hya and HD 100546 with the ATCA using just three antennas equipped at 3 mm show the promise for future millimetre-wave observations of proto-planetary disks located deep in the southern sky. We look forward to using the fully upgraded mm ATCA for further studies of these and other southern disk systems.

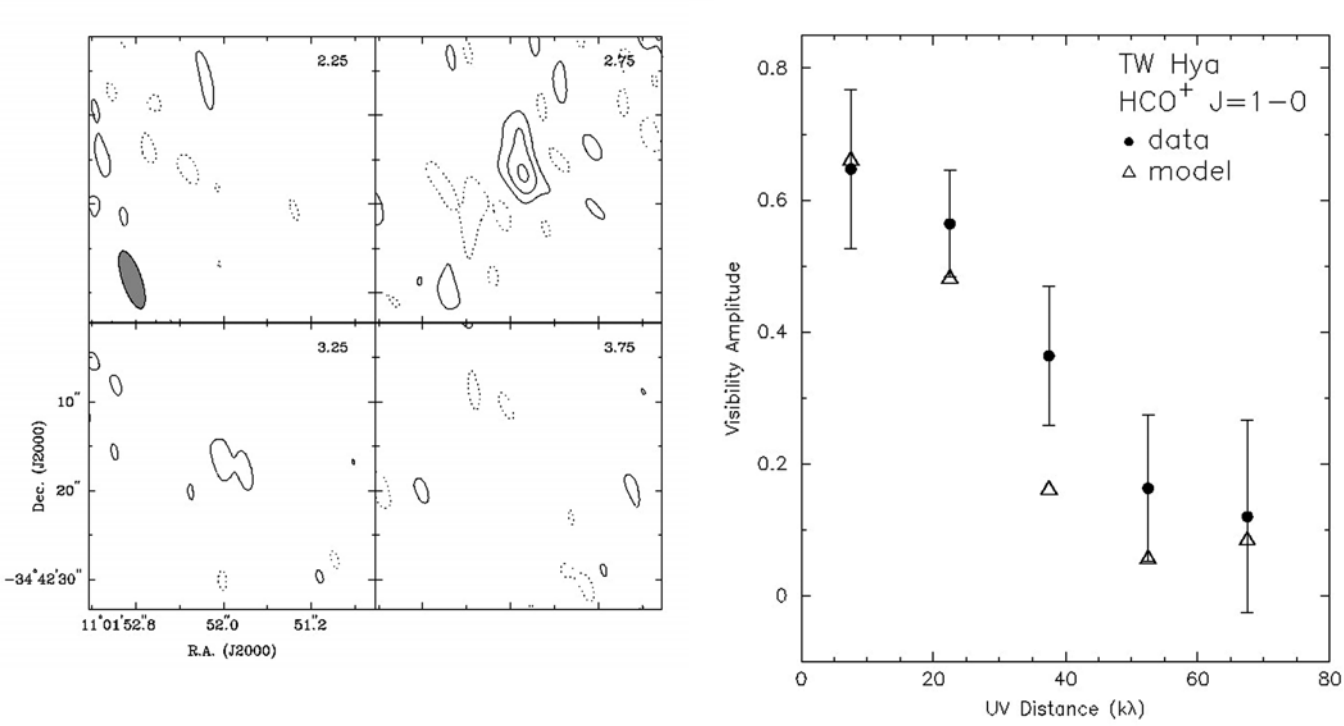

Figure 2: *Left* – Velocity channel maps of HCO^+ line emission observed from TW Hya. The contour levels are ±2, 4, 6,...× 66 mJy (0.7 K). Negative contours are dotted. The ellipse in the lower left corner of the upper left panel shows the synthesized beam of size 6.9 × 2.1 arcsecond². *Right* – Visibility amplitude of observed and modelled HCO^+ J =1–0 emission versus baseline length integrated over 0.5 km s^{-1} width centered at LSR velocity 2.75 km s^{-1}, annularly averaged in 15 kλ bins. The error bars represent ±1 standard deviation for each bin. The model values derive from the calculation of van Zadelhoff et al. (2001), sampled at the same visibility points as the observations.

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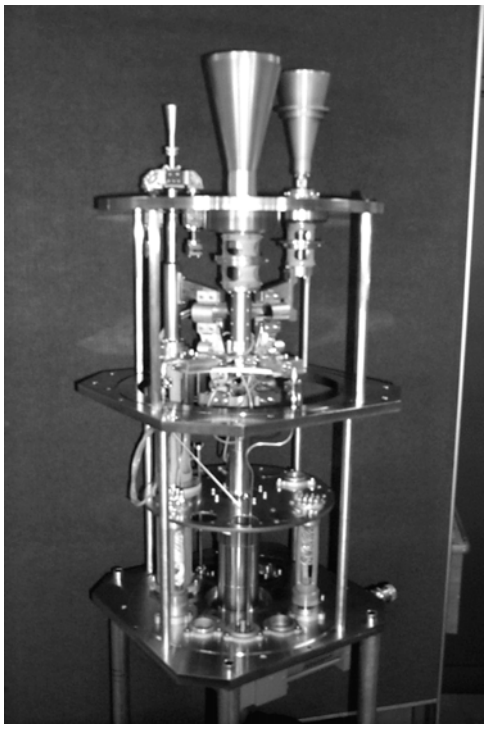
Wilner et al., (2000), ApJ 534, L101

David Wilner (CfA), Tyler Bourke (CfA), Chris Wright (ADFA), Jes Jørgensen (Leiden), Ewine van Dishoeck (Leiden) and Tony Wong (ATNF)

(dwilner@cfa.harvard.edu)



One of the mm receivers of the Compact Array.

Regular items

SKA program report

Figure 1: ATNF Director Ron Ekers (front right) and Connell Wagner Regional Manager Tony Barry signing the SKA collaboration agreement. Others present (L-R) are Kourosh Kayvani, Steve Negus, Jeff Schafer (all from Connell Wagner), Peter Hall, Ray Norris and Kieran Greene.

The SKA/LOFAR team has been busy on a number of fronts, including technical projects and preparations to host the LOFAR delegation visit (page 11). Good results continue to be obtained from the artificial dielectrics project and, with colleagues in CTIP (CSIRO Telecommunications and Industrial Physics), CMS (CSIRO Molecular Science) and CMST (CSIRO Manufacturing Science and Technology), we expect to have a prototype 1-m Luneburg lens constructed using the new material by mid-2003.

In another multi-beaming antenna project, we have commenced specification and design of a prototype phased array to be developed in collaboration with ASTRON and CEA Communications P/L. This antenna will probably be an 8×8 Vivaldi horn array which, in a fully-developed form, could be used as a focal-plane array at Parkes. Operating in the approximate frequency range 500 MHz – 1.5 GHz, the array will have digital-beam forming and signal processing to emulate the data processing and transport undertaken in a small SKA-station. The general approach, as mapped out under the MNRF 2001 program, is to evaluate which multi-beaming antenna technology – or combination of technologies – offers the best path to the SKA; the larger-scale CSIRO demonstrator will then focus on that direction.

The phased-array work has been given a boost by the welcome presence of Arnold van Ardenne from ASTRON (Netherlands), who is visiting for three months. We are also pleased to welcome Bill Imbriale from Jet Propulsion Laboratory (USA), who is visiting CTIP/ATNF for one year. Two summer vacation students are working in the SKA area this year. Paul Connor from Tasmania University is undertaking an SKA infrastructure study and Simon Nawrot from University of Western Sydney is working on a radio frequency systems project. Still on the personnel front, Suzy Jackson will be transferring to the SKA group in May to contribute to research and development in the phased-array project; Suzy will also be commencing a PhD in this area.

In December the ATNF signed a collaborative agreement with Connell Wagner P/L, one of Australia's largest engineering consultancies (Figure 1). Connell Wagner will contribute $0.5 M in services to the SKA over the next year. Projects are underway in several areas, the largest of which is an engineering infrastructure study for possible sites for the SKA. While this will examine potential Australian sites in detail, it will also be enormously useful for planners within the international SKA consortium. Peter Hall and Steve Negus will be program leaders for ATNF and Connell Wagner respectively, while Ron Beresford will manage the technical projects on ATNF's behalf.

Field work has been high on the agenda, with a December expedition by Ron Beresford to a potential SKA site near Murnpeowie, in outback South Australia. In collaboration with Robert Jenkins, the Senior Project Manager for the South Australia Office of Economic Development, Ron spent a week doing a first-round inspection and making preliminary interference measurements (Figure 2). Further work is planned in western New South Wales and, along with completed phase-one Western Australia studies, the newer evaluations will be incorporated into Australia's initial site analysis document to be submitted to the International SKA Steering Committee (ISSC) by 31 May 2003.

Peter Hall, SKA/LOFAR Program Leader (Peter.Hall@csiro.au)

Figure 2: Interference testing at Murnpeowie Station,130 km north-east of Leigh Creek, South Australia

ATNF outreach

Summer Vacation program

Each summer the ATNF coordinates a summer vacation program for undergraduate students who have completed at least three years of their degrees. This year the program was held jointly with CSIRO Telecommunications and Industrial Physics (CTIP). We received over 300 applications for 19 positions, eight with the ATNF and 11 with CTIP. Six of the ATNF students were based at Marsfield with the other two at Narrabri.

The vacation program provides the students with a tremendous opportunity to experience working in a research team. Each of the students worked for about 12 weeks on a research project with supervision from a research scientist or engineer. Many of the students commented that they enjoyed the CSIRO work environment and that the program has attracted them to consider further study or research careers. At the end of the program, on 6 February 2003, the students held a one-day symposium, organized by Albert Teoh, and gave excellent presentations covering a diverse range of topics.

In mid-January the students took part in an Observatory Trip where they spent four days at either the Parkes or Narrabri Observatory and worked in small teams on observing projects. Each group was allocated approximately 8 – 12 hours for observations with the telescopes. The student observations were supported by Naomi McClure-Griffiths at Parkes, and DJ Pisano at Narrabri, with safety and telescope training provided by staff at the Observatories.

The Observing Trip was a big challenge for the vacation students but also extremely rewarding. Here, reprinted from the summer vacation students' newsletter, *The Jubbly Decibel*, are some comments on their experiences:

"We learnt that when you are at a telescope such as Parkes, using a watch is absolutely useless unless it shows UTC, sidereal times and AEST. Life literally revolves around the stars. Amidst our simple but irregular cycle of sleeping and observing, we managed also to climb the dish, play cricket under the dish, watch *The Dish* (apparently a requirement for any Parkes astronomer), play cards, listen to music, take some photos and explore the Visitors Centre."

"We set out knowing very little about what to expect; thrown (quite intentionally) straight into the deep end of observations, with only DJ Pisano for a floaty and the stars for a guide. Most of us were engineers or physicists with no idea about astronomy, observation or interferometry, let alone the truly vital skills of Rubics puzzle solving, mastering Miriad, and staying awake for 36 hours straight."

"The observation results were mixed, with the Pulsar group failing completely to get any useful pulsar data whatsoever. However, thanks to recently visible events in a black hole far, far away, a good measure of dignity (and some useful data) was recovered, and we thank the powers that be in far reaches of the universe for flaring just in time to save us."

Jessica Chapman
(Jessica.Chapman@csiro.au)

Front row (from left): Ying Guo, Jessica Chapman, Natasha Maddox, Albert Teoh, Paul Connor, Mark Foreman, Naomi McClure-Griffiths
Middle row: Lok Sang Ho, Kirsty Rhook, Samantha Mickle, George Petrakis, Anne Barnett, Michael Laxen, Andrew Danson, Suzannah Molloy
Back row: Kingsley Allen, Steven Irrgang, Jurgen Fripp, Simon Nawrot, Dean Karantonis

Compact Array and Mopra report

Staff and visitors

In late 2002, we farewelled Judy Stump and welcomed back Jacqui Wieringa. Judy served as the observatory's librarian while Jacqui was on maternity leave. Also in late 2002, we farewelled Steven Tingay, who has left to take up a position at Swinburne. Steven had been with us for three years as a Bolton postdoc, working mainly on radio galaxies and VLBI observations. With his new role in the Swinburne SKA group, and with his continuing interest in using the Long Baseline Array, we expect that Steven will be a frequent visitor to the ATNF sites. In mid-January we welcomed Michael Dahlem (page 7). Michael will be working on various systems-related projects at the observatory, including work related to the two MNRF programs, the SKA and tracking the radio-frequency interference environment at Narrabri.

The last few months have been a hive of activity with medium to long-term stays by five undergraduate students. Kate Smith (University of Albuquerque) left us in November after staying at Narrabri for three months, and learning the madness of Melbourne Cup on her final day. Kate worked on understanding high frequency source counts for CMB experiments. Andrew Danson (University of Newcastle) and Suzie Molloy (Monash) have been with us since early December as part of the ATNF Vacation Scholarship Program. Suzie has been busy using genetic algorithms to predict atmospheric phase given measurements from our two water-vapour radiometers. In early January, Le Cuong Nguyen (UTS) joined us to do six months of industrial experience as part of his computer science degree. Le Cuong and Andrew are developing new components of the ATCA monitoring system, as well as helping with some computer systems administration. In mid-December, Prue Sutton (University of Newcastle) started two months of work, studiously copying to disk and crosschecking the ATCA data archive (see below).

Archive to disk project

In conjunction with Rob Power at CSIRO Mathematical & Information Science (CMIS), over the Christmas period the entire Compact Array data archive has been copied from CDs onto a disk farm. All 1.5 Terabytes of the archive now sits on CMIS disks in Canberra (it is also backed up onto 53 DLT tapes). This is an early step in the process of developing the Compact Array archive as an example of a "virtual observatory". It also provides a duplicate copy of the archive in a physically distinct place to Narrabri. Our next step in the coming few months is to make the disk archive accessible over the Internet, and thus streamline the data archive request process. In the longer term, various grants are funding a collaborative project between the ATNF and CMIS to develop an ATNF virtual observatory focused on the ATCA archive.

Operations

The lost time was somewhat higher than normal. Lost time can be broken into three roughly equal components. Firstly, the term has been unusually windy: a third of the lost time was a result of wind-stow conditions. Secondly, as luck would have it, a nearby lightning strike during a severe thunderstorm on Christmas evening caused damage in numerous array systems. Rather than a relaxing Boxing Day, several staff were out at the Array attending to the problems. Considering the amount of damage, it is a tribute to them that four antennas were back up in the mid-afternoon, and that normal observing was restored by lunch on 27 December. The same lightning strike knocked out the University of Birmingham dome and IPS for considerably longer than this. The remaining third of downtime consisted of numerous smaller faults. The (old) antenna control computers remain our single-biggest "non-weather" source of lost time.

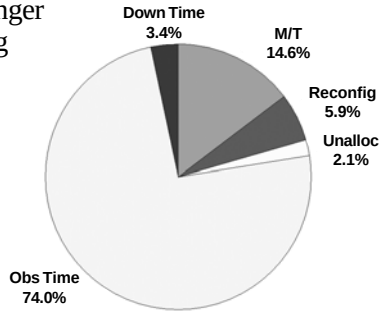


Figure 1: ATCA usage for September 2002 term

User feedback

Figures 2 and 3 summarize the results from the Narrabri user feedback questionnaires in 2002. Figure 2 is for all observers, whereas Figure 3 shows the results of questions specifically related to the new 3- and 12-mm systems. Users rate various aspects of the observatory on a scale of 1 (poor) to 5 (excellent).

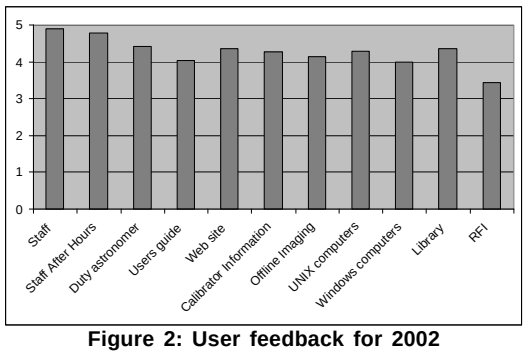


Figure 2: User feedback for 2002

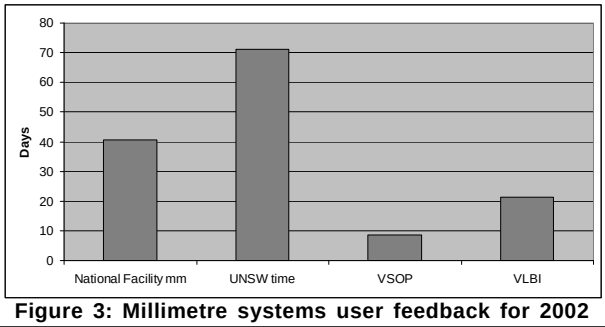


Figure 3: Millimetre systems user feedback for 2002

Upgrading the Compact Array

With the coming of summer, observing at 3- and 12-mm wavelengths finished for the year on 21 October and 7 November respectively. Although there were two 12-mm runs in early January, millimetre observing does not start fully until the second-half of April. With the first winter of "common user" observing with the interim millimetre receivers complete, we can now start to make more meaningful estimates of the fraction of time useful for millimetre observing. An analysis of weather patterns indicates that during winter months, a simple swap scheduling scheme would increase the chances of getting good weather from 65% to around 80 – 90%. For further information see *www.atnf.csiro.au/observers/docs/3mm/weather/2002.html*

The upgrade of the antenna control computers (ACCs) is tantalisingly close to completion at the Compact Array. Observing with the new ACCs is now routine, and we have successfully used the new ACCs during the calibration observations needed immediately after a re-configuration. In general we now expect observations in unallocated time to use the new ACCs. Some frustrating 'pSOS' bugs are currently preventing a straightforward remote reboot of the new ACCs. We believe the ability to do this is critical before we switch to using these fully.

Regarding the millimetre receiver upgrades, a shutdown is scheduled for 1 – 10 April to outfit the Array with 12-mm receiver packages on the remaining three antennas. A second shutdown in May will complete the 12-mm upgrade. After May, module swaps will no longer be required, and the full 16 – 25 GHz band at 12 mm will be available. Between the April and May shutdowns, much of the 12-mm system functionality will be available, but there will be some practical restrictions on its use because of some missing components. Unfortunately the 3-mm upgrade has not proceeded as quickly as expected. The local-oscillator system for the 3-mm receivers is missing some critical components. This means that, at best, only one additional 3-mm system will be delivered this year, probably late in the winter.

A new round of holographic measurements were made on antenna CA02 in December. Apart from the innermost ring (which is approximately 0.8 mm offset from its nominal position) the panel alignment has an rms of 200 microns. The results are in broad agreement with photogrammetry done on this antenna in February 2002.

The work on the deformation on the main antenna structure with elevation (page 16) has led to a project to provide better sub-reflector control: the sub-reflector will be given both axial and a tilt control. Using these, we hope to improve the primary beam shape and to recover some lost antenna gain at lower elevations.

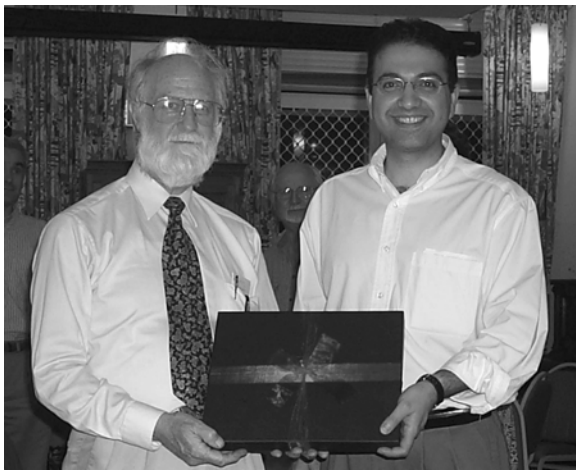


Figure 4: Mehrdad Baghai, Director BD&C, presenting a memento to Prof Ron Ekers.

Visitors Centre and special events

The Visitors Centre had approximately 11,000 visitors in 2002 and several after-hours star evenings, such as for the Vintage Car Club. Plans are currently being drawn up to renovate the surrounding gardens, including an exploratory pathway and a spiral galaxy inspired area.

In November the observatory hosted a meeting by the CSIRO Business Development and Commercialisation unit (BD&C, Figure 4), with an unusual twist as the participants were unaware of their destination until the flight departed!

Mopra

Observing at Mopra using the 3-mm SIS system continued until 10 November 2002. Over the summer period, Mopra has been used as a VLBI-only telescope. Mopra continues to support both the once-a-term VLBI observing week and approximately weekly observations in conjunction with the VSOP mission. Figure 5 gives the number of 24-hour days of scheduled observing at Mopra in 2002. Overall, usage was very similar to 2001, with a total scheduled observing time of 142×24 hours.

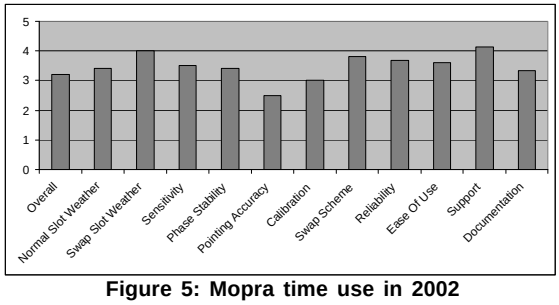


Figure 5: Mopra time use in 2002

On 27 October, as part of the Coonabarabran "Festival of the Stars", we held a Mopra Open Day. In total we had about 110 visitors come through the observatory, look through the Control Room and climb up to the Vertex Room.

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

Parkes Observatory report

Staff

Two new staff members have just joined us to bring the Parkes team back up to full strength in cryogenics and receiver support. Brett Dawson joined us from Ericsson in December as our new receiver engineer.

David Catlin started in January as our receiver technician, and at the start of the second week rushed back to Sydney for the birth of his second child. Mother Tracey and new daughter Emily are both well, and together with their three-year-old Bryn should be moving to Parkes to join Dave in a few weeks. Dave has moved to the ATNF from a position with a contractor maintaining flight simulators for the RAAF at Richmond.

Our administrative trainee, Louise Munday, left towards the end of the year. Lou made a major career advancement to the position of Assistant to Peter O'Keefe, head of People Development at CSIRO Corporate in Canberra. Lou has been tireless in her role as Observatory 'front-person' over the last year and her cheerful presence will certainly be missed.

A new administrative trainee, Bonnie Lanzarini, has just joined us. Bonnie will be in the front office answering the phones on Tuesdays and Wednesdays and will be completing her TAFE studies on other days of the week. Until recently Bonnie was living near Venice, so adds multilingual virtuosity to her other many skills.

Sincere thanks are due to Noel Freeman who stepped in at short notice to provide essential administrative support over December when both Geoff Freeman and Julia Hockings were away for a few weeks. Noel's calm intelligence, capability and unflappable nature made a busy period managable. We wish him well as he starts his studies at Charles Sturt University in Bathurst.

Coffee and foccaccia and other goodies

Construction of the cafe in the grounds of the Parkes Visitors Centre is well underway. In one week prior to Christmas the site was transformed from bare dirt to one bearing a dramatic steel structure - the frame of the cafe and new covered BBQ area. The accompanying photo shows the cafe as it was when the builders took a break for Christmas. Assuming all continues according to plan, the cafe will be open for operation around the end of March - just in time for the Easter rush.

CPSR2

The new Caltech-Parkes-Swinburne baseband recorder continues to be honed into a fully commissioned machine. The only important remaining step is to repackage the equipment into two, large fully-shielded racks, whose manufacture to specifications has taken longer than expected.

Surface upgrade

The upgrade of the telescope surface - as part of the preparations for Mars tracking in late 2003 – early 2004 - is about to start. Around 180 new perforated aluminium panels will be fitted to the telescope in March, replacing half of the remaining steel mesh panels. Six of the new panels have just been fitted - a major effort in more than 40 degree heat accompanied by strong winds, smoke and dust on one of the most unpleasant days in Parkes so far this summer. Despite the elements the fitting was completely straightforward and the panels look great. The remaining 174 will be fitted over a period of four weeks, followed by a week or so of holography and adjustment of the surface.

Figure 1: Café at Parkes Observatory around Christmas 2002

Initial holography measurements at 12 GHz using beacons on the Optus satellites are in progress at

the time of writing and will set a good baseline from which start the final adjustment of the panels in March – April.

Together with a new 8-GHz receiver being built by the Marsfield receiver group, the upgrade will result in a doubling of the sensitivity of the telescope at 8.4 GHz, and the extended aluminium surface may facilitate further receiver developments between 6 – 25 GHz in future years.

10/50cm Pulsar receiver

Fitting tests of the eagerly awaited 10/50-cm receiver took place on 28 January and went so well that the receiver was installed and removed from the focus cabin in around 9 hours - much less than the 24 hours set aside for the job. The receiver is so large that it will need to be installed (and removed) in two parts - but Pat Sykes and Graham Moorey have come up with an elegant system for aligning the two halves which worked beautifully. The current plan is for the installation of a fully functional receiver to take place in August, before Mars tracking begins in earnest.

Operations news

Impressions of the current El Nino climate cycle have been that it has been drier (of course) and hotter and windier than usual this year. The last several months have been extraordinarily windy, with more than 10% of time lost this year to date due to wind. Time lost to equipment faults is small by comparison.

The new zenith drive gears fitted to the telescope in October last year continue to work well with no major problems. The final stages of the work in October involved the grinding of each tooth on the zenith rack gears attached to the counterweight. The grinding was done using air-operated but hand-held grinders, working 12 hours a day over a period spanning a week and a half. This mammoth job was completed with unfailing cheerfulness by Chris Titterton and Daniel Jukic from Hofman's - a Perth based gear company - together with Clive Murphy from Narrabri. The results are a very obvious improvement in the shape of the teeth and the contact pattern between them and the teeth of the output pinions, reducing wear.

A number of niggling faults in the drive system have arisen in the last few months. While the drives have exercised the problem-solving skills of the local technical staff - which are considerable - little observing time has been lost.

Notable was a temporary apparent increase in friction in the zenith drive system which had the effect of reducing the motor currents when near the dish horizon. This may well reflect the much better meshing of the gears and the rack resulting from the gearbox and rack refurbishment last October. Attempts to characterize the friction have led to the identification (and correction) of a manufacturing fault in the drive control-electronics. The most recent tests indicate that the frictional losses have now decreased to almost the same level as recorded in the old zenith gearboxes back in April 2000, presumably as a result of the 'bedding in' of the new gears and bearings. Some aspects of this issue are not yet fully understood and we will continue our tests and monitoring.

Subtle earth fault problems have also provided challenges. One led to power for the azimuth brake solenoids leaking across to the zenith brake solenoids with potentially serious consequences. Another resulted in the significant differential ground potential between different buildings on site corrupting the timing signals on the station clock.

Operational developments

At the time of writing, the first astronomical observations using the wideband correlator are underway. The new correlator provides up to 1 GHz of bandwidth, dual polarization, for pulsar timing and also for spectral-line work. In addition to increased sensitivity, the correlator provides full polarization capability, filling the vacuum in this area left by the demise of the Caltech correlator a year or more ago.

At present the correlator is being used at 256-MHz bandwidth with the multibeam correlator, through the standard conversion rack, and is producing high-quality data, with only relatively minor software wrinkles left to be smoothed out. Both the new correlator and CPSR2 have been successfully integrated into TCS (Telescope Control System), the Observatory's main observing interface.

Bringing the correlator into full operation is the culmination of many months of hard work, most significantly from Warwick Wilson and Evan Davis, the architects of the system. Mike Kesteven, Mark Calabretta and Simon Hoyle have all made important contributions to the software, as has Aidan Hotan from Swinburne.

John Reynolds
Parkes Officer-in-Charge
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Time Assignment information

Compact Array information

In 2003 MAYT the Compact Array will offer array configurations H75, EW214, EW367, 750C, 1.5C and 6D. Note that the H75 is an addition to the previously advertised arrays. In addition, the term will start with EW352. We expect a one-week shut down in late May. In addition to the standard 20, 13, 6 and 3-cm systems, we expect that 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). As in 2002, three antennas will be available with 3-mm systems for the winter of 2003, 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.

During the term the EW367 array will be configured in a "shuffled" state. This is relevant for 3-mm observing where only three antennas are available. The EW214 and shuffled EW367 arrays provide complementary Fourier coverage. In 2003, for 3-mm proposals, we will be continuing to use a swap scheme to give some robustness against poor weather. To generate a pool of proposals for use as swap partners, we are offering service observing. Service observations will be strictly limited to centimetre wavelength projects where the service observation can be used as a swap partner. The ATNF will provide an operator to do the service proposals.

Mopra information

In 2003 Mopra will be operated in a similar way to 2002. Under an agreement between the ATNF and the University of New South Wales (UNSW), there will be a mix of "national facility" and UNSW-guaranteed time. The 3-mm SIS receiver will be available for use during the winter season.

Tidbinbilla news

From November 2002 until February 2003 the 70-m antenna was unavailable due to maintainance activities. For the remainder of the 2003JANT term approximately 135 hours will be available for radio astronomy. Of this, it is expected that 40 hours will be needed for installation and testing of three new K-band filters, 15 hours will be used for LBA observations, leaving 80 hours for service spectroscopy. As expected the majority of the available time is restricted to hours when Mars is below the horizon at Tidbinbilla.

Special rules applying to NAPA and ToO proposal data release

To clarify some existing policies, results from target-of-opportunity (ToO) and non-a priori assignable proposals (NAPAs) should be made publicly available as soon as possible via an appropriate international astronomy alert service. The results should be made public in time for other groups to follow up the same event. The ATNF now advertises these observations as they are made. See *www.narrabri.atnf.csiro.au/observing/napa_too.html*

In general, the raw data for these sorts of observations have the same proprietary period as regular observing. However the proprietary period will be suspended if results from the observations are not made public within seven days.

Changes to the ATNF Time Assignment Committee

The National Facility structure of the ATNF (previously Radiophysics) was originally established in 1986 with the setting up of a Steering Committee and Time Assignment Committee. The Steering Committee appoints the TAC members and approves TAC policies. Under the original guidelines, the Director was also the TAC Chair. This structure has worked well with Professor Ron Ekers as TAC Chair from November 1989 until November 2002.

With the imminent departure of Ron Ekers as Director of the ATNF, some changes have been made to the Time Assignment Committee (TAC). Under new guidelines agreed by the ATNF Steering Committee in 2002, the TAC Chair is now appointed by the ATNF Director, normally from an institution outside of CSIRO. The TAC remains advisory to the Director and the Director may attend the meetings as an observer but does not have voting rights.
Brian Schmidt (Research School of Astronomy & Astrophysics, Canberra) took over as TAC Chair in November 2002.

Following a request from the Users Committee, the TAC has recently made some changes in reporting feedback on observing proposals. The TAC letters sent to the proposers will now include the mean grade assigned to each proposal, and the mean grade for all Compact Array and Parkes proposals.

A current list of TAC members is available on the web at *www.atnf.csiro.au/management/tac/*.

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ATNF publications list

Publication lists for papers which include ATNF data are available on the web at: *www.atnf.csiro.au/research/publications*. Please email any corrections or additions to Christine van de Leeuw *(Christine.vanderleeuw@csiro.au)*. This list includes published refereed articles and conference papers, including ATNF data, compiled since the October 2002 newsletter. Papers including one or more ATNF authors are indicated by an asterisk.

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