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CSIRO Australia Telescope National Facility Annual Report 2008

CSIRO Australia Telescope National Facility
Annual Report 2008

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This is the report of the Steering Committee of the
CSIRO Australia Telescope National Facility for the calendar year 2008

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Cover image: The Australia Telescope Compact Array celebrated 20 years of operation in 2008.

Cover image: David Smyth, CSIRO

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Director's Report

In a number of ways, 2008 marked a transitional year for the Australia Telescope National Facility (ATNF). As the Australian SKA Pathfinder (ASKAP) project ramped up, significant changes were implemented in the operations model for the ATNF telescopes. These changes, designed to deliver a sustainable operations model into the ASKAP era, were made against the backdrop of the final stages of the Compact Array Broadband Backend (CABB) project, one of the most ambitious and challenging engineering projects ever undertaken by the ATNF.

The fact that the ATNF moves into 2009 with a renewed and successful operating model, a world-class ASKAP team and great promise for CABB stands as a testament to the hard work, dedication and professionalism of all ATNF staff and the excellent support services provided by CSIRO.

ATNF is beginning to see the scientific outcomes of the longer-term, campaign-style programs such as the Methanol Multibeam Survey, the H_2O Galactic Plane Survey and pulsar astrometry programs. While the evolution to more survey programs may be responsible for a marginal decline in the number of papers over the past two years, the international impact of – and demand for – the telescopes remains at historic highs. International astronomers account for greater than 40% of the use of all telescopes. It is also encouraging to note that in addition to the Compact Array and Parkes telescopes, the productivity of both the Long Baseline Array and Mopra remain strong.

ATNF engineers have made major strides throughout the year on the CABB system. By the end of the year CABB had been successfully implemented on five ATCA antennas, albeit with limited bandwidth. The community can look forward with both confidence and excitement to a fully commissioned system in the first half of 2009. During 2008, the Parkes Testbed Facility for ASKAP was also successfully commissioned and "first light" was obtained with the prototype phased array feed – already delivering world-class performance for this innovative new technology.

ATNF also continued to build skills for the future. Working with our university colleagues, ATNF co-supervised 37 students in 2008, from 17 different institutions and six different countries.

Credit: Wheeler Studios.

This year also marked the end of my five and a half year tenure as ATNF Director. This role has been the most challenging and rewarding of my professional career to date. I have been privileged to work with some of the most talented scientists and engineers in the world over that period. Through the Decadal Planning process and National Collaborative Research Infrastructure Strategy investment plan, I have also been fortunate to play a role in helping shape and implement Australia's broader strategy for astronomy.

I look forward to even greater challenges in my new role as CSIRO Square Kilometre Array Director, with the knowledge that we have strong support for astronomy at both the organisational level in CSIRO and at the national level from the Commonwealth Government of Australia. That support is fundamentally based on the quality of the Australian astronomical community and its National Facilities.

Brian Boyle
ATNF Director

Chairman's Report

The events and activities described in this ATNF Annual Report occurred in 2008 – some of them more than 18 months ago, so I am writing very much for the record. In July 2009, shortly before I wrote this foreword, the world celebrated the 40th anniversary of Neil Armstrong landing on the moon – an event in which Australia, including the radio telescope at Parkes, played a not unimportant role. The global coverage of the anniversary was enormous and led to many other articles being written about space exploration since 1969; a common theme was lost opportunities and unrealised dreams.

In this context and with reference to the International Space Station (ISS), Roger Linius, the senior curator for space history at the Smithsonian National Air and Space Musuem, was quoted in *New Scientist* as saying:

In 100 years, the ISS will be remembered for the remarkable technological feat of cooperatively building and operating it, and probably not for much else...I think that its cooperative aspects are the way forward (*New Scientist*, 11 July 2009, p32).

These words apply equally to radio astronomy. Telescopes such as the Square Kilometre Array (SKA) will not be built unless there is profound cooperation between many nations and organisations within nations. Just as building and operating the ISS represented fundamental challenges for the collaborating nations, especially the USA and Russia which had been Cold War adversaries, so in radio astronomy new organisations, new methods of operation and new behaviours will be required if new instruments are to be built and new science done.

The *ATNF Annual Report 2008* contains frequent references to the sorts of changes that will be needed for radio astronomy to remain one of the strongest pillars of Australian science into the future. Examples include:

- remote telescope operations and observing, and
- growing confidence in, and use of, advanced technologies, including simulation, to make best use of the data coming from the telescopes and to make best use of the telescopes themselves.

Credit: Wheeler Studios.

Perhaps the most important single change at ATNF occurred just after the period covered by this report when in February 2009 Professor Brian Boyle stood down from the ATNF Director's position in order to become the CSIRO SKA Director. Professor Boyle's commitment to keeping Australia at the forefront of world radio astronomy through the development of the Australian SKA Pathfinder and his tireless advocacy for the SKA around the world has been extraordinary. The entire national and international astronomy community owes him an enormous debt of gratitude for his commitment and achievements as ATNF Director.

In 2008, the Prime Minister, the Hon. Kevin Rudd, and several of his senior colleagues routinely raised Australia's bid to host the SKA with foreign leaders. Such prominence serves as a reminder that radio astronomy in Australia may never quite be the same again.

Brett Biddington
Chair, Australia Telescope Steering Committee

ATNF Senior Management

ATNF Director
Brian Boyle

Executive Secretary
Anne Barends

Deputy Director
Lewis Ball

Assistant Director
ASKAP
Dave DeBoer

Assistant Director
Operations
Dave McConnell

Assistant Director
Astrophysics
Robert Braun

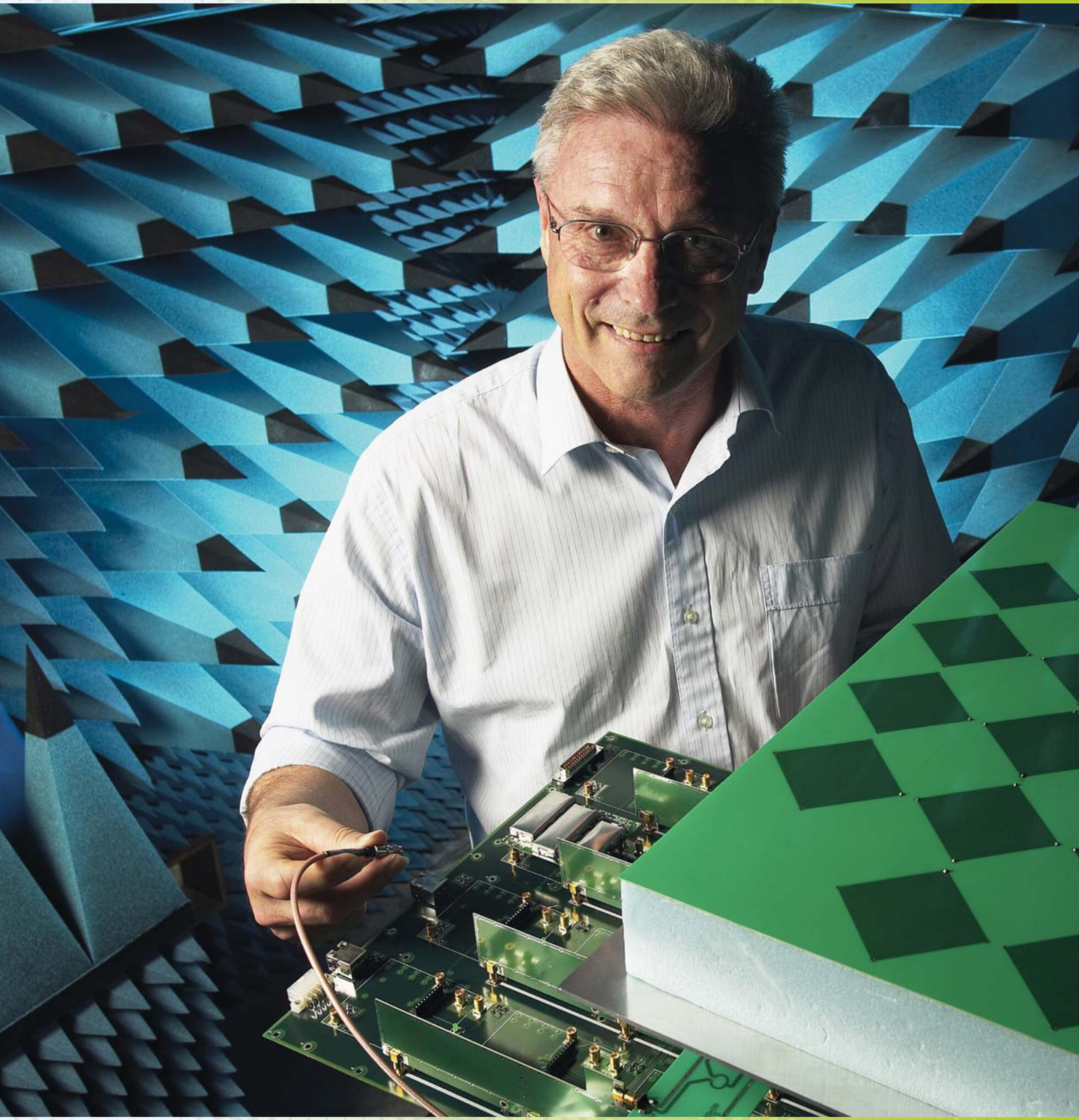
Assistant Director
Engineering
Graeme Carrad

Business Strategist
Phil Crosby

Policy Strategist
Michelle Storey

Credit: Wheeler Studios.

1.
The ATNF in Brief



CSIRO Digital Systems Engineer John O'Sullivan with a revolutionary detector-receiver array being developed for the ASKAP telescope.

Credit: Chris Walsh, Patrick Jones Photo Studio.

The ATNF in Brief

The Australia Telescope National Facility (ATNF) is managed as a National Facility by CSIRO, and is a CSIRO division in its own right. Staffed by around 185 people, the ATNF is the largest single astronomical institution in Australia, with its Sydney headquarters co-located with those of the Anglo-Australian Observatory in Marsfield. In fulfilling its mission, the Facility provides a uniquely powerful view of the southern hemisphere radio spectrum.

Our Mission

- To operate and develop the Australia Telescope as a national research facility for use by Australian and international researchers;
- To exploit the telescope's unique southern location and technological advantages to maintain its position as a world-class radio astronomy observatory;
- To further the advancement of knowledge.

An Overview of the Facility

The Australia Telescope comprises eight antennas and associated instrumentation located at three geographically separate locations and supported by staff and facilities at the CSIRO Radiophysics Laboratory at Marsfield in Sydney. The three observatories are near the towns of Parkes, Narrabri and Coonabarabran, all in rural NSW.

Parkes Observatory is home to the 64-m Parkes radio telescope, a single, fully steerable antenna equipped with receivers that operate in frequency ranges from 74 MHz to 22 GHz, with bands in the range from 600 MHz to 9 GHz the most commonly used. This telescope has been successfully operated since 1961 and is famous as a national symbol for Australian scientific achievement. Instrumental upgrades, including a 13-beam focal plane array, have maintained the telescope as a state-of-the-art instrument.

Six identical 22-m antennas make up the Australia Telescope Compact Array (ATCA), an earth-rotation synthesis telescope located at the Paul Wild Observatory outside Narrabri. The ATCA is equipped with receivers that operate at frequencies between 1.4 and 110 GHz, with use at the highest frequencies restricted primarily to a "winter season" by atmospheric stability and transparency considerations.

The Mopra Telescope is a single 22-m diameter antenna near Coonabarabran, used primarily for large-scale mapping projects at the higher end of the ATCA frequency range, and as part of the Long Baseline Array (see below).

The ATNF also negotiates telescope time with the CSIRO administered 70-m and 34-m antennas at the Tidbinbilla Deep Space Tracking Station outside Canberra. NASA/JPL makes approximately 5% of 70-m antenna time available to astronomical research programs.

The eight ATNF radio telescopes can be used together (sometimes in conjunction with antennas operated by The University of Tasmania at Ceduna and Hobart, and the Tidbinbilla 70-m antenna) as a Long Baseline Array (LBA) for a technique known as Very Long Baseline Interferometry (VLBI).

ATNF is also in the process of developing a next-generation radio telescope, the Australian SKA Pathfinder (ASKAP). ASKAP will be a wide field-of-view survey telescope made up of 36 antennas, each 12 metres in diameter. It will be located in a superbly radio-quiet area in the Mid West region of Western Australia and be a key demonstrator instrument for new technologies for the international Square Kilometre Array (SKA) project.

Technical research and development supporting upgrades of the Facility, as well as for the new ASKAP instrument, are conducted at the ATNF's headquarters in Marsfield.

The ATNF's activities are directed and administered from its Marsfield headquarters, with Parkes and Narrabri observatory activities directly supervised by a Site Manager and System Scientist at each site. Mopra is administered from the Narrabri observatory.

Governance

The Australia Telescope is operated as a National Facility under guidelines originally established by the Australian Science and Technology Council. The ATNF is a division of CSIRO and is responsible via the Executive to the Minister for Innovation, Industry, Science and Research.

Divisional policy, strategic planning and operational management are the responsibility of the Director and the ATNF Management Group (AMG) comprising the Director and Deputy Director (Brian Boyle and Lewis Ball), the Research Program Leaders (Robert Braun, Tim Cornwell, Graeme Carrad and Jessica Chapman), the ATNF Finance, P&C and Communications Managers (Neil Derwent, Alison Jones and Mary Mulcahy) and the Parkes and Narrabri Site Managers (Brett Dawson and Brett Hiscock).

Divisional plans reflect both CSIRO's 2007 – 2011 Strategic Plan and the ATNF's vision statement.

ATNF policy is shaped by the Australia Telescope Steering Committee (ATSC), an independent committee appointed by the Minister. The Steering Committee meets at least once a year to advise the Director regarding broad directions of the ATNF's scientific activities and longer term strategies for the development of the Australia Telescope. The Steering Committee appoints the Australia Telescope Users Committee (ATUC) and the Time Assignment Committee (TAC). ATUC represents the interests of the community of astronomy researchers who use the Australia Telescope. The committee provides feedback to the ATNF Director, discussing problems with, and suggesting changes to, ATNF operations. It also discusses and provides advice on the scientific merit of future development projects. ATUC meetings are also a forum for informing telescope users of the current status and planned development of ATNF facilities, and recent scientific results. The TAC reviews proposals and allocates observing time.

The committee members for 2008 are listed in Appendix A.

ATNF Management Changes in 2008

In November, the ATNF Management Group (AMG) replaced the ATNF Leadership Team, which comprised the Director and Deputy Director (Brian Boyle and Lewis Ball), the Assistant Directors who lead the four research themes (Robert Braun, Graeme Carrad, Dave DeBoer and Dave McConnell), the Business Strategist (Phil Crosby), and Policy Strategist (Michelle Storey).

The AMG aims to:

- Help key managers on the capability side of the CSIRO-wide matrix organisational structure with continuing to successfully implement the strategy;
- Draw effectively on the Business Unit support functions (P&C, finance, communications);
- Engage the observatory sites more effectively.

Funding

In 2007 – 2008, the organisation's total expenditure was A$31.4 million. The total revenue was A$35.0 million, including a direct appropriation of A$29.7 million from CSIRO. A summary of ATNF finances for the year is given in Appendix B.

The Australia Telescope Community

As at the end of 2008 the ATNF's total staff complement was around 185 people. This was made up of paid staff (research scientists and engineers, technical and administrative support), postgraduate students, visiting scientists and fellows. These resources are distributed across four sites within NSW and the ACT, and Geraldton in Western Australia. A list of all staff who worked for the ATNF during 2008, including staff from other business units, is given in Appendix C.

Australian and international observers use the Australia Telescope without charge for approximately 60% and 40% of the available time respectively. This is in accordance with general practice of the worldwide radio-astronomy community, in which telescope users from different countries gain reciprocal access to facilities on the basis of scientific merit. Such access provides Australian scientists with a diversity of instruments and leads to a rich network of international collaborations.

Observing time on the ATNF's telescopes is awarded twice a year by the TAC to astronomers on the basis of the merits of their proposed research programs. Approximately 90% of the Australia Telescope's users come from outside the ATNF. Proposals for time on the Compact Array typically exceed the time available by a factor of 2.0, for Parkes proposals exceed time available by a factor of 1.7, and for Mopra the oversubscription rate is around 1.3. Approximately 130 proposals are received for the summer semester (October to March) and 190 in the winter semester (April to September) – the difference reflects the high demand for winter millimetre observing using Mopra and the Compact Array.

The ATNF has strong links with its primary user base, the university community, both within Australia and around the world. The "user operator" model adopted by the Australia Telescope is unusual, if not unique, in world terms. Members of each observing proposal operate the telescope for their allocated time and the ATNF hosts a constant stream of visiting astronomers from around the world who come for periods of between a few days and a few weeks. This is a significant contributor to the strength of the relationship between the ATNF and the astronomers that use it. These relationships are further strengthened by the open, international and collaborative nature of astronomical research. Over the past decade 77% of Australian astronomy papers have had international co-authors.

Research scientists and engineers are heavily involved in the training of postgraduate students, an important contributor to the strength of the interactions between ATNF staff and university colleagues. In 2008, ATNF staff co-supervised 37 PhD students, most of whom are undertaking degrees at Australian universities. CSIRO provides direct financial support to most of these students, supplementing the support that they receive through their host universities. The majority of ATNF's current PhD students have an Australian Postgraduate Research Award.

The Wider Astronomical Community and Other Relationships

While astronomers on the ATSC provide the ATNF Director with strategic advice from the Australian and international research community, the ATNF provides similar input to other parts of the research community via staff representation on other research community bodies and committees. ATUC provides an effective route for operational feedback and input on future directions from the research community to the ATNF as well as providing communications from ATNF to the user community.

CSIRO is a full member of Astronomy Australia Ltd, an organisation established in early 2007 as a company for the principal objective of managing the National Collaborative Research Infrastructure Strategy (NCRIS) funds for astronomy.

The ATNF also has contracted links to the research and space community, both for the provision of equipment and for provision of research outcomes, data, or aspects of national facility operations to organisations external to CSIRO. Such contracts are small in number, and in the past have generally concerned the delivery of instrumentation for astronomy, and/or space tracking services. The ATNF has also entered into contracts with Australian university partners for the provision of services that contribute to the operation of the National Facility, and this is now the ATNF's favoured mode of engagement. Engagement with university partners is seen as increasingly important and will continue to be actively pursued over coming years by the ATNF as an effective means of broadening the National Facility resource base, and ensuring the vitality of the Australian astronomy research community as a whole.

ATNF's links with the Australian and international community are increasing in complexity as the organisation progresses towards the SKA. Links within Australia are growing, with new radio astronomy groups being established at universities in Western Australia as well as groups at Macquarie University and James Cook University taking interest in specific areas of SKA research and development.

International alliances are also growing, with a small number of "formal" links underlined by collaborative agreements supplemented by a larger number of informal community collaborations. The formal linkages are primarily between CSIRO and NRC-Canada, NSF-South Africa and EU-SKADS. Other key linkages are with ASTRON in the Netherlands, PrepSKA (SKA Preparatory Phase project), and research groups in the USA, India, and China.

Finally, as the ATNF moves through the design, development and construction phases of the ASKAP project, industry will play a crucial role in the delivery and through-life support of the technologies and infrastructure required. The scale of ASKAP and the consequent requirement to "productise" many of its components necessitates the engagement of industry at new levels of depth and scale. Relationships with industry continued to develop through 2008 with engagement occurring at the research collaboration level and more strategically through the Australian SKA Industry Consortium.

Research Themes

The strategic goals and purpose of the ATNF by theme (as at the end of 2008) are as follows:

Astrophysics

Theme Goal

To conduct world-class research in astrophysics, retaining astronomy's position as Australia's highest impact science and furthering our understanding of the Universe through innovative use of CSIRO's telescopes.

Theme Purpose

This theme results in world-class science that directly influences international astronomical research and shapes our understanding of the Universe.

The ATNF Astrophysics Group undertakes major observational research projects, many of which involve sizable national and international collaborations. The success of these projects is underpinned by a deep understanding and technical knowledge of the telescope systems. In turn, the knowledge gained is used to provide the scientific case and the technical requirements for new generations of telescopes and instrumentation, ensuring that they deliver maximum scientific impact by targeting the highest priority science questions.

Medium-term theme goals (1–5 years) include: (i) powerful new tests of general relativity; (ii) the study of the formation and evolution of distant galaxies; (iii) new surveys for molecules and pulsars in the heart of the Milky Way; (iv) new wide area neutral hydrogen surveys of the disk and halo of the Milky Way; (v) the study of star formation in the Milky Way and external galaxies.

Longer-term goals (5–10 years) include: (i) detection of the cosmic background of gravitational radiation; (ii) elucidating the structure and equation-of-state of neutron star interiors; (iii) measuring the gaseous evolution of distant galaxies ($0<z<1$); (iv) measurement of the equation of state of dark energy; (v) understanding the evolution of cosmic magnetic fields.

Australia Telescope National Facility Operations

Theme Goal

To continue to operate the most productive radio astronomy facility in the southern hemisphere in order to serve the Australian and international scientific community.

Theme Purpose

This theme operates the National Facility observatories (the Compact Array near Narrabri, single-dish telescopes at Mopra, Parkes and the radio astronomy facilities at the Tidbinbilla NASA DSN station, and the Long Baseline Array) to maximise the scientific value of experiments conducted by Facility users.

In the medium term, the theme must prepare for operation of a new telescope – ASKAP – in WA which is being developed under a sister theme, the Australian SKA Pathfinder. To facilitate this while ensuring the continued world-class operation and scientific impact of the existing facilities at Parkes, Narrabri and Coonabarabran, ATNF's operations are undergoing a substantial internal restructuring with the establishment of a single Science Operations Centre in Marsfield serving all ATNF facilities, and reorganisation into a Science Operations stream and an Engineering Operations stream.

The high impact of the ATNF will be sustained by ensuring continuous operation with very high reliability (<5% lost time) and excellent data quality – facilitating astronomical research conducted with our radio telescopes that contributes to the understanding of the Universe.

Technologies for Radio Astronomy

Theme Goal

To develop frontline technology for the advancement of radio astronomy in Australia.

Theme Purpose

To ensure that the ATNF's existing radio telescopes remain at the leading edge of world technology, securing continued demand from the astronomy research community for the ATNF's radio telescopes, with the effect of maximising the science outcomes from astronomy conducted with the Facility.

This directly complements the development of a new radio telescope undertaken in the sister-theme, ASKAP.

These technological developments underpin astronomy's position as the highest impact field of Australian science and its role in shaping our understanding of the Universe.

In addition, this theme supports important spacecraft tracking programs in collaboration with NASA, supplies radio astronomy instrumentation to outside organisations and undertakes strategic collaborations with other radio astronomy institutes. These secondary activities allow a broad range of specialist talent to be maintained and developed within the ATNF, provide significant external revenue for re-investment in the National Facility, and facilitate the international communication necessary to ensure that technological developments at the ATNF continue to be world class.

Spacecraft tracking programs contribute directly to the high profile within the Australian community of CSIRO's involvement in frontline science leading to an improved understanding of our more immediate environment in our Solar System.

The Australian SKA Pathfinder (ASKAP)

Theme Goal

To maximise Australia's participation in the Square Kilometre Array (SKA).

Theme Purpose

This theme's purpose is to maximise Australia's involvement in the SKA via (a) developing the infrastructure for a new remote observatory in Western Australia (Murchison Radio-astronomy Observatory or MRO); (b) building a world-class radio telescope, the Australian SKA Pathfinder (ASKAP); and (c) participating in international SKA design efforts.

This development of a new radio telescope complements the technology development for existing radio telescopes undertaken in the sister theme, Technologies for Radio Astronomy.

In low frequency (<3 GHz) survey applications, ASKAP will deliver a roughly 20-fold increase in speed over the existing facilities.

ASKAP will provide considerable impact through: (i) addressing outstanding technology risks along the SKA development path; (ii) delivering a world-class astronomical facility at the world's best site for metre and centimetre radio astronomy; (iii) maximising Australia's participation in the SKA – a billion Euro international facility; (iv) paving the way forward to leverage significant international funds to an SKA sited in Australia.

Most significantly, this theme will exploit Australia's unique combination of global position, technical expertise and radio-quiet environment to deliver another world-leading instrument to study the southern sky and address the biggest questions regarding our knowledge of the Universe.

The Australia Telescope Compact Array

Credit: Graeme Carrad, CSIRO.

The Parkes Radio Telescope

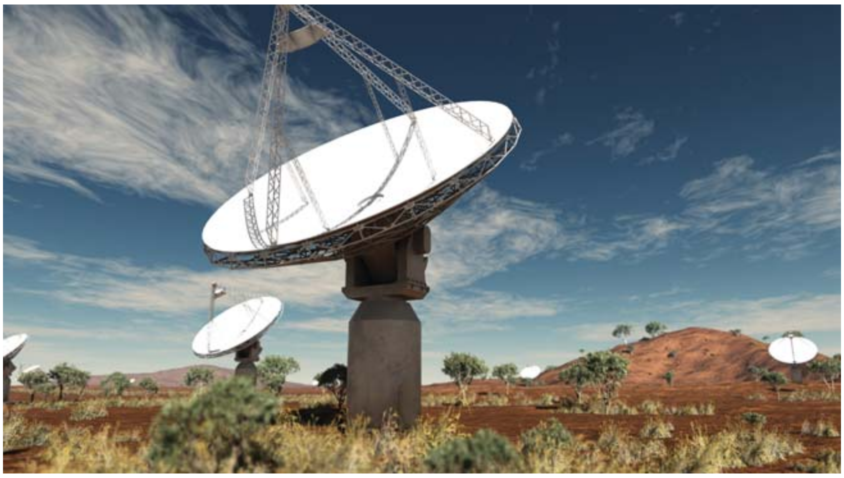
Credit: David McClenaghan, CSIRO.

The Mopra Radio Telescope

Credit: John Masterson, CSIRO.

The Tidbinbilla DSS43 70-m Antenna

Credit: Canberra Deep Space Communication Complex.



The Australian SKA Pathfinder (ASKAP)

Artist's impression of ASKAP at the Murchison Radio-astronomy Observatory.
Credit: Swinburne Astronomy Productions. Design data provided by CSIRO.

2.
Performance Indicators

The 64-m Parkes telescope is the second most highly cited radio telescope in the world in its class (Trimble and Cega 2008, *Astron. Nachr.* 329(6): 632–647).

Credit: John Sarkissian, CSIRO.

Performance Indicators

1. Scheduled and Successfully Completed Observing Time

For the Parkes radio telescope and the Compact Array the ATNF sets a target that at least 70% of time should be allocated for astronomical observations while the time lost during scheduled observations from equipment failure should be below 5%.

For Parkes and Narrabri, approximately 10% of time is made available as "Director's time". This is time that is initially reserved in the published version of the schedule, but which is later made available for approved observing projects.

For most projects, the proposing astronomers are required to be present at the ATNF observatory for their scheduled time. For the Compact Array, remote observing is also possible from other sites. In 2008, 84.7% of Compact Array observations were taken by observers present at Narrabri. All Mopra observations were taken remotely, with 90% taken from Narrabri and the other 10% from locations including Nagoya, Boston, Cairns and Illinois.

Table 1: Telescope usage in 2008.

	Compact Array	Parkes	Mopra*
Successful astronomy observations	77.3%	77.7%	72.5%
Maintenance/test time	15.8%	10.7%	7.5%
Time lost due to equipment failure	3.4%	1.3%	3.0%
Time lost due to weather	1.0%	2.8%	2.0%
Idle time	2.5%	7.5%	15.0%

* Mopra statistics are for dates between 28 April and 26 October, corresponding to the "millimetre season".

2. Response of the ATNF to Recommendations by the User Committee

The ATNF User Committee (ATUC) is an advisory group that meets twice a year to represent the user community in the ATNF decision-making process. After each meeting the committee presents a list of recommendations to the Director. ATUC considers matters raised by the user community, current operations and priorities for future developments.

In most cases the ATNF accepts and implements ATUC recommendations. In 2007, ATUC made 42 recommendations to the ATNF. Of these, 33 were accepted, and 25 of these were completed by December 2007. For the remaining eight recommendations that were accepted, most were completed in 2008.

The ATUC members are listed in Appendix C.

3. Time Allocation on ATNF Facilities

The allocation of time on ATNF facilities is done on the basis of scientific merit. Two six-month observing semesters are held each year, from October to March (OCTS) and from April to September (APRS). For the period from 1 October 2007 to 30 September 2008 a total of 199 proposals were allocated time on ATNF facilities (each proposal is counted once only per calendar year although some proposals are submitted twice). Of these, 92 were for the Compact Array, 47 were for the Parkes telescope, 41 were for the Mopra telescope and 19 were for the Long Baseline Array. Observing programs allocated time on ATNF facilities are listed in Appendix D.

The ATNF also accepts proposals requesting service observations with the Tidbinbilla DSS43 (70-m) and DSS-34 (34-m) antennas operated by the Canberra Deep Space Communication Complex, as part of the NASA Deep Space Network.

Figures 1, 2 and 3 show the time allocated to observing teams on the Compact Array, Parkes radio telescope and Mopra as a percentage of the total allocated time, determined by affiliation of the team leader.

Figures 4, 5 and 6 show the time allocated to observing teams as a percentage of the total allocated time, determined using the affiliations of all team members. In these plots the time allocated to each proposal has been divided evenly between all authors on the proposal. Including all authors on the proposals for all facilities, ATNF staff were allocated approximately 25% of time during the year.

From October 2007 to September 2008, the time allocation for the Compact Array was 45.7, 19.4 and 34.9 per cent for proposals with ATNF, other Australian and overseas team leaders respectively (Figure 1). If the time allocation is determined using all team members, then the time allocation for other Australian and overseas users was approximately 6 and 8 per cent higher respectively, while the time allocation for ATNF was approximately 14 per cent lower (see Figure 4). For the Parkes telescope, the time allocation for non-ATNF proposers (Australian and overseas) counted in both ways was approximately 75% (Figures 2 and 5).

Figures 3 and 6 show that only 3% of the total time on the Mopra telescope was allocated to proposals with ATNF team leaders. Twenty-nine per cent of time was allocated to proposals with other Australian primary investigators and 68% was allocated to proposals with overseas primary investigators. Including all team members, the time allocation to the ATNF is higher (9%) with a correspondingly lower allocation to other Australians.

The ATNF facilities are able to support a broad range of science areas that include Galactic (ISM, pulsar, X-ray binaries, star formation, stellar evolution, magnetic fields), extragalactic (galaxy formation, ISM, Magellanic Clouds, cosmic magnetism) and cosmological science. The research programs involve astronomers from many institutions in Australia and overseas. Typically the proposals allocated time by the ATNF over one year include at least 400 authors. Of these, approximately 40 authors are from the ATNF, 80 are from 14 other institutions in Australia, and 280 authors are from around 120 overseas institutions in 20 countries.

Figure 1: Compact Array time allocation by primary investigator, January 2001 – September 2008. For 2004 the time corresponds to nine months, from January to September. From 2005 onwards the time allocation is for 12 months from October to September.

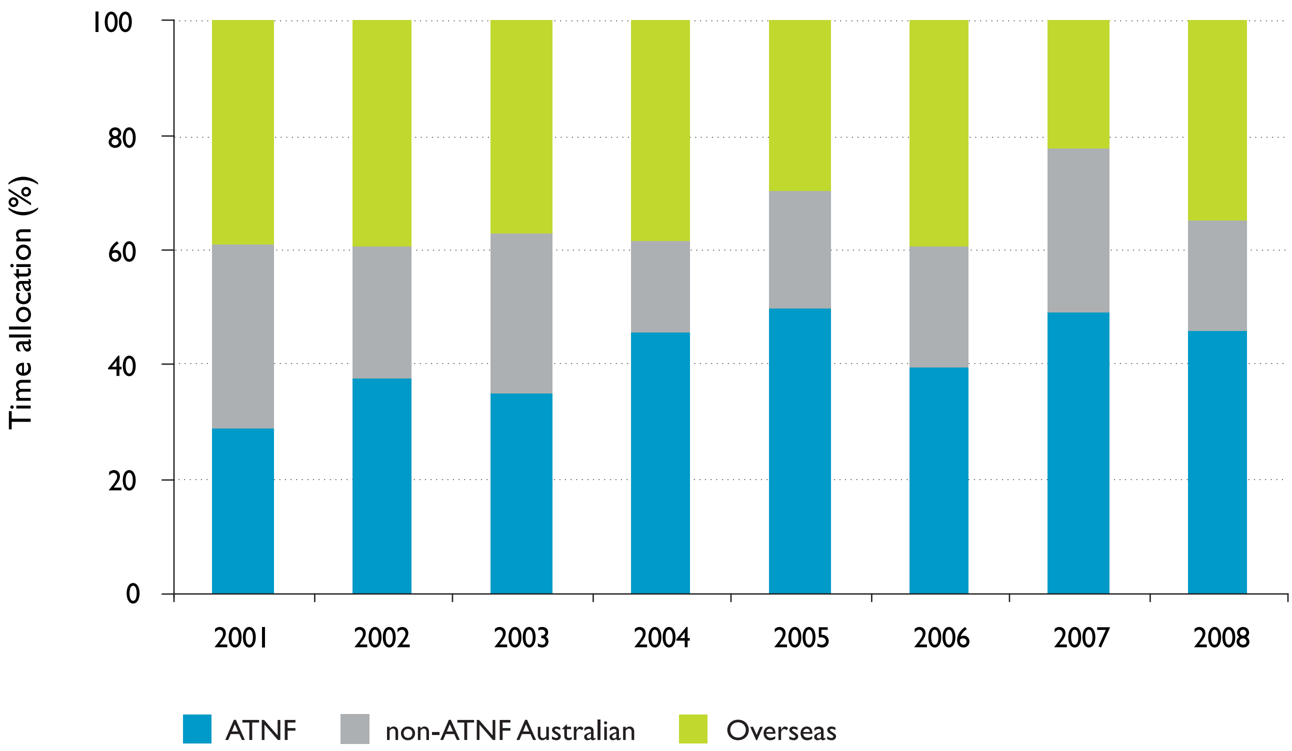


Figure 2: Parkes time allocation by primary investigator, January 2001 – September 2008. For 2004 the time corresponds to nine months, from January to September. From 2005 onwards the time allocation is for 12 months from October to September.

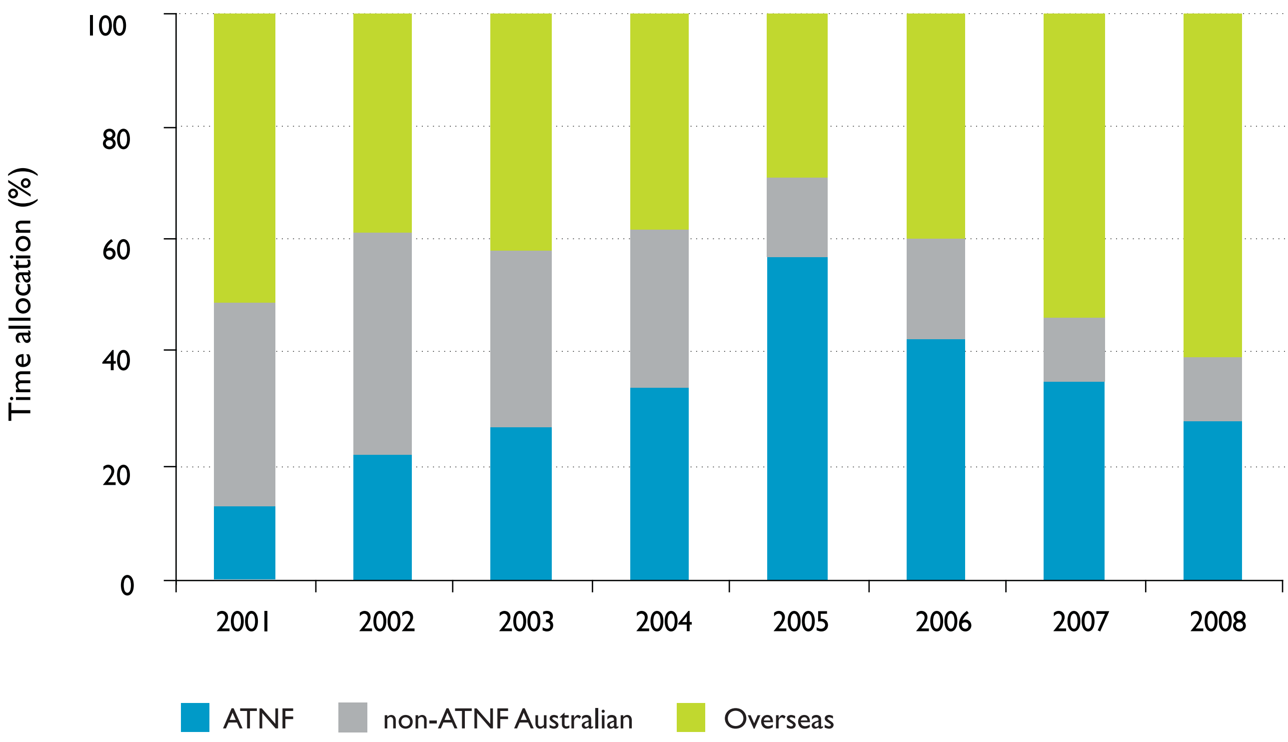


Figure 3: Mopra time allocation by primary investigator, 2004 – 2008. Most Mopra observing occurs during the "millimetre season" from May to October.

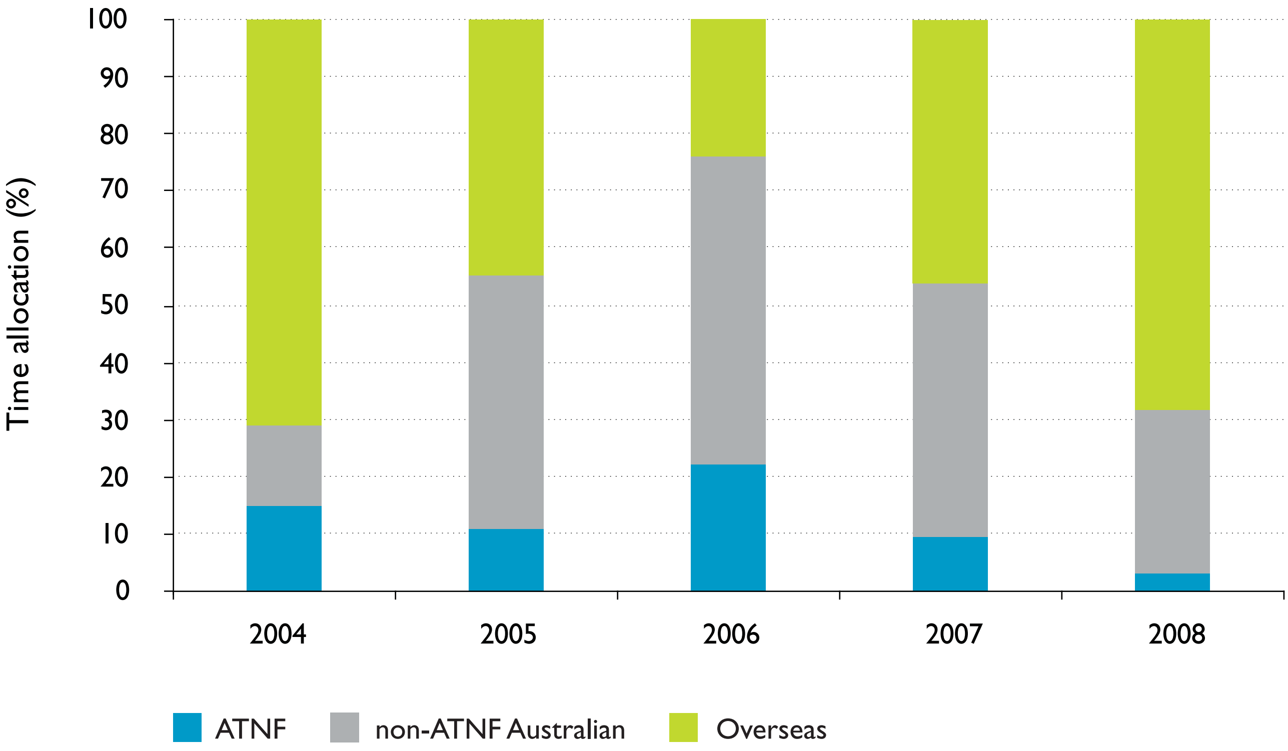


Figure 4: Compact Array time allocation by all investigators.

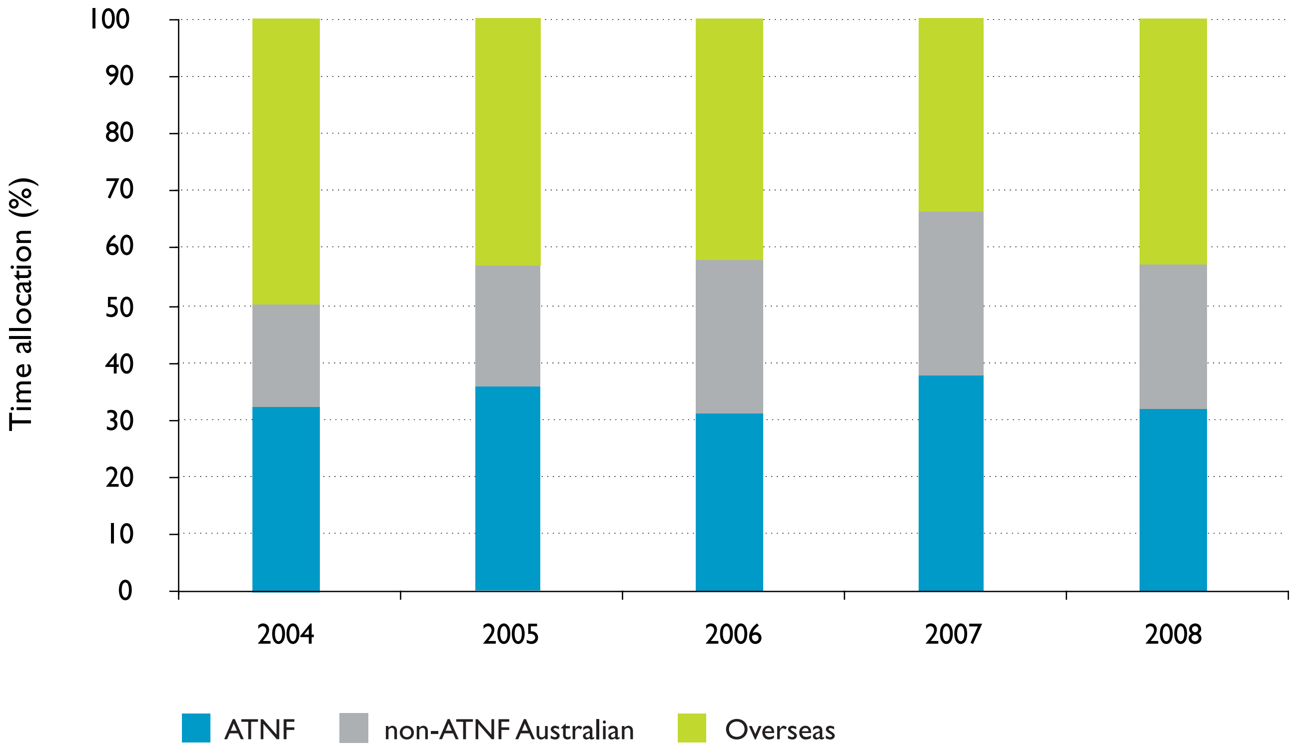


Figure 5: Parkes time allocation by all investigators.

Figure 6: Mopra time allocation by all investigators.

4. Teaching

In December 2008, there were 37 PhD students being co-supervised by ATNF staff. Their affiliations and thesis titles are given in Appendix E.

Four students were awarded PhDs during the year and their theses are listed in Appendix F.

Figure 7 shows the numbers of PhD students affiliated with the ATNF since 2003. Figure 8 shows the institutions that our current students are enrolled in. In 2008 there were more students enrolled in Australian universities with the majority being enrolled at the University of Sydney, Swinburne University of Technology and the University of Tasmania.

Figure 7: Numbers of postgraduate students affiliated with the ATNF.

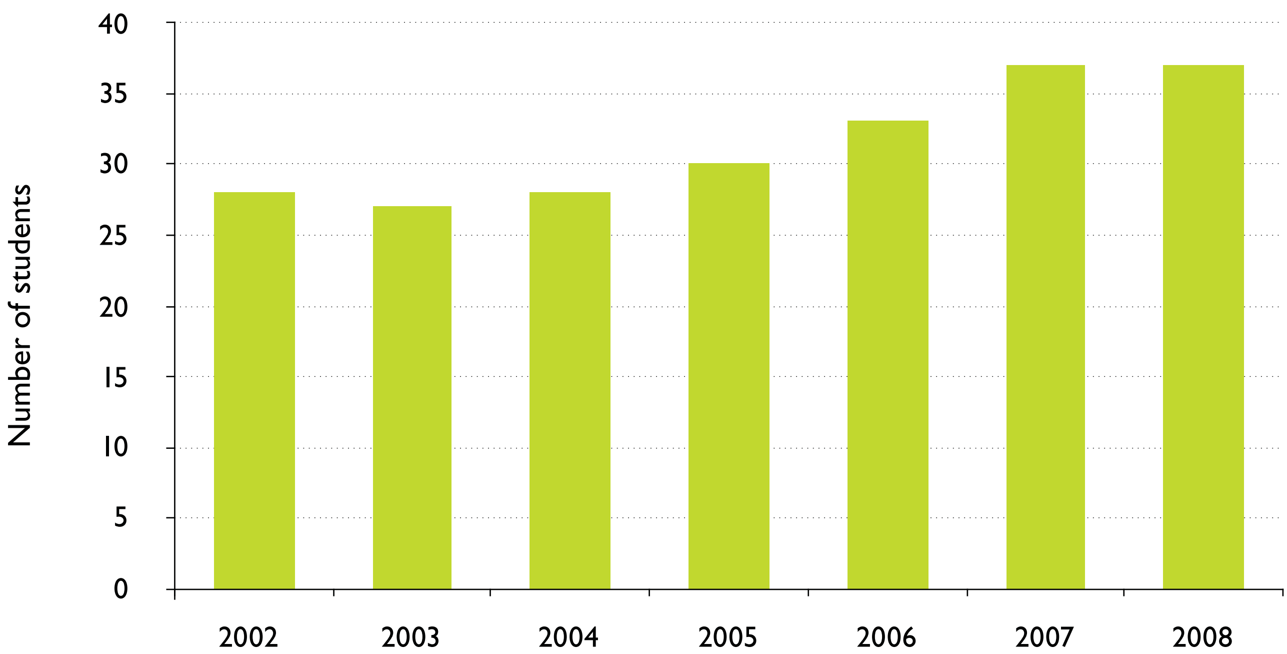
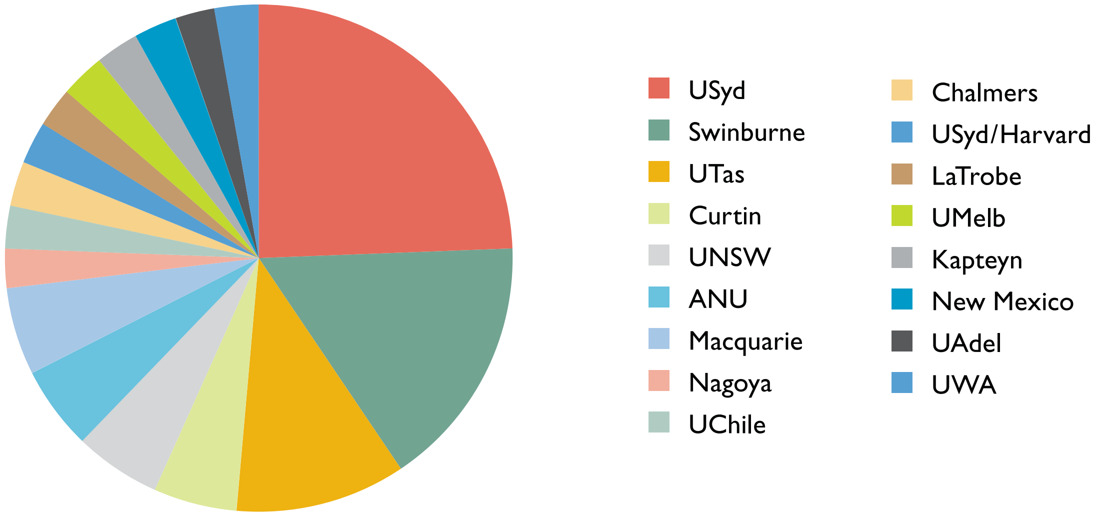


Figure 8: Postgraduate student affiliations 2008.



5. Publications and Citations

Figure 9 shows the number of publications in refereed journals which include data obtained with all Australia Telescope facilities. The publication counts do not include IAU telegrams, abstracts, reports, historical papers, articles for popular magazines, or other papers by ATNF authors. In 2008, 99 papers with ATNF data were published in refereed journals. These are listed in Appendix G, which also lists 111 other papers (conference papers with ATNF data and other papers by ATNF staff). ATNF staff were included as authors on 53% of papers published in refereed journals during the year and as primary investigators on 12% of papers. If all authors on each paper are treated equally, then ATNF authors contributed approximately 20% of all authorship to papers published (for comparison, the total telescope time allocated to ATNF staff was around 25% if all authors are treated equally on time allocation proposals).

Figure 9: Publications from data obtained with all Australia Telescope facilities (Compact Array, Mopra, Parkes, Tidbinbilla and VLBI), published in refereed journals.

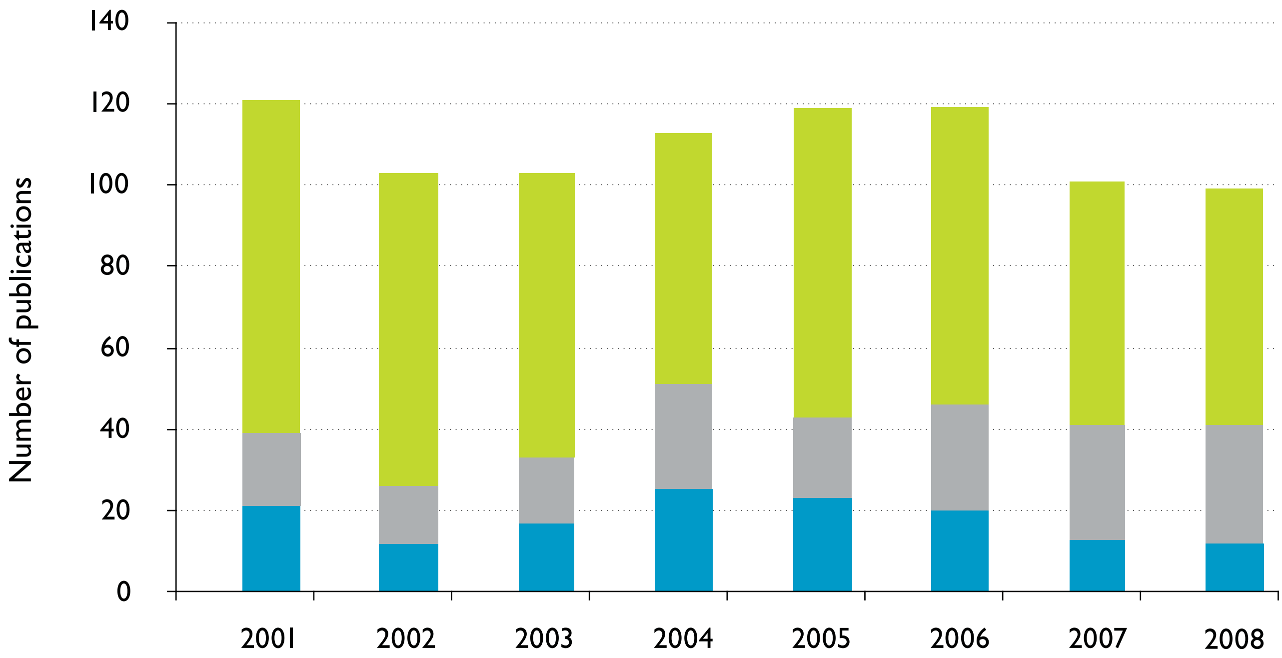
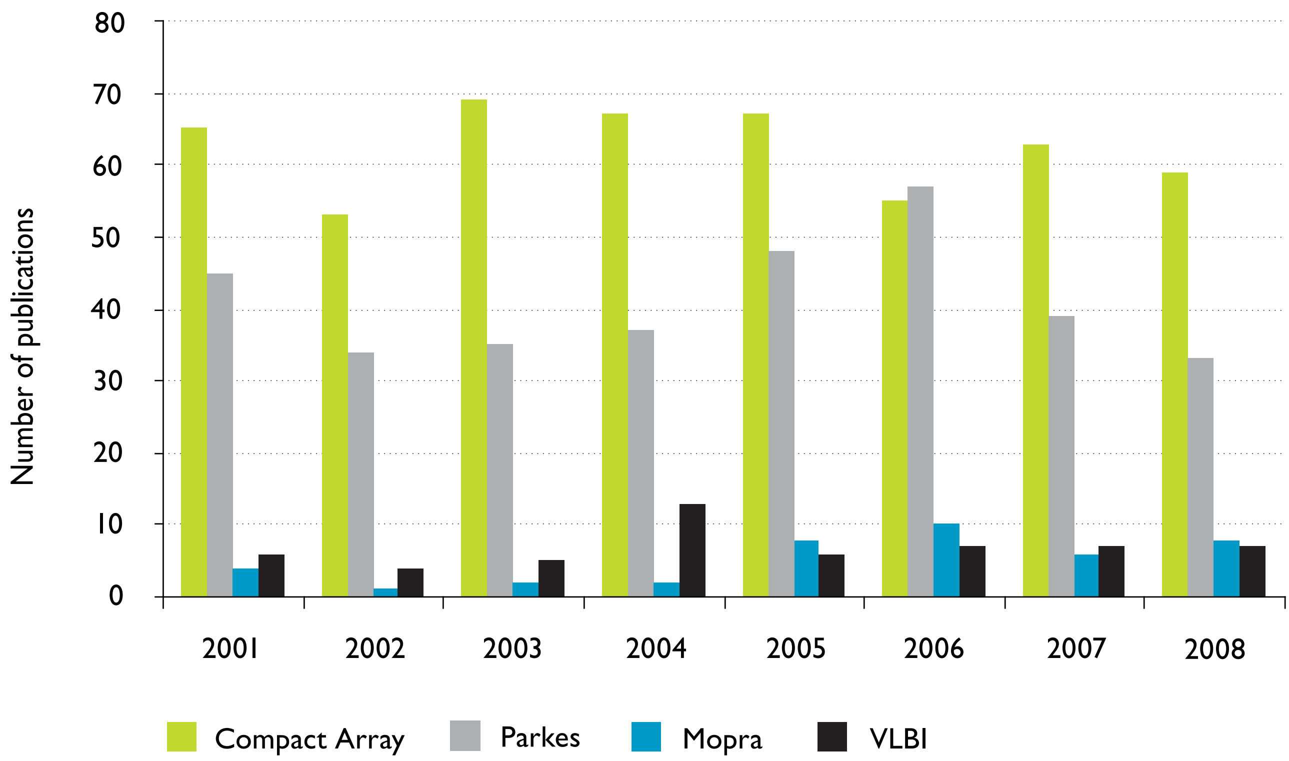


Figure 10 shows ATNF publication numbers for papers that include Compact Array, Parkes, Mopra and LBA data, respectively. A small number of papers with data from more than one facility are counted more than once.

The ATNF facilities are both cost effective and scientifically productive. Overall the ATNF is ranked second in the world behind the NRAO in terms of total number of refereed publications while the Compact Array and Parkes rank second and third respectively in the world in terms of total number of citations to refereed papers (Trimble and *Cega 2008, Astron. Nachr.* 329(6): 632 – 647). In terms of citations per paper, Parkes is the second most highly cited radio telescope in the world in its class after Ryle (which has higher citation/paper ratio but significantly smaller number of total papers than Parkes).

Astronomy leads Australian science as a discipline of international standing and has a particularly high level of international collaboration. For our current facilities, the ATNF achieves the best science outcomes, in terms of publication and citation counts, when science teams include both Australian and overseas astronomers.

Figure 10: Publications from data obtained with the Compact Array, Parkes, Mopra and LBA in 2001 – 2008.



6. Public Relations

Figure 11 shows the count of public relations activities for the years 2001 – 2008. During 2008 the ATNF issued five media releases (see Appendix H for a full list) and featured in at least 206 newspaper articles. ATNF staff gave at least 37 television and radio interviews and at least 70 public lectures.

The Internet is a major tool for communication with professional astronomers and the public. In 2008 there were 2.3 million "visits" (29.4 million "hits") to the central ATNF website (www.atnf.csiro.au). During the year there were also approximately 420,000 visits (5.8 million hits) to the outreach and education website. The ATNF also contributed to the central CSIRO website at www.csiro.au.

Figure 12 shows the number of visitors to the Parkes and Narrabri Visitors Centres. In 2001 visitor numbers to the Parkes Visitors Centre more than doubled following the release of the movie *The Dish*. These numbers peaked at 136,000 in 2003 and then declined to 94,000 visitors in 2006. However, 2007 saw an increase to almost 105,000, which may have been partly attributable to the Open Day held at Parkes in September 2007. In 2008, there were 92,000 visitors to the Centre.

Approximately 13,000 visitors came to the Narrabri Visitors Centre in 2008, including 500 people who visited during the Open Day held in July to celebrate the telescope's 20th birthday.

Figure 11: ATNF public relations activities.

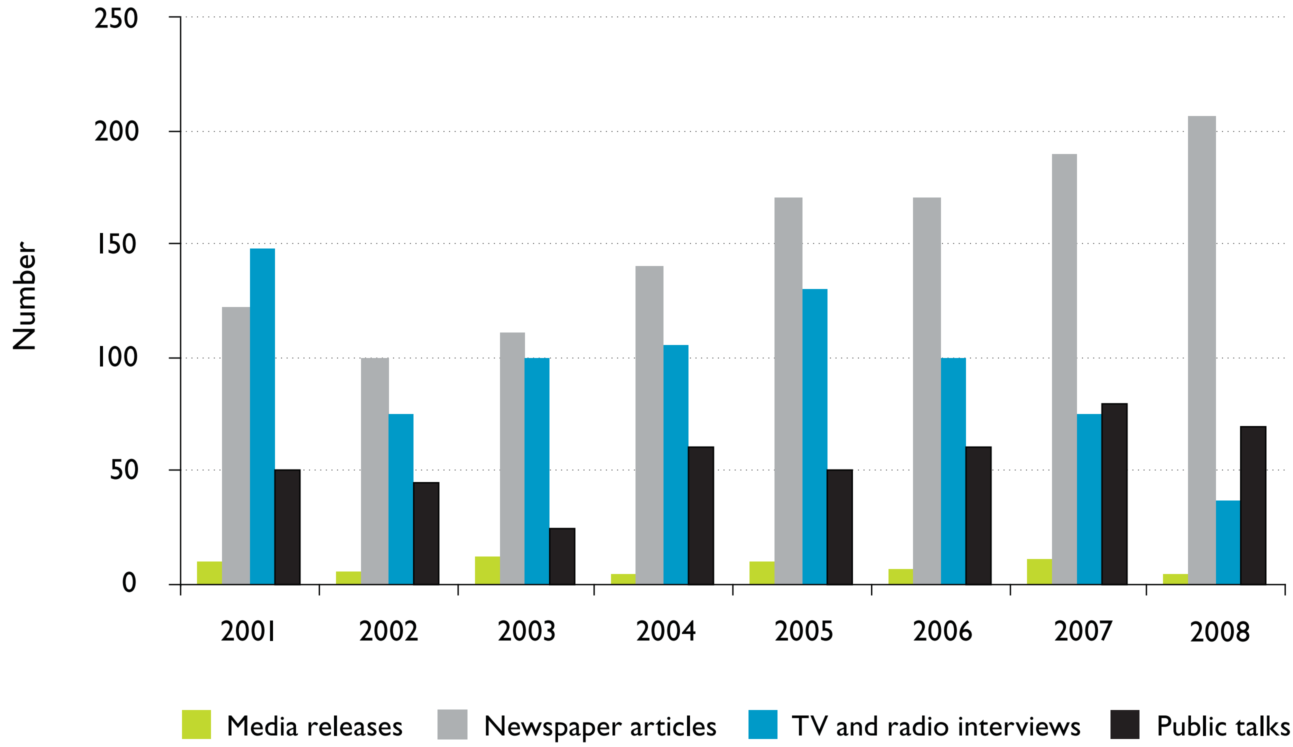
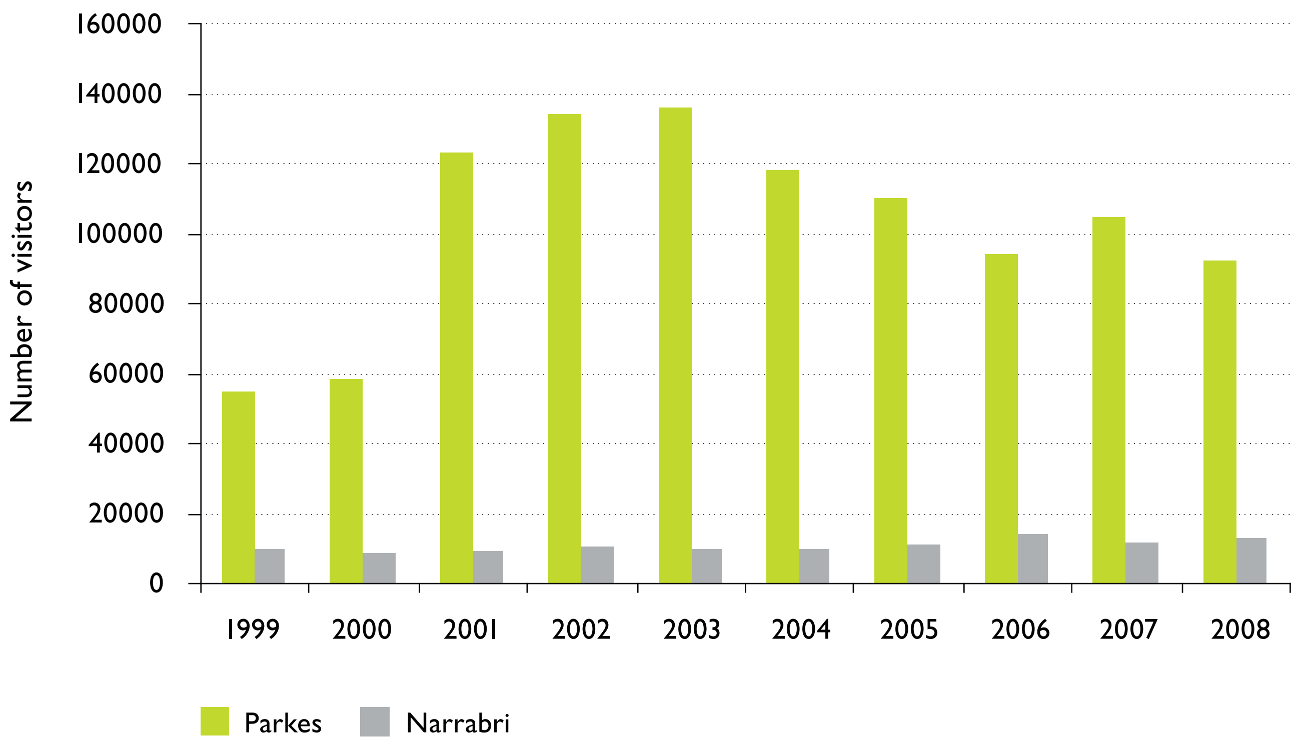


Figure 12: Visitors Centre statistics.



7. User Feedback

Observers at the Parkes, Compact Array and Mopra telescopes are asked to complete a user feedback questionnaire with responses given on a scale of 0 (low) to 10 (high). Feedback is obtained separately for Compact Array observations with the centimetre and millimetre systems.

Figures 13 to 16 show the user feedback from 2006 – 2008 for Parkes, ATCA (cm observing), ATCA (mm observing) and Mopra respectively. Table 2 indicates the average user responses for 2006 – 2008 for all three observatories.

In 2008 observers at the Parkes telescope reported the highest level of satisfaction with an average rating of 9.0 out of 10. In 2008 there was a significantly higher level of satisfaction for freedom from radio interference than in the previous two years.

Figure 14 shows that in 2008 there was a drop in the level of user satisfaction for observers at the Compact Array in the services provided for calibration and documentation. Improvements to user documentation and online calibration source information are planned for both the Compact Array and Mopra in 2009.

Observers at the Compact Array generally report a lower level of satisfaction for observations at millimetre wavelengths than for centimetre wavelengths. This largely reflects the increased difficulty in millimetre observing due to the more unstable atmosphere, which makes it harder to obtain good quality observations of the astronomical sources being studied, and calibration sources.

Figure 13: Parkes user feedback on a scale from 1 (poor) to 10 (excellent).

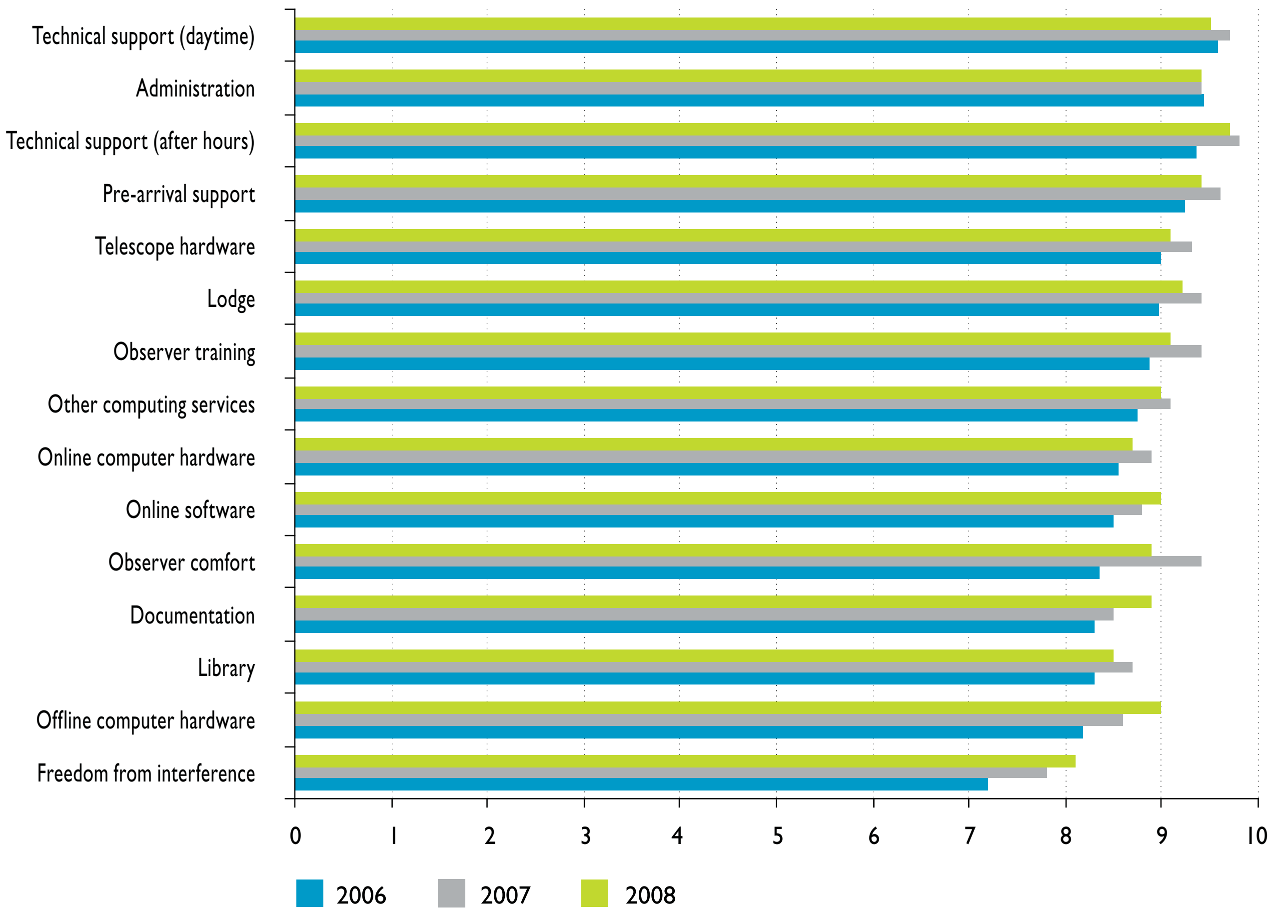


Figure 14: Compact Array user feedback for centimetre observations on a scale from 1 (poor) to 10 (excellent).

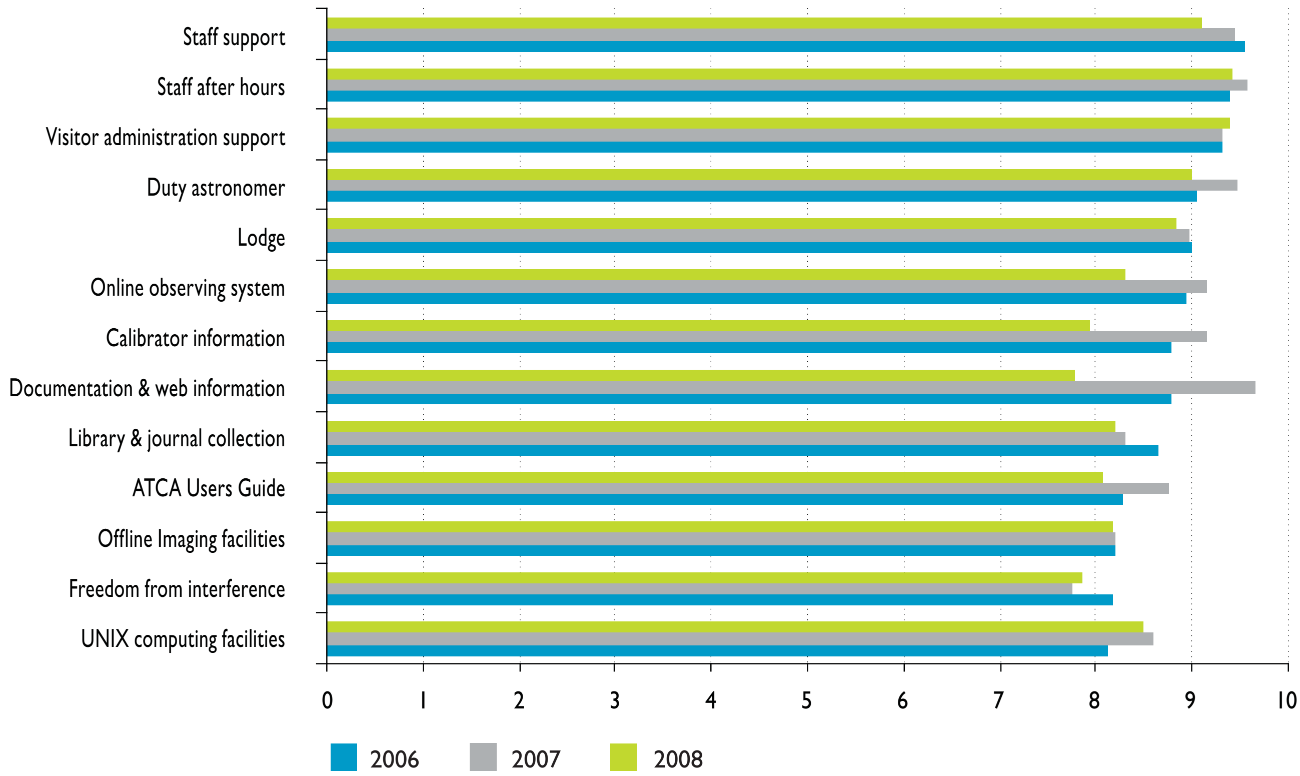


Figure 15: Compact Array user feedback for millimetre observations on a scale from 1 (poor) to 10 (excellent).

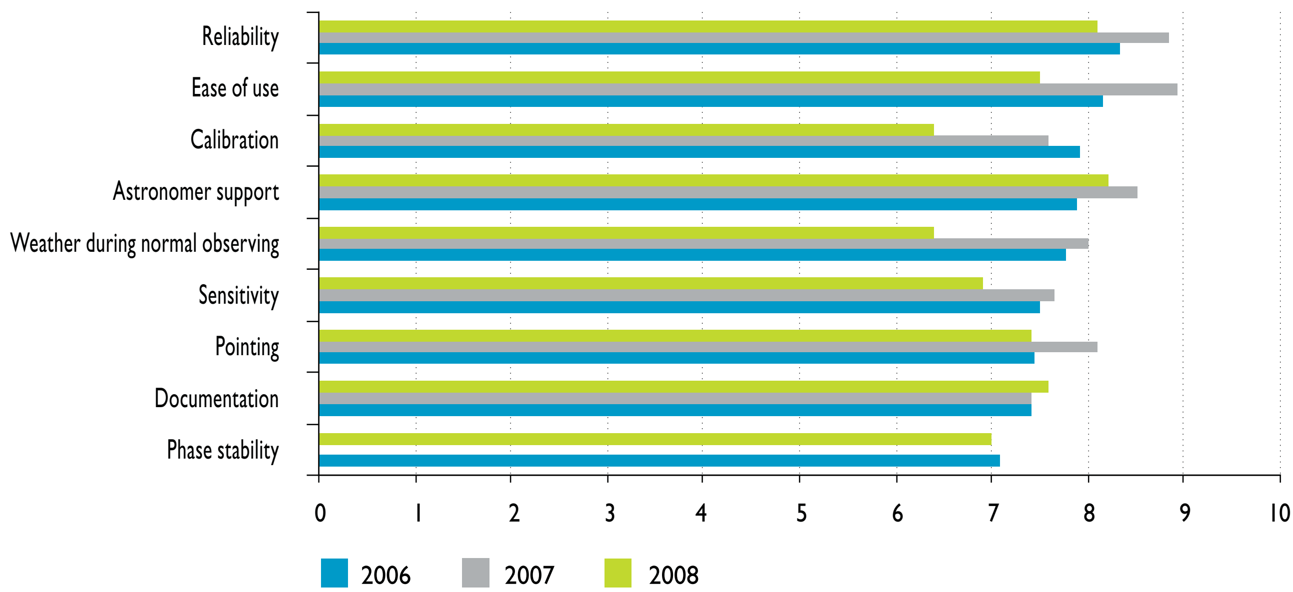


Figure 16: Mopra user feedback on a scale from 1 (poor) to 10 (excellent).

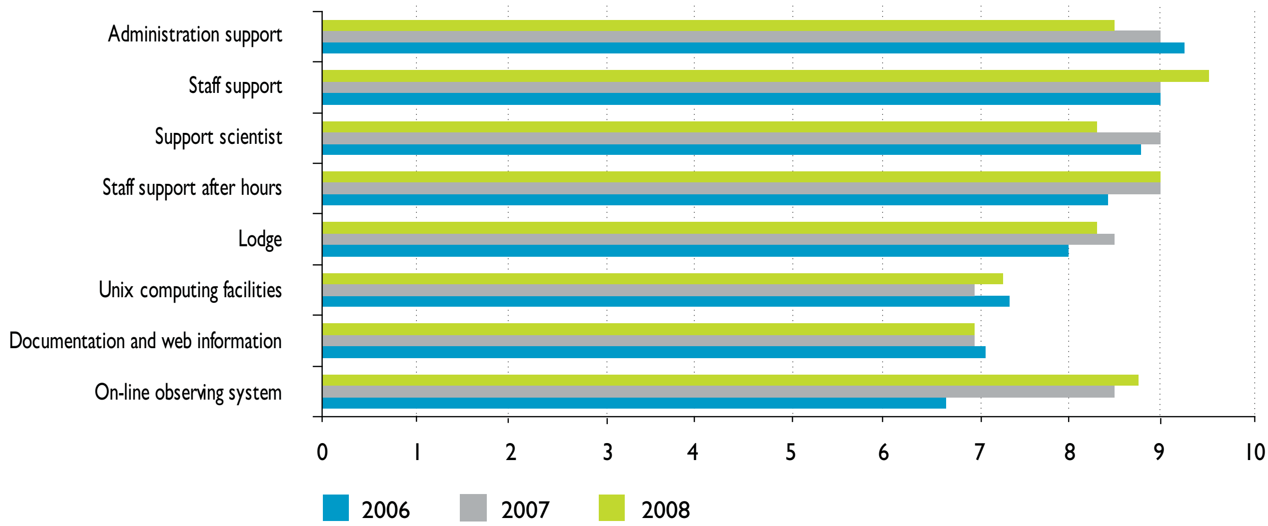


Table 2: Average telescope user feedback questionnaire satisfaction score on a scale from 1 (poor) to 10 (excellent).

Telescope	2006	2007	2008
Parkes	8.7	9.1	9.0
ATCA (cm)	8.8	8.9	8.5
ATCA (mm)	7.7	7.7	7.3
Mopra	7.9	8.2	8.3

3.
Astrophysics

During 2008 more than 90 astronomy proposals were allocated observing time on the Australia Telescope Compact Array.

Credit: David Smyth, CSIRO.

Astrophysics

Overview

The Astrophysics Group undertakes major observational research projects, many of which involve sizable national and international collaborations. The success of these projects is underpinned to a large degree by a deep understanding and technical knowledge of the telescope systems. This knowledge is then used to provide the scientific case and the technical requirements for new generations of telescopes and instrumentation, ensuring that they deliver maximum scientific impact by targeting the highest priority science questions. As researchers appointed within a National Facility, the group is charged with two primary responsibilities:

- To conduct original astrophysical research;
- To provide effective scientific support to ATNF users (both national and international) and to ATNF projects (for example, in the role of project scientist for instrumental upgrades).

While the division between these responsibilities varies by individual, about half of the group effort is expended in each role. In addition to the full members of the Astrophysics Group, there are a substantial number of staff PhD astronomers who have primary responsibilities within other themes of the ATNF, but who are still actively engaged (at the 10 – 50% level) in astrophysics research.

The Astrophysics Group has strong expertise in observational radio astronomy, particularly in the centimetre to metre wavelength range, as well as expertise in other wavelength ranges. The group also has a very broad range of astronomical research interests. This breadth is important for National Facility support, given the diversity of the non-CSIRO user community and the range of projects supported on the facilities. Comparably broad groups are not found anywhere else in Australia. Some of the main areas of astrophysical research that staff were involved in during 2008 were:

- Pulsar research;
- Galaxy interstellar medium and star formation studies;
- Stellar evolution;
- Nearby galaxy research;
- Active galactic nuclei and radio galaxies.

Graduate Student Program

ATNF Astrophysics (and some other) staff continue to co-supervise PhD students from (mostly) Australian universities. The program helps strengthen training in radio astronomy science and techniques, and furthers collaboration between the ATNF and universities. In December 2008 there were 37 PhD students affiliated with the ATNF (these students are listed in Appendix E). In June 2008 the students organised and held a full-day student symposium where they presented their research to fellow students and staff.

Distinguished Visitors Program

The ATNF has a distinguished visitors program which provides some financial and other support to facilitate visits from leading researchers for extended periods (from several weeks to a year).

During the year the ATNF enjoyed visits from many colleagues including:

- Martin Cohen (Univ. Calif. Berkeley, USA);
- Jim Condon (NRAO, USA);
- Simon Driver (St. Andrews Coll., UK);
- Jayanne English (Univ. Manitoba, Canada);
- Cesar Esteban (Inst. Astro. Canarias, Spain);
- Patrick Hennebelle (Paris Obs., France);
- Peter Kalberla (Univ. Bonn, Germany);
- Jay Lockman (NRAO, USA);
- Daniel Pisano (NRAO, USA);
- Barney Rickett (Univ. Calif. San Diego, USA);
- Ingrid Stairs (Univ. British Columbia, Canada);
- Geoff Wright (Univ. Sussex, UK).

Special Events

In 2008 ATNF staff and collaborators organised several conferences and workshops:

- *Annual ATNF Student Symposium*, Sydney, 10 June;
- *Australia Telescope Compact Array Science Day*, Sydney, 11 June;
- *Merging Black Holes in Galaxies: Galaxy Evolution, AGN and Gravitational Waves,* Medlow Bath, 15 – 20 June;
- *ASKAP – Optical/IR Synergies Meeting*, Melbourne, 25 – 26 September;
- *8th Synthesis Imaging School*, Narrabri, 29 September – 3 October;
- *Mopra Milky Way Surveys*, Sydney, 3 November;
- *AstroFest Symposium*, Sydney, 3 – 4 December.

Of particular note was the *Merging Black Holes in Galaxies* conference, which marked the first installment of the *Southern Cross Astrophysics Conference Series*, jointly organised by the ATNF and the Anglo-Australian Observatory.

The reports on the following pages describe a few of the many projects carried out by ATNF staff and National Facility users during the year.

The Methanol Multibeam Survey

Jimi Green (CSIRO ATNF), on behalf of the MMB Survey Team*

The methanol multibeam (MMB) project has a team of 25 collaborators, spread across Australia, the United Kingdom and Europe, and aims to survey the whole plane of our Galaxy for methanol maser emission at 6668 MHz. Earlier studies of the Galaxy have revealed maser emission at different radio frequencies from a number of different molecules (for example, OH, H_2O, SiO, HCN, H_2CO, NH_3) and in a wide variety of astrophysical environments (such as regions of high mass star formation, supernova remnants, evolved stars and circumstellar envelopes). The 6668 MHz methanol maser however is an unambiguous tracer of high-mass star formation, and is exceptionally valuable as one of the brightest and most widespread signposts to the formation of high-mass stars.

Understanding the formation of high-mass stars is a fundamental challenge in astronomy. Current star formation models struggle to create stars much more massive than eight times the mass of our Sun because the onset of core nuclear reactions occurs whilst the star is still in its primordial accreting phase. Several different theories exist, including the coalescence and merging of low-mass stars in dense systems, as well as models similar to standard mass stars, which accrete the matter onto the star through a disc. Observations of high-mass stars are hampered by two factors. First, they spend a very short time in the pre-main sequence phase where they are accreting the majority of their final mass and thus are relatively rare. Second, high-mass stars are usually deeply embedded in thick dust cocoons and lie at large distances (several kiloparsec), and therefore are technically much more difficult to observe.

The MMB seeks to address these questions. The beginning of the survey was described in the ATNF Annual Report 2006 and the survey team has now successfully finished its southern hemisphere observing program with the Parkes radio telescope. The principal survey was completed within the intended two-year time scale and surpassed initial expectations by pushing observations to more northern declinations (Green et al. 2008a). Through a total of approximately 140 days of observations, by a combined team of 21 observers, almost 65% of the Galactic plane has been observed (Figure 1). The efficient nature of the survey allowed for both the Small and Large Magellanic Clouds to be surveyed in addition to the Milky Way (Green et al. 2008b). The MMB receiver, custom built for

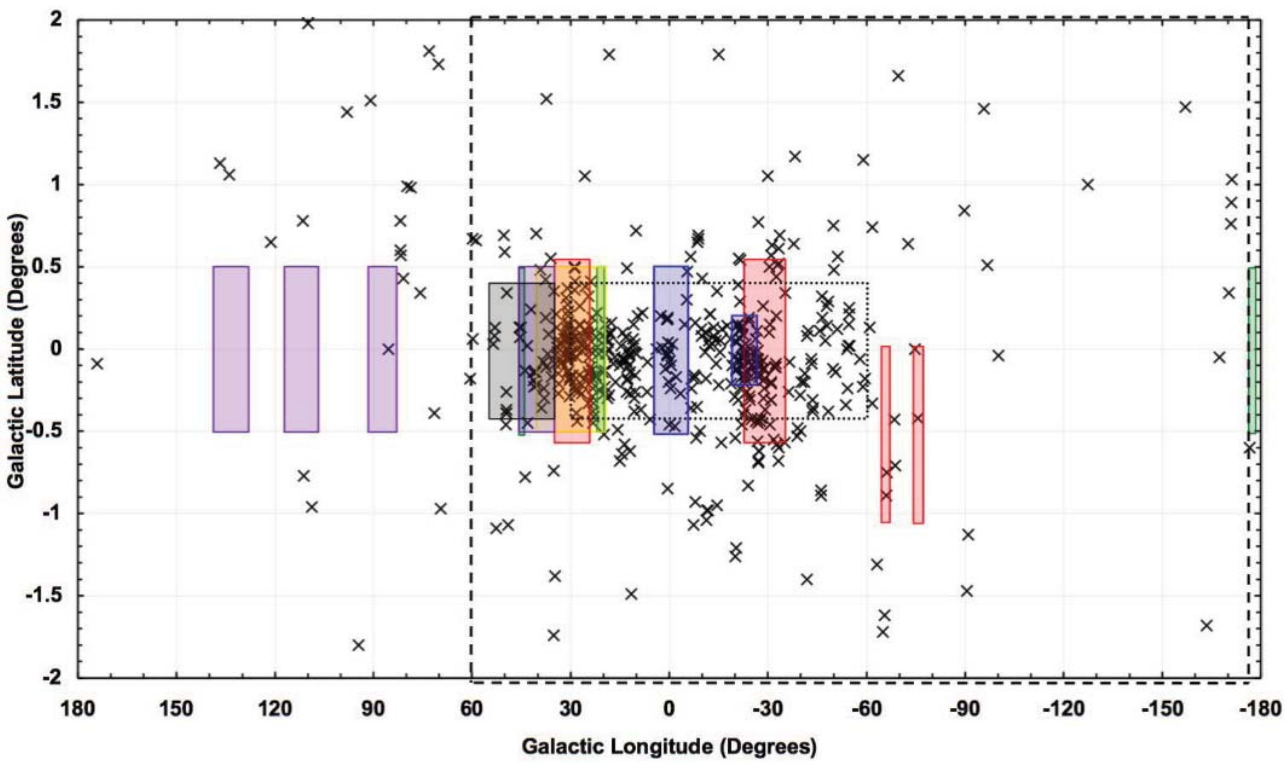


Figure 1: Galactic population of 6668 MHz methanol masers within a two-degree latitude range from the Pestalozzi et al. (2005) catalogue. Boxed regions highlight previous surveys. Dashed line delineates the Parkes MMB survey region. Dotted line delineates the main area of the "Pulsar Piggy-back" survey. Note the region surveyed is a long thin strip, but the longitude scale has been compressed by a factor of 50 to fit the page.

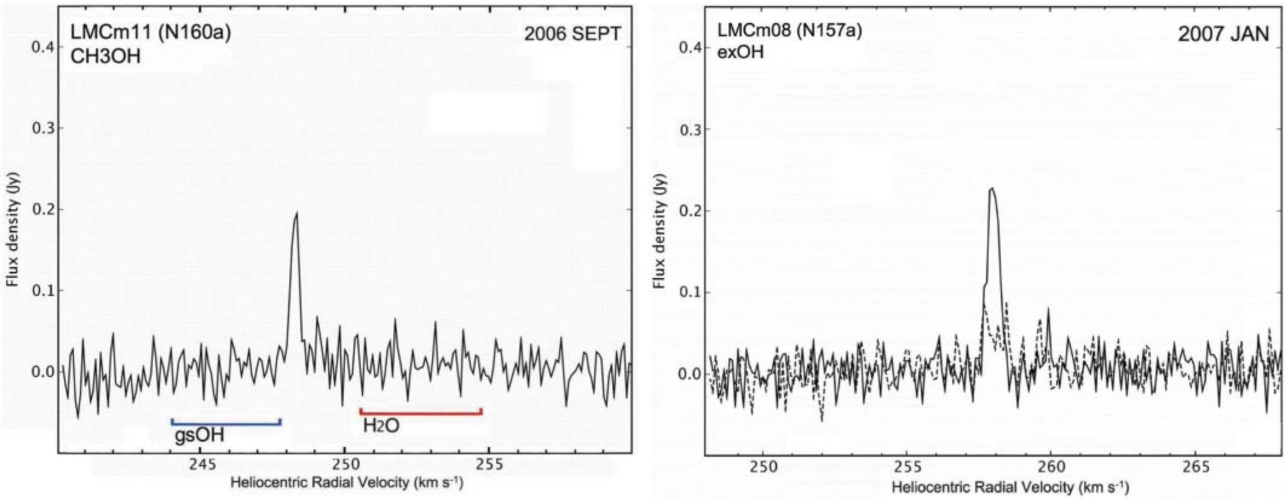


Figure 2: New maser detections in the Large Magellanic Cloud. 6668 MHz methanol detection (left) and 6035 MHz hydroxyl detection (right). The bars labelled gsOH and H2O indicate the velocity ranges of maser emission of associated ground-state hydroxyl and 22 GHz water.

the project and incorporating seven beams, allowed for observations of another species and transition. We were able to simultaneously observe the excited state 6035 MHz hydroxyl maser for which only approximately 100 examples were known prior to the MMB survey. The MMB receiver has also been used for pulsar studies, during which we were able to make a simultaneous deep methanol search of selected regions of sky (allowing us to study extremely weak masers).

Concurrently with the Parkes observations, all sources have been observed with the Australia Telescope Compact Array to provide highly accurate positions. These are crucial to the science goals of understanding high-mass star formation.

Close to 1000 detections have been made throughout the range of longitudes observed. This represents the largest and most complete catalogue of 6668 MHz methanol masers to date. With the high spectral resolution provided by the multibeam and wideband correlators at Parkes, precise velocities are determined for the masers. This allows us to estimate the distances to the masers and confirms that masers have been discovered out to the furthest edges of the Milky Way.

In addition to improving our understanding of Galactic structure, and Galactic dynamics, the MMB observed the Large and Small Magellanic Clouds, where only a handful of star formation masers were known to exist. The survey made new detections of both methanol and excited-state hydroxyl masers (Figure 2) and, through the unbiased and systematic nature of the survey, enabled comparisons to be made between the Galactic and extragalactic populations. The Large Magellanic Cloud demonstrated an under-abundance of methanol masers by a factor of about five (Green et al. 2008b).

The first catalogue paper covering the Galactic Centre is in preparation and the survey team is working to move operations to complete the coverage of the parts of the Galactic plane visible only from the northern hemisphere. A wealth of follow-up studies are already underway including: probing the molecular gas in which the masers are found; establishing which other species and transitions of maser are present and how they relate spatially and kinematically; exploring the behaviour of associated dust and ionised gas; and cross-correlating with objects from other large surveys, such as the Spitzer Dark Clouds.

References

Green, J. A., et al., 2008a, MNRAS, 392, 783

Green, J. A., et al., 2008b, MNRAS, 385, 948

Pestalozzi, M.R., Minier, V. and Booth, R.S., 2005, A&A, 432, 737

*The MMB Survey Team

J.L. Caswell, G.A. Fuller, J.A. Green, A. Avison, S.L. Breen, K. Brooks, M.G. Burton, A. Chrysostomou, J. Cox, P.J. Diamond, S.P. Ellingsen, M.D. Gray, M.G. Hoare, M.R.W. Masheder, N.M. McClure-Griffiths, M. Pestalozzi, C. Phillips, L. Quinn, M.A. Thompson, M.A. Voronkov, A. Walsh, D. Ward-Thompson, D. Wong-McSweeney, J.A. Yates, and R.J. Cohen.

HI discs in Radio Galaxies with the Compact Array

Björn Emonts (CSIRO ATNF)

Observations of neutral hydrogen (HI) gas are an excellent tool for tracing physical processes that play a crucial role in active galactic nuclear (AGN) activity. On the one hand, observations of HI emission-line gas on the scale of the active host galaxy are ideal for tracing gas-rich mergers and interactions, which have often been invoked to be a possible triggering mechanism for AGN activity. On the other hand, HI gas detected in absorption against a possible bright radio continuum component of the AGN can trace the distribution and kinematics of the gas down to the very central region. This can provide profound insight in AGN-related processes, such as AGN fuelling and feedback (in the form of gas infall and outflow), which are crucial processes in the evolution of active galaxies. In order to show the potential for using HI observations to study the origin and evolution of active galaxies, here we report on several recent publications on HI in nearby radio galaxies.

NGC 612 is one of the nearest powerful radio galaxies (z=0.003), which we studied in detail in HI with the ATCA (Emonts et al. 2008a). Figure 1 shows the detection of an enormous disc of HI gas (140 kpc in diameter) surrounding the lenticular host galaxy. The HI disc appears to have regular rotation and follows the optical disc and dust lane of NGC 612 (across which a young stellar population has been detected; Holt et al. 2007). In addition, a very faint HI bridge appears to extend across 400 kpc from NGC 612 in the direction of an HI-rich companion galaxy, indicating that an encounter between both galaxies likely occurred.

We also observed large-scale, regular rotating HI discs and rings similar to the one in NGC 612 in a complete sample of low-power radio galaxies in the north, though interestingly only in those systems with a compact radio source (none of the extended, low-power radio sources contains such

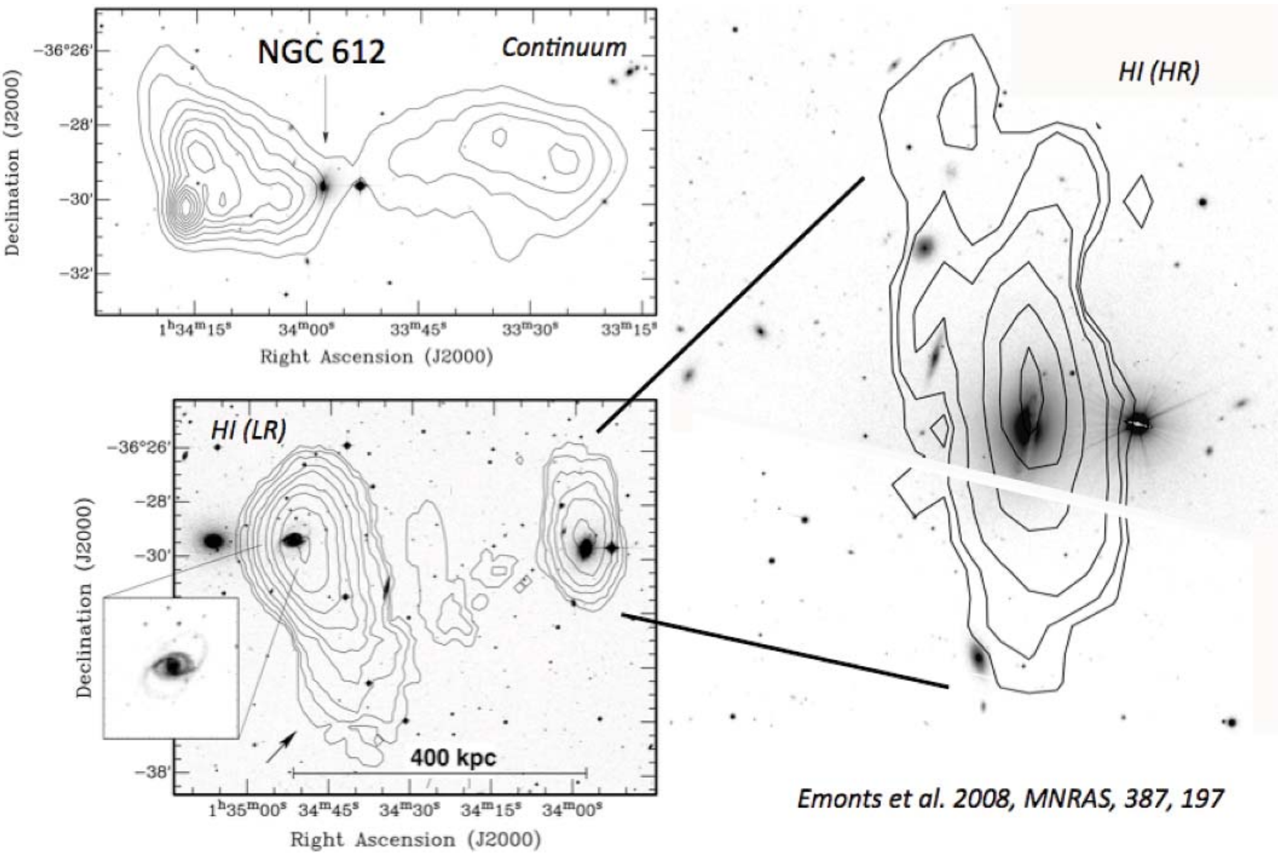


Figure 1: HI in the nearby powerful radio galaxy NGC 612 (from Emonts et al. 2008a). Left (top): Radio continuum map of NGC 612 (contours) superimposed on to an optical image of NGC 612 (greyscale). Right: Large-scale HI disc (contours) surrounding the S0 host galaxy NGC 612 (greyscale). The HI disc has a diameter of 140 kpc and a total mass of MHI = 1.8 × 109 $M_{\odot}$. Left (bottom): Low resolution HI map showing the environment of NGC 612, with a large HI bridge extending towards a gas-rich companion galaxy.

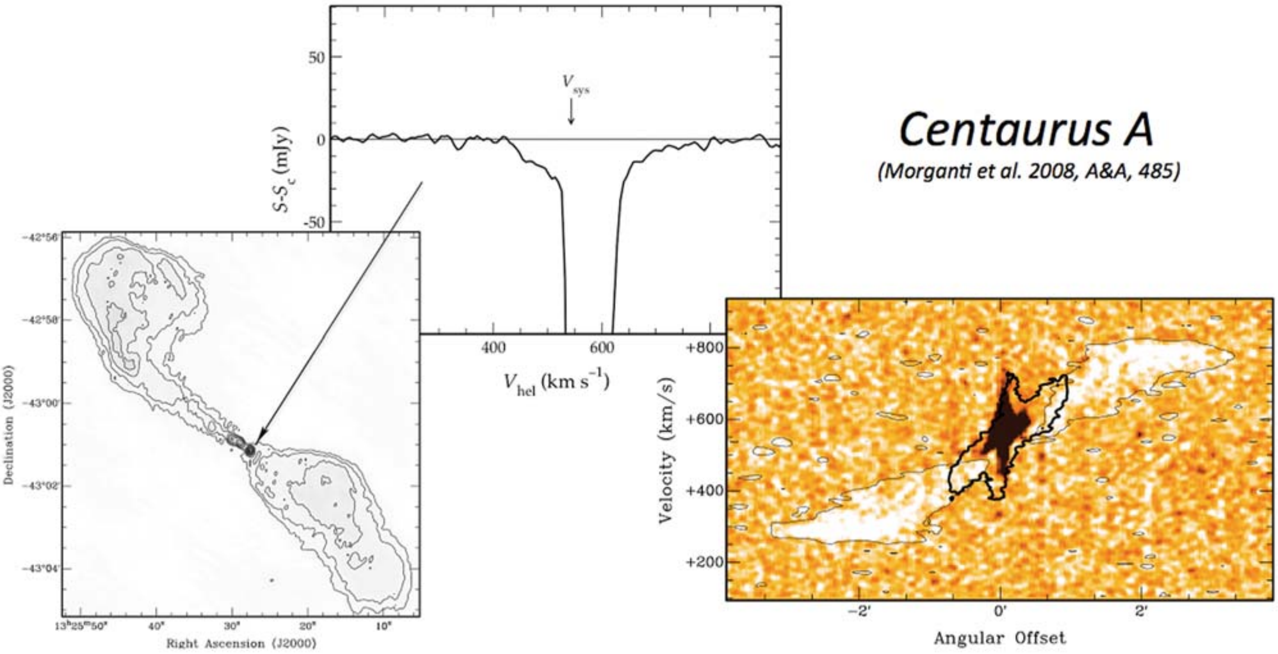


Figure 2: HI absorption study of Centaurus A (from Morganti et al. 2008). Left: Radio continuum of the inner jets of Centaurus A indicating the central radio continuum component against which the HI absorption profile was detected. Middle: HI absorption profile, which clearly shows both a broad blue- and red-shifted wing. Right: Position-velocity plot highlighting the kpc-scale and circumnuclear discs of HI in Centaurus A (greyscale and thin contours), with superimposed CO emission from Liszt (2001; thick contours). Note that the CO observations do not extend beyond a radius of about one arcminute.

large-scale and massive HI structures; Emonts et al. 2007). The origin of these HI discs/rings could be related to gas settling in regular rotation after a major galaxy merger (see Emonts et al. 2006, 2008b for an example), but this scenario is not immediately obvious for all the HI discs/rings that have been detected and other formation mechanisms have been suggested. Nevertheless, from their regular morphology, it is clear that these large-scale HI discs/rings are old (at least one to several Gyr) and their formation shows no apparent causal relation with the current episode of radio-AGN activity.

In fact, very similar large-scale HI discs and rings have recently been catalogued in samples of radio-quiet early-type galaxies (Oosterloo et al. 2007, Morganti et al. 2006). The largest sample comes from a follow-up study with the ATCA of the HI Parkes All Sky Survey (HIPASS) observations of early-type galaxies (Oosterloo et al. 2007). At the high-mass end, the HI detections in the HIPASS follow-up sample are dominated by these large-scale HI discs/rings, very similar to what we find in nearby radio galaxies. One nice recent example of a single-case study is the early-type galaxy ESO 381-47, where combined ATCA, VLA, NTT and GALEX data show an early-type galaxy with an enormous HI disc that hosts a ring of star formation (Donovan et al. 2009).

The occurrence of large-scale, old discs of cold neutral hydrogen gas in a significant fraction of nearby early-type galaxies – both radio-loud and radio-quiet – bears similarities with the presence of giant Lyα-halos around powerful high-z radio galaxies (see, for example, Villar-Martin et al. 2003). This raises the interesting question whether the HI structures that we see in the nearby Universe are perhaps relics of these giant Lyα halos and therefore form fossil records for processes that formed the most massive galaxies in the early Universe?

By far the nearest radio galaxy is Centaurus A. Centaurus A is also known to contain an HI disc, though in this case the disc is only 15 kpc in diameter and hence confined within the optical boundary of the host galaxy (van Gorkom et al. 1990, Schiminovich et al. 1994). Recent high-resolution observations with the ATCA by Morganti et al. (2008) studied the neutral gas in absorption against the radio continuum in the nuclear region. They find evidence in HI for a circumnuclear disc (see Figure 2), disproving earlier claims of gas infall that were based on only a partial coverage of the total absorption profile. The case of Centaurus A shows the potential of HI absorption studies for tracing the physical processes in the central regions of radio galaxies. Similar studies have revealed other important AGN processes and one example is the case of 3C305, where clear evidence is found for a fast HI outflow that is driven by the radio jets in the central kpc-scale region (Morganti et al. 2005). Another interesting case is B2 0402+379, where broad HI absorption shows indications for the extreme kinematics in the gaseous medium surrounding a binary black hole (Morganti et al. 2009).

HI observations are therefore an ideal tool to trace the origin and evolution of radio galaxies from scales of the host galaxy environment down to the inner pc-scale region of the active nucleus. In ongoing work we are studying the large-scale HI content of various types of radio galaxies in a more systematic way. A better understanding of the role of the cold gas in radio galaxies will provide essential information about the origin and evolution of these systems.

References

Donovan, J.L., Serra, P., van Gorkom, J.H., Trager, S.C., Oosterloo, T., Hibbard, J.E., Morganti, R., Schiminovich, D. and van der Hulst, J.M. 2009, AJ, 137, 5037

Emonts, B.H.C., Morganti, R., Oosterloo, T.A., Holt, J., Tadhunter, C.N., van der Hulst, J.M., Ojha, R. and Sadler, E.M. 2008a, MNRAS, 387, 197

Emonts, B.H.C., Morganti, R., van Gorkom, J.H., Oosterloo, T.A., Brogt, E. and Tadhunter, C.N. 2008b, A&A, 488, 519

Emonts, B.H.C., Morganti, R., Oosterloo, T.A., van der Hulst, J.M., van Moorsel, G. and Tadhunter, C.N. 2007, A&A, 464, L1

Emonts, B.H.C., Morganti, R., Tadhunter, C.N., Holt, J., Oosterloo, T.A., van der Hulst, J.M. and Wills, K.A. 2006, A&A, 454, 125

Holt, J., Tadhunter, C.N., González Delgado, R.M., Inskip, K.J., Rodriguez, J., Emonts, B.H. C., Morganti, R. and Wills, K.A. 2007, MNRAS, 381, 611

Liszt, H. 2001, A&A, 371, 865

Morganti, R., Emonts, B. and Oosterloo, T. 2009, A&A, 496, L9

Morganti, R., Oosterloo, T., Struve, C. and Saripalli, L. 2008, A&A, 485

Morganti, R., de Zeeuw, P.T., Oosterloo, T.A., McDermid, R.M., Krajnović, D., Cappellari, M., Kenn, F., Weijmans, A. and Sarzi, M. 2006, MNRAS, 371, 157

Morganti, R., Oosterloo, T.A., Tadhunter, C.N., van Moorsel, G. and Emonts, B. 2005, A&A, 439, 521

Oosterloo, T.A., Morganti, R., Sadler, E. M., van der Hulst, T. and Serra, P. 2007, A&A, 465, 787

Schiminovich, D., van Gorkom, J.H., van der Hulst, J.M. and Kasow, S. 1994, ApJ, 423, L101

van Gorkom, J.H., van der Hulst, J.M., Haschick, A.D. and Tubbs, A.D. 1990, AJ, 99, 1781

Villar-Martín, M., Vernet, J., di Serego Alighieri, S., Fosbury, R., Humphrey, A. and Pentericci, L. 2003, MNRAS, 346, 273

Seven Pulsar Parallax Distance Measurements with the Long Baseline Array

Adam Deller (NRAO)

Radio pulsars offer a chance to test physics in truly extreme environments such as a solar mass or more of material crammed into an object barely 20 km across, rotating at rates that can exceed hundreds of times per second. Often, however, interpretations of pulsar observations are hampered by the fact that the distance to the object is very uncertain. The best opportunity to estimate a pulsar's distance is provided by the dispersion of the radio pulse with frequency, which indicates the amount of ionised material between the pulsar and observer, but the inhomogeneity of the interstellar medium leaves this approach prone to large errors.

For some subsets of pulsars, other methods are available. For example, long-term pulsar timing can measure the curvature of the arriving wavefront and infer the pulsar distance, but this can only be achieved for a select group of pulsars with extremely stable rotation periods (for example, Hotan et al. 2006). For the vast majority of pulsars, however, only one technique can provide a model-independent distance (and hence luminosity, transverse velocity etc) measure – Very Long Baseline Interferometry (VLBI).

VLBI observations measure the apparent position shift of the pulsar (the parallax) induced over the course of a year as the Earth orbits the Sun. Even for the closest pulsars (within a few hundred parsecs) the maximum displacement is tiny (less than 10 milli-arcseconds). Obtaining this level of precision is challenging for pulsar VLBI, as most pulsars are very faint at centimetre wavelengths typically used for astrometry and, at longer wavelengths, observers are faced with the twin challenges of reduced resolution and increased disturbance from the Earth's ionosphere.

Nevertheless previous observing programs, particularly with the Very Long Baseline Array (VLBA) in the US, have been successful in measuring parallaxes for dozens of pulsars (for example, Brisken et al. 2002 and Chatterjee et al. 2009). However, the pre-eminence of northern hemisphere VLBI arrays has meant a dearth of parallax measurements in the southern skies. Prior to 2008, only two (of around 20) parallax measurements were for pulsars in the southern hemisphere, leaving the southern skies lacking anchors for the dispersion-measure based distance scale.

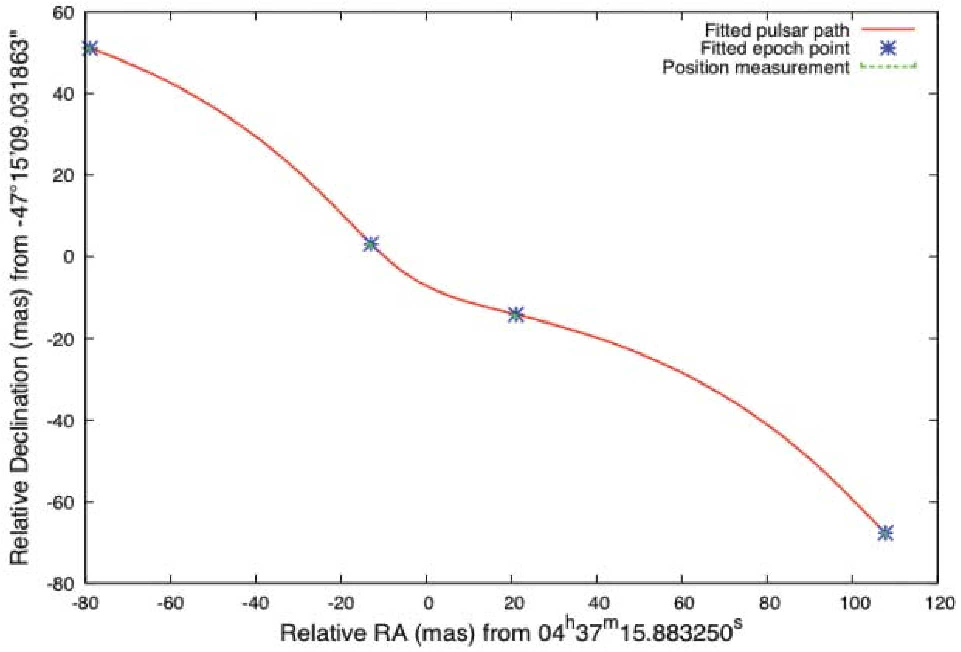
In order to redress this imbalance a two-year campaign with the Long Baseline Array (LBA) was undertaken (Deller et al., 2009a). The recent update to LBA capabilities, including higher-speed data recorders and a new software correlator, allowed improved sensitivity making the targeting of faint pulsars such as the double pulsar J0737-3039A/B possible. In addition, improvements were made to LBA data processing (such as refined station positions) to enable sub-mas positional accuracies to be obtained. The two-year program obtained parallax measurements for seven (of eight) targets, trebling the number of southern pulsars with VLBI distance measurements. The implications of the measurements are different for each individual pulsar, and several of the highlights are discussed below.

The distance of 156.3 ± 1.3 pc obtained for PSR J0437-4715 is the most precise pulsar distance, in absolute or fractional terms, obtained to date. Combining this result with years of precision pulsar timing it proved possible to very accurately measure the apparent line-of-sight acceleration of PSR J0437-4715 and hence place tight limits on acceleration sources, such as nearby massive bodies or a time variation of the gravitational constant G (Deller et al. 2008). Figure 1 shows the measured and fitted motion of PSR J0437-4715 pulsar before and after the subtraction of its proper motion.

The distance to the double pulsar PSR J0737-3039A/B has been highly sought after to enable the calculation of kinematic contributions to the observed timing model, allowing improved tests of General Relativity (GR). The distance to PSR J0737-3039A/B was measured as 1150 +220 -160 pc, more than twice the dispersion measure estimate. The new distance limits the uncertainty in kinematic contributions to timing to one part in 10^4 of the GR effect, meaning that GR can be tested with this system to the 0.01% level (Deller et al. 2009b).

Finally, the distance to PSR J0630-2834 was found to have been previously overestimated by a factor of around five, a large error even by the standards of pulsar distances! While PSR J0630-2834 had been previously thought to shine extremely brightly in X-rays, 20 times brighter than "ordinary" pulsars, the newly measured distance demotes it to a more pedestrian level (Deller et al. 2009a).

VLBI pulsar astrometry is a booming field – the number of published VLBI pulsar parallaxes has doubled in the past year. Due to its location, the LBA is uniquely placed to contribute to this field, and ongoing development should enable it to target an ever greater number of astronomically fascinating objects.



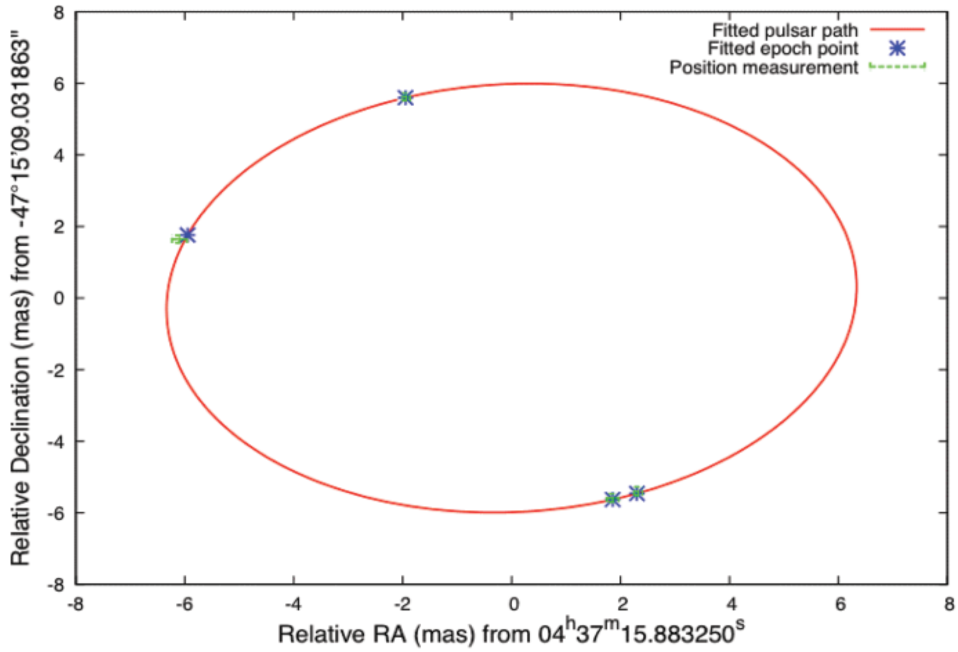


Figure 1: The measured positions of PSR J0437-4715 (green), with its fitted path overlaid (red line). Above: Actual fitted positions. The error bars are too small to discern. Right: Positions after the subtraction of fitted proper motion, leaving the ellipse due to annual parallax.

References

Brisken, W.F., Benson, J.M., Goss, W.M. and Thorsett, S.E. 2002, ApJ, 571, 906

Chatterjee, S. et al. 2009, ApJ, 698, 250

Deller, A.T., Verbiest, J.P.W., Tingay, S.J. and Bailes, M. 2008, 685, L67

Deller, A.T., Tingay, S.J., Bailes, M. and Reynolds, J.R. 2009a, ApJ, accepted (arxiv http://arxiv.org/abs/0906.3897).

Deller, A.T., Bailes, M. and Tingay, S.J. 2009b, Science, 323, 1327

Hotan, A.W., Bailes, M., and Ord, S.M. 2006, MNRAS, 369, 1502

The Highest Velocity Water Maser in the Galaxy

Andrew Walsh (James Cook University)

Over the past two years we have been surveying our Galaxy for water masers using the Mopra radio telescope. Water masers appear as extremely intense points of radio emission in the sky. They pinpoint unusual conditions in our Galaxy that are only found around the youngest stars, as they form, or around old stars as they shed their outer layers in preparation for the end of their lives.

The H_2O Southern Galactic Plane Survey (HOPS) has so far surveyed 60 square degrees of the southern and inner Galaxy. We have found 368 water masers, 277 of which appear to be previously unknown. Figure 1 shows a small portion of the Galaxy so far surveyed in ammonia emission, with the positions of water masers shown by the plus symbols. Most of the emission seen in this figure is associated with the centre of the Galaxy – the so-called Central Molecular Zone.

During our survey we observed a previously known water fountain G9.1-0.4 (Deacon et al. 2007). A water fountain is a type of water maser that displays an extremely broad velocity spread of maser emission peaks (>100 km/s; Likkel and Morris 1988) and are found exclusively towards post-asymptotic giant branch (AGB) stars. The water masers are thought to occur in the jet from the old star as it transforms from the AGB to the planetary nebula stage. Our HOPS

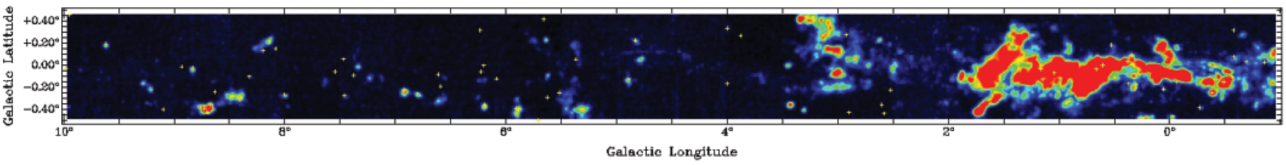


Figure 1: The inner Galaxy shown in ammonia emission mapped by HOPS, tracing dense gas and sites of star formation. The plus symbols show the positions of detected water masers.

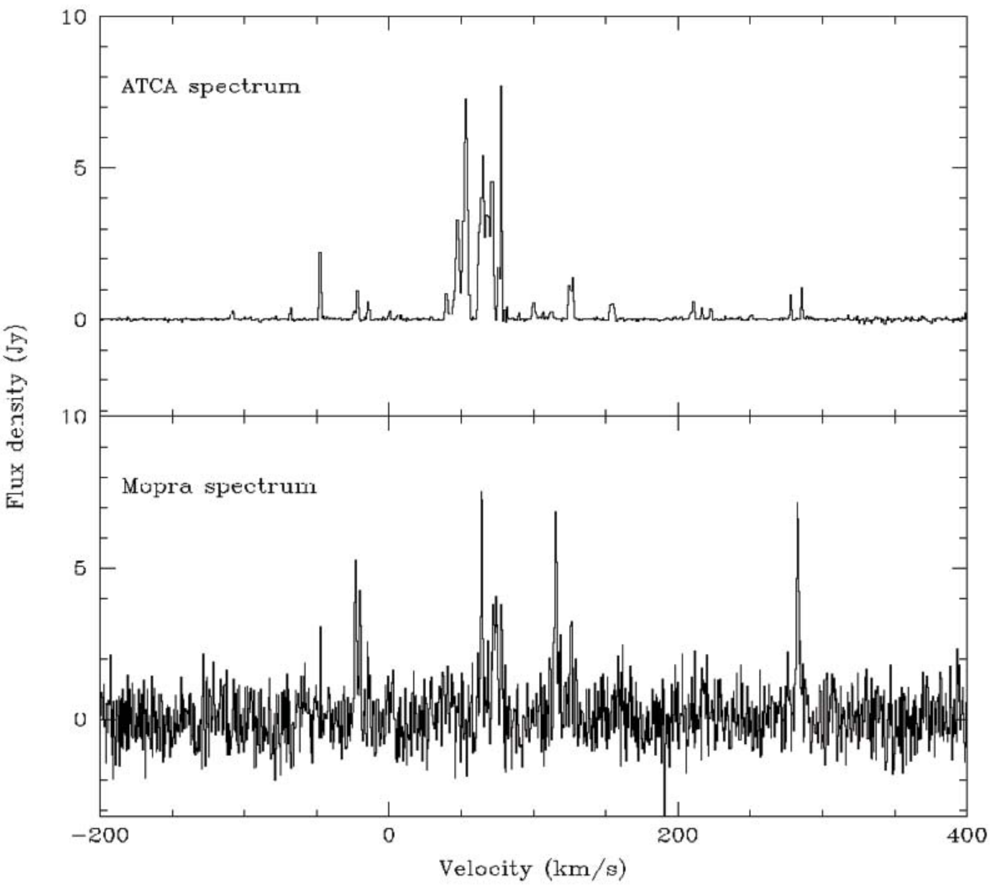


Figure 2: Water maser spectra of G9.1-0.4, taken with Mopra (bottom) and the ATCA (top). The full range of water maser emission seen in the ATCA spectrum is 398 km/s.

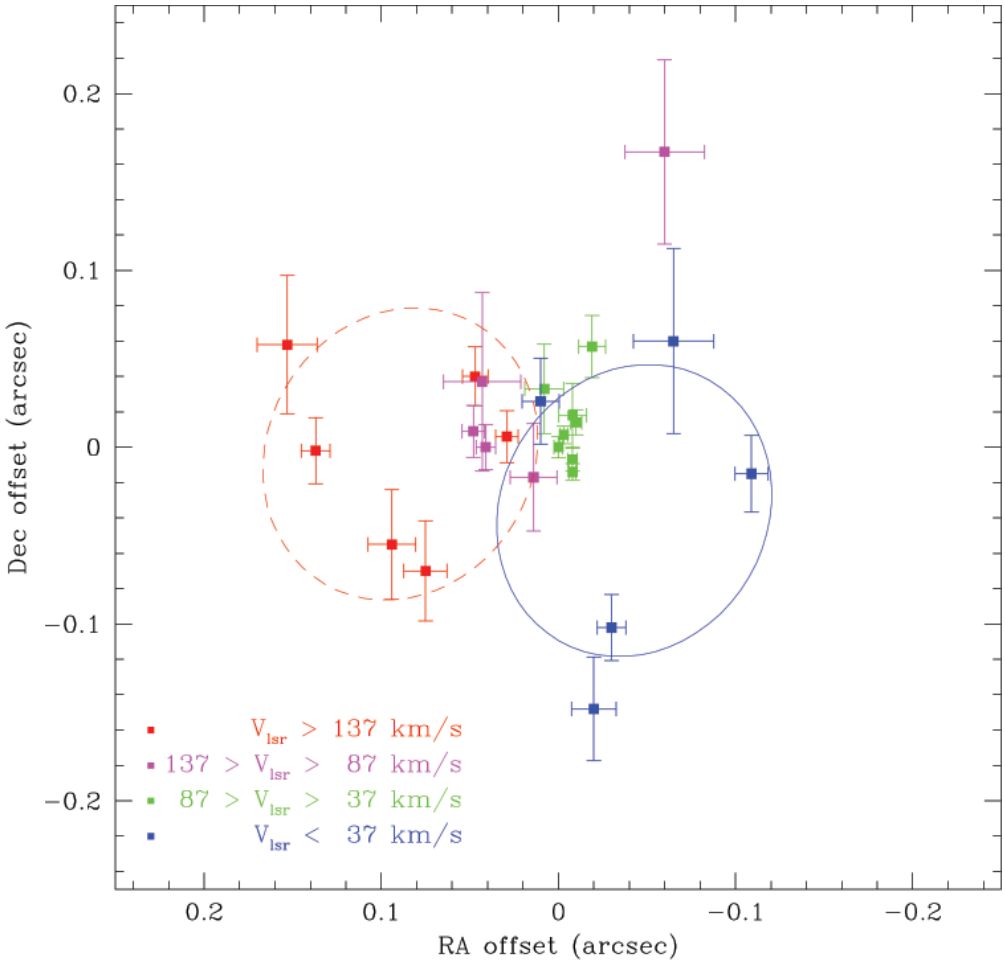


Figure 3: **Distribution of maser emission peaks, relative to the position of the main maser peak. Each maser peak is colour coded, according to its velocity in the spectrum. There is a tendency for the red-shifted maser peaks to occur to the left and blue-shifted peaks to occur to the right of the figure, which may indicate the orientation of the jet.**

observations of G9.1-0.4 were the first to observe a wide band of the spectrum, equivalent to nearly 2000 km/s. We found emission that extends well beyond that previously known (see Figure 2).

We decided to follow up the Mopra observations with ATCA observations (Walsh et al. 2009), which allow us to pinpoint the position of the water fountain, as well as constrain its projected size to much smaller than the Mopra beam. Figure 2 shows the spectrum of emission observed with the ATCA. Due to intrinsic variability of the water masers we saw emission over a larger range than with Mopra, giving a full range of maser emission of over 398 km/s!

In addition to finding a larger range of velocities, we were able to pinpoint the relative position of individual maser peaks in the spectrum, shown in Figure 3. The figure shows that all the maser peaks are contained within a region no larger than 0.3 x 0.3 arcseconds, equivalent to a projected size of 1900 x 1900AU. Given that the masers are moving at such high relative velocities and that the emission is confined to a very small region on the sky, we conclude that either the jet which houses the masers is pointed almost exactly along the line of sight, or that the maser proper motions are significantly higher than we measure here. Either way, G9.1-0.4 is a very interesting region worthy of further study.

We are planning follow-up observations of this unique system with the LBA. This will hopefully allow us to derive an accurate distance to the system, as well as look for proper motions, so that we can see how close the jet is to the line of sight.

References

Deacon, R.M., Chapman, J.M., Green, A. J. and Sevenster, M.N. 2007, ApJ, 658, 1096

Likkel, L. and Morris, M. 1988, ApJ, 329, 914

Walsh, A.J., Breen, S.L., Bains, I. and Vlemmings, W.H.T. 2009, MNRAS Lett. 394, 70

The Simulated HI Sky at Low Redshift

Attila Popping (Kapteyn Astronomical Institute and CSIRO ATNF)

Current cosmological models ascribe only about 4% of the density in the Universe to baryons or atomic and sub-atomic particles. The majority of these baryons reside outside of galaxies; stars and cold galactic gas may account for about one third (Fukugita et al. 1998). Intergalactic baryons have historically been traced in absorption, such as the Lyα forest arising from diffuse photo-ionised gas that may account for up to 30% of baryons. The remaining baryons are predicted to exist in a warm-hot intergalactic medium (WHIM) (for example, Davé et al. 1999; Cen and Ostriker 1999), which is shock heated during the collapse of density perturbations that give rise to the cosmic web.

Unfortunately, emission from intergalactic baryons is difficult to observe because current telescope sensitivities result in a detection limit of column densities $N_{HI} \geq 10^{19}$ cm^{-2}. Exploration of the low column density regime is essential for gaining a deeper understanding of the repository of baryons that drive galaxy formation and evolution. This gas, residing in filamentary structures, is the reservoir that fuels future star formation and could provide a direct signature of smooth cold mode accretion predicted to dominate gas acquisition in star forming galaxies today.

We have employed a state-of-the art cosmological hydrodynamic simulation to study the 21-cm emission properties from filamentary large-scale structure and the galaxies within them. We hope to gain more insights into the distribution of HI below $N_{HI} \sim 10^{19}$ cm^{-2}. Such Lyman limit systems are expected to trace out the cosmic web, and are relatively unexplored. A modified version of the N-body+hydrodynamic code Gadget-2 is employed, the code has been described in detail in Oppenheimer and Davé (2006, 2008).

Beginning with a 32 h^{-1} Mpc simulation, we extract the neutral hydrogen component by determining the neutral fraction, assuming equilibrium between photo-ionisation and radiative recombination. In the high density regimes a post-processed correction for self-shielding is applied, as the neutral fraction here is close to unity. When gas has cooled sufficiently, it coexists in the molecular (H_2) and atomic (HI) phases. The H_2 regions are found in dense molecular clouds where star formation occurs.

Wong and Blitz (2002) have made the case that the amount of molecular hydrogen that is formed in galaxies is determined by only one parameter, the interstellar gas pressure. In hydrostatic pressure equilibrium, the hydrostatic pressure is balanced by the sum of all contributions to the gas pressure. Thermal pressure is directly coupled to energy dissipation via radiation, and therefore thermal pressure can track the total pressure due to various equi-partition mechanisms.

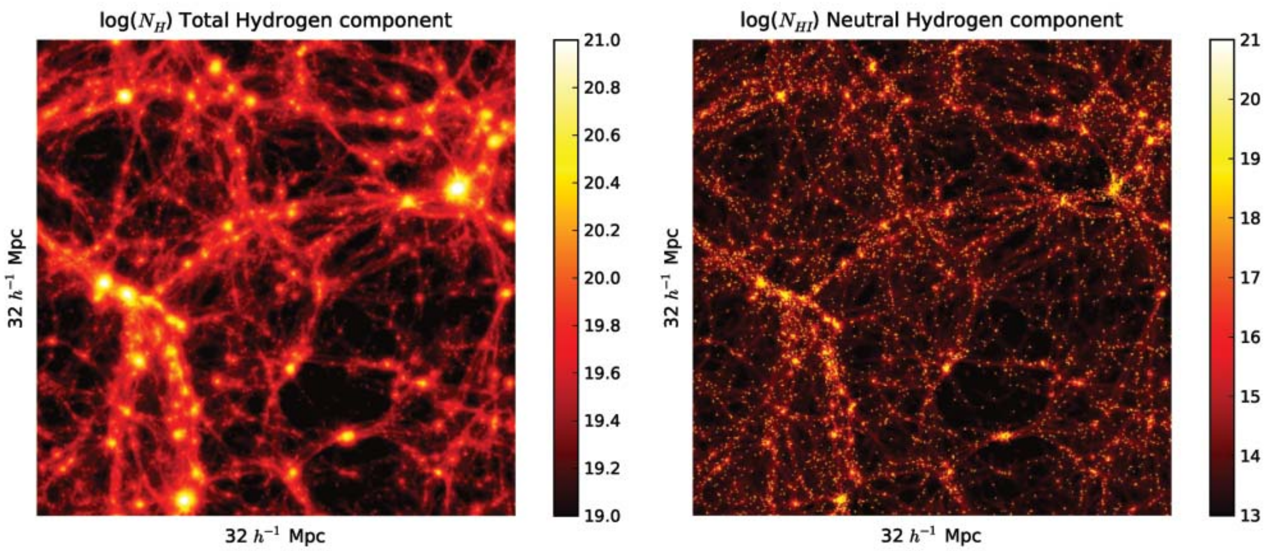


Figure 1: Left: Column density of total H gas integrated over a depth of 32 h^{-1} Mpc on a logarithmic scale, gridded to a resolution of 80 kpc. Right: Neutral hydrogen component of the same region. In the neutral hydrogen distribution the highest densities are comparable to the densities in the total hydrogen distribution, but there is a very sharp transition to low neutral column densities as the gas becomes optically thin. Note the very different scales on the two plots, the total hydrogen spanning only two orders of magnitude and the neutral hydrogen spanning eight orders of magnitude.

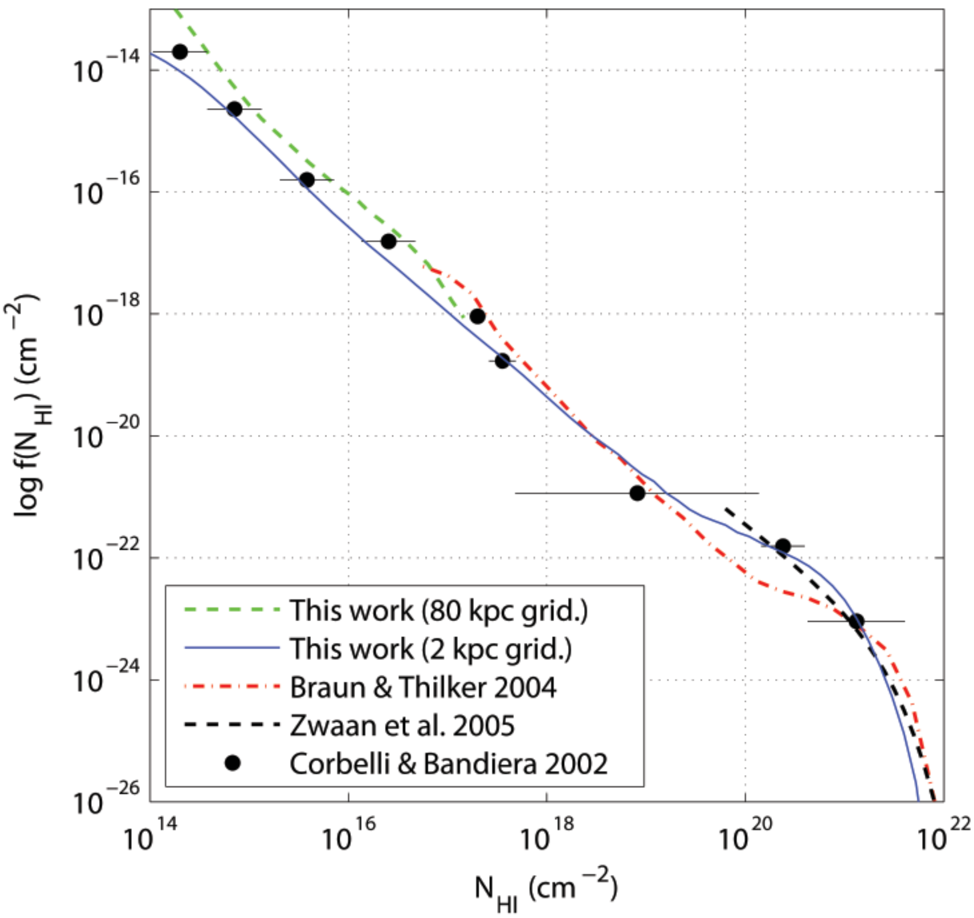


Figure 2: Combined HI distribution functions of the simulation, gridded to a resolution of 2 kpc (solid blue line) and 80 kpc (dashed green line). Overlaid are distribution functions from observational data of M31 (Braun and Thilker 2004), WHISP (Swaters et al. (2002), Zwaan et al. (2005)) and QSO absorption lines (Corbelli and Bandiera 2002) respectively. The reconstructed HI distribution function corresponds very well to all observed distribution functions.

The molecular hydrogen and the self-shielding transition are both modelled by a critical thermal pressure. Above the first threshold limit (P/k = 155 cm^{-3} K) the gas is assumed to recombine and the neutral fraction is set to unity. At even higher pressures (P/k = 810 cm^{-3} K) the atomic hydrogen is assumed to become molecular hydrogen, so the atomic fraction becomes zero. These processes only apply to simulated particles for which the recombination time is shorter than the sound-crossing time on kpc scales. Gas for which the recombination time is longer than the sound-crossing time can not be in thermal equilibrium and we assume that these particles are all ionised.

Figure 1 shows reconstructed maps of the distribution of the total hydrogen budget in the left panel and the neutral component in the right panel. The simulated HI distribution robustly describes the full column density range between $N_{HI} \sim 10^{14}$ and $\sim 10^{21}$ cm^{-2}. A wide range of statistical comparisons have been made between the reconstructed HI distribution and existing observational constraints, including the two-point correlation function, the HI mass function and the HI column density distribution. The simulated distribution function is demonstrated in Figure 2 and compared with values from the literature. There is agreement between all these statistical measures of the observations and the simulations, which is a very encouraging result. Based on this agreement, the simulated HI distribution may be a plausible description of the HI universe, at least on the intermediate spatial scales that are both well resolved and well sampled.

This simulation can not only be used for getting a better understanding of the HI distribution, especially at low column densities; the reconstructed maps are also used to simulate observations of existing and future telescopes by adding noise and taking account of the sensitivity of the telescopes. In Popping et al. (2009) we discuss simulated maps of the existing Parkes and Arecibo telescopes, and compare these with the capabilities of two future telescopes, the Australian SKA Pathfinder (ASKAP) and the SKA (Square Kilometre Array). To make a fair comparison we assume that all telescopes have 500 hours of observing time to map 30 square degrees of the sky.

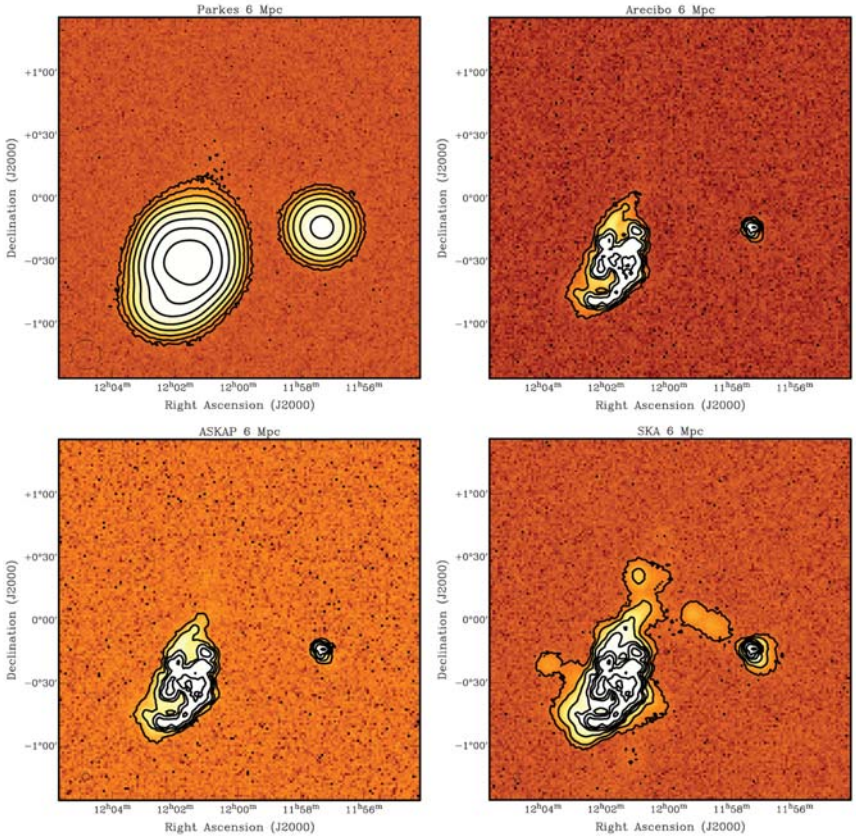


Figure 3: Simulated observations of the same object at a fixed distance of 6 Mpc for Parkes (top left), Arecibo (top right), ASKAP (bottom left) and SKA (bottom right). Contour levels start at a 3 level after 500-hour observation of a 30 square degree field. For Parkes every subsequent contour is a factor of three higher than the previous one. For ASKAP and Arecibo, the contour interval is a factor of seven. For the SKA the contours start a 4×10^{16} cm^{-2} and increase by a factor of six. Parkes is not really competitive in detecting substructures at this distance. While the other telescopes all have sufficient resolution, only the SKA is sensitive enough to detect the faint diffuse sub-structures.

In our example the simulated maps are located at a distance of 6 Mpc. Figure 3 shows the reconstructed HI maps for all four telescopes with contours starting at a 3σ level. The differences between the four panels are obvious. Observed with the Parkes telescope (in the top left panel), the object has essentially no resolved structure although the lowest contour has a value of only 10^{17} cm^{-2}. Clearly the beam size is too large and only suitable for very nearby galaxies, closer than 6 Mpc. Arecibo, with a much smaller beam, can resolve the inner core of the object and the outer contour corresponds to ~ 9×10^{17} cm^{-2}. ASKAP has a very similar sensitivity limit as Arecibo with a comparable beam size; the outer contour here is ~ 7×10^{17} cm^{-2}. However it is notable that it reaches Arecibo sensitivities with a much smaller collecting area. Furthermore, these deep integrations have not really been explored so the given sensitivities are theoretical limits. It is very likely that correcting for systematic effects, like the shape of the spectral band-pass, will be more achievable with an interferometer like ASKAP than with a large single dish telescope. In the SKA image essentially all companions can be clearly distinguished down to a contour level of ~ 4×10^{16} cm^{-2}.

This preliminary study shows that as HI observations of diffuse gas outside of galactic disks continue to improve, simulations will play a vital role in guiding and interpreting such data to help us better understand the role that HI plays in galaxy formation.

For a more complete description of this work see Popping et al. (2009).

References

Braun, R. and Thilker, D.A. 2004, A&A, 417, 421

Cen, R. and Ostriker, J.P. 1999, ApJ, 514, 1

Corbelli, E. and Bandiera, R. 2002, ApJ, 567, 712

Davé, R., Hernquist, L., Katz, N. andWeinberg, D.H. 1999, ApJ, 511, 521

Fukugita, M., Hogan, C.J. and Peebles, P.J.E. 1998, ApJ, 503, 518

Oppenheimer, B.D. and Davé, R. 2006, MNRAS, 373, 1265

Oppenheimer, B. D. and Davé, R. 2008, MNRAS, 387, 577

Popping, A., Davé, R., Braun, R. and Oppenheimer, B.D. 2009, A&A, in press

Wong, T. and Blitz, L. 2002, ApJ, 569, 157

Zwaan, M.A., van der Hulst, J.M., Briggs, F.H., Verheijen, M.A.W. and Ryan-Weber, E.V. 2005, MNRAS, 364, 1467

4. Operations

Participants enjoyed the three-day *Astronomy from the Ground Up!* workshop for teachers held at Parkes in May 2008.

Credit: Rob Hollow, CSIRO.

Operations

A Re-organisation for the Future

During 2007 the ATNF addressed the issue of how its facilities will be operated once the Australian SKA Pathfinder (ASKAP) is operating early next decade. Adding an observatory in Western Australia to the existing facilities operated in New South Wales will present organisational and resourcing challenges. Late in 2007 the outline of an approach was released (*Future ATNF Operations*, December 2007) and during 2008 the plans were refined and steps taken towards their implementation. The plan will take several years to execute and is designed to establish structures and procedures that will readily support ASKAP when its operations begin. The major step taken in 2008 was the adoption of a new management structure within National Facility Operations.

Science and Engineering Operations

In July 2008 the ATNF adopted a new structure for managing telescope operations comprising two new organisational entities: Science Operations and Engineering Operations. This replaced the earlier division into observatory-based management units. Engineering Operations deal with the hardware (telescopes, instrumentation, infrastructure) and Science Operations deal with software and "live-ware" (the users, their support, proposals, allocation to the telescopes, and the operational and data reducing software and associated computing). Science Operations also includes the running of the specialised accommodation services at the observatories and the visitors' lodge at Marsfield.

Engineering Operations is divided into four areas:

- Mechanical, Drives and Electrical (MDE);
- Digital and Servo Electronics (DSE);
- Receivers, LO and Conversion (RLOC);
- Cryogenics (CRYO).

In each of these, personnel are responsible for monitoring performance, diagnosing faults, replacing and repairing faulty modules, manual re-configurations, and scheduling and executing the maintenance program.

Science Operations is also divided into four areas:

- Telescope Operations and Science Services (TOSS): Telescope calibration and systems analysis; Time Assignment Committee; calibration sources and catalogues; user guides and all user support;
- Computing Infrastructure (CI): Operating systems; site-site communications; observers' environment; data management; infrastructure and network services;
- Scientific Computing and Archives (SCA): Telescope control and monitoring software; data reduction; image analysis; scheduling software;
- Visitors Services (VS): Visitor administration; accommodation bookings; lodge services.

The intent of the new structure is to encourage greater coordination and technical alignment amongst the three observatories (four observatories in future) and to establish managerial structures that will facilitate the adoption of the best and most efficient aspects of the various operational practices.

Officers-in-Charge, Site Managers and System Scientists

In the past the ATNF observatories have functioned well under the local management of the Officers-in-Charge (OICs). In most cases the OICs have been experienced radio astronomers with considerable knowledge of radio astronomy techniques and the technical details of the telescopes. The new management structure took some of the emphasis away from observatory-specific management, but it was recognised that many of the OIC functions would remain important. Two new positions were created at both the Parkes and Narrabri Observatories: Site Manager and System Scientist. The Site Manager has responsibility for the day-to-day activities at the observatory, has direct line management responsibility for most observatory staff, and is responsible for the engineering integrity of the observatory. The System Scientist specialises in the scientific performance of the telescope and is the main contact for telescope users requiring specialised knowledge of the system.

Community Consultation

Following the initial release of *Future ATNF Operations* in December 2007, it was clear that many ATNF users had significant concerns with the proposed plans. In response to this, the ATNF took several initiatives to address members of the community to clarify the intent of the plans and to seek their input.

During March and early April 2008, Jessica Chapman, David McConnell and Lewis Ball visited groups of astronomers from eight universities in Sydney, Canberra, Hobart, Perth and Melbourne to present the plans and gather feedback through discussion. These visits were extremely valuable in helping the ATNF to understand a diverse range of perspectives and interests from different regions within Australia, and the different concerns of particular research groups. Further discussion was held during a well-attended forum in Marsfield in mid-March, and the ATNF Users Committee also encouraged and received feedback.

A web forum was set up to facilitate input from both Australian and international astronomers. This proved to be an effective technique, with detailed and perceptive written comments received from approximately 35 individuals, again representing different parts of the international community.

David McConnell and Jessica Chapman attended the June meeting of the American Astronomical Society in St Louis, USA, to present and discuss plans for ATNF facilities and future operations.

On 11 June, a one-day workshop *Future Science with the Australia Telescope Compact Array* was held at Marsfield. The meeting intended to provide a current view of the scientific strengths of the ATCA, now and into the ASKAP era. Astronomers were invited to contribute a science talk describing the important experiments they envisage with the ATCA over the next five years and beyond.

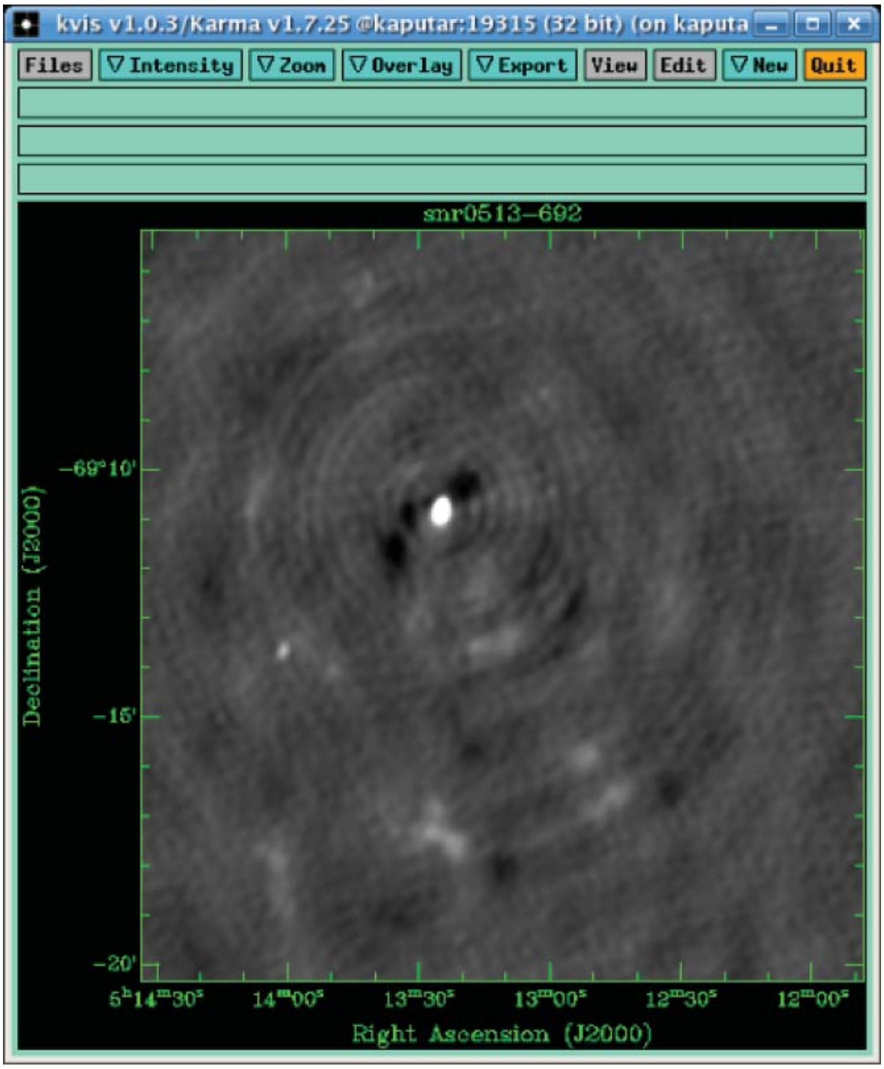
A second version of *Future ATNF Operations* was released late in 2008 that reflected much of the discussion and feedback from the community of ATNF users.

Observatory Reports

Australia Telescope Compact Array

CABB

Activities at the Compact Array during 2008 were dominated by the preparations for CABB, the Compact Array Broadband Backend upgrade. Although the original schedule for the full installation of CABB in October 2008 was not met, a number of significant and encouraging milestones were passed. In February the CABB samplers were used on three antennas to gather data from the 20-cm receivers for the "Lunar Cerenkov" experiment to provide the required timing accuracy of potential neutrino events, the offset between the clocks in each antenna needed to be



The first ATCA image using CABB was produced from observations of SNR0513-692 made by Warwick Wilson at 5 GHz. The image was compared with the image made from simultaneous visibility data collected with the old Australia Telescope correlator, confirming that CABB was operating as expected. Credit: Mark Wieringa, CSIRO.

known to nanosecond accuracy. This calibration was done using a software cross-correlation between data from the CABB samplers. In August an interim installation of CABB equipment in three antennas and a partially built correlator in the screened room was successfully used to acquire fringes on a three-baseline array. In November dual polarisation, 2 GHz auto-correlation spectra were obtained from five antennas. In December the first CABB images were made with five antennas, but less than the full 2 GHz bandwidth.

See page 50 of the Technology chapter for more information on CABB.

Seeing Monitor

The Compact Array seeing monitor uses two 1.8-m dishes pointed at a geostationary satellite. This has operated since May 2004 and has provided a valuable measure of atmospheric stability. In late 2007 Optus started migrating the satellite to a new position, a process that took about a month, and so the monitor dishes required re-pointing every couple of days. Longer term, the current 30 GHz beacon will become unavailable, and the seeing monitor was retuned in September to operate using an alternate 20 GHz beacon.

Spacecraft Tracking

Engineering tests are continuing for NASA, both tracking the 32 GHz beacon on the Cassini spacecraft, in orbit around Saturn, and in receiving downlink telemetry in the 8 GHz band from satellites orbiting Mars. For the April semester the commitment to NASA tracking is about 10 hours per month, but it is anticipated that the launch of the Kepler spacecraft in early 2009 will see the allocation for tracking increase to something approaching the nominal average of 10 hours per week.

Synthesis Workshop

The ATNF held its *8th Synthesis Imaging School* from 29 September to 3 October 2008 at the Compact Array. A total of 32 students attended the school, with about a quarter of these being members of the ASKAP group. The format included lectures on all aspects of interferometry and data analysis as well as practical sessions involving ATCA observing and data reduction. Social events included an on-site meal, with diners entertained by Andrew Walsh's exposition on "Complex Molecules in Space, and Can We Make Beer Out of Them?". During one of the morning coffee breaks a 20th birthday cake was wheeled in and a rousing version of "Happy Birthday" was sung to the ATCA!

Feedback from participants was overwhelmingly positive. The efforts of all lecturers, tutors and Narrabri staff in preparing for the school and ensuring it ran smoothly are greatly appreciated, with the tireless behind-the-scenes work of Jo Houldsworth and Marg McFee particularly noteworthy.

Parkes

John Reynolds – a Decade Leading the Parkes Observatory

The end of 2008 was significant in marking the end of John Reynold's period at the Parkes Observatory. For most of his ten years at Parkes, John was Officer-in-Charge. Through his leadership of the observatory's operation and development over that time he is widely recognised as one of the main contributors to the telescope's scientific output. John's time at Parkes was recognised with a small symposium held at Parkes on 27 November. About 70 people (ATNF staff, astronomers and members of the local community) gathered and heard a number of invited speakers give their views of John's contributions to different aspects of the telescope's scientific work. The topics reviewed covered the chief areas of the telescope's science (HI spectroscopy, pulsar studies, VLBI), and indicated the breadth of John's knowledge. The presentations were followed by celebratory drinks and a memorable dinner in The Dish Café, and several fine examples of after-dinner oratory.

13-mm Receiver

A new 13-mm (K-band) receiver was delivered and partially commissioned in September 2008. For more detail refer to page 51 of the Technology chapter.

300 – 900 MHz DRAO Receiver

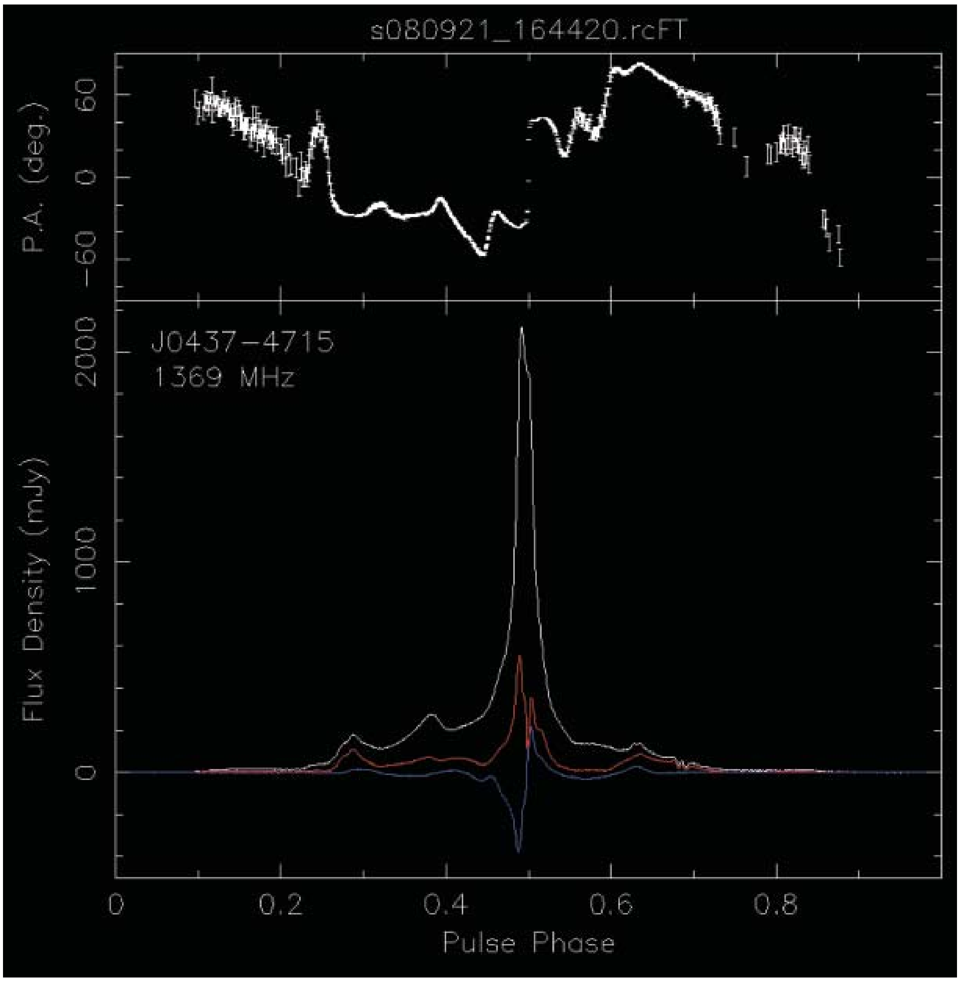
The ability to support user-supplied instrumentation on Parkes has always been one of the telescope's strengths. Maik Wolleben and Tom Landecker of the Canadian DRAO arrived at Parkes in September with a 300 – 900MHz receiver. The receiver was successfully installed and used for the first observing session of the Global Magneto-Ionic Medium Survey, which aims to measure sky polarisation over both hemispheres from 300 to 1800 MHz.

Signal Processing at Parkes

A spin-off of the CABB work for the ATCA has been the development of pulsar digital filterbanks (PDFBs) for Parkes. There are now three operating PDFBs available at Parkes, and five systems have been built by the ATNF under contract to other observatories around the world including three in Europe and two in China.

During 2008 the two most recent models, PDFB3 and PDFB4 were installed at Parkes. These build on the success of their predecessor PDFB2. PDFB3 contains two CABB processors and digitisers, whereas PDFB4 contain one of each. PDFB4 has similar characteristics and performance to PDFB3 for normal pulsar timing, except for short period pulsars where PDFB3 has an advantage of extra processing power. PDFB3 and PDFB4 can also be used as spectrometers in both simple

The DRAO 300 – 900 MHz receiver being hoisted up to the Parkes prime focus. Credit: Maik Wolleben, DRAO.



A pulse profile of PSR0437-4715 recorded with PDFB3. Credit: Dick Manchester, CSIRO.

and time-binning modes. PDFB3, for example, can be used as a two-frequency, dual-polarisation spectrometer with 8192 spectral channels over two 256 MHz bandwidth bands.

Radio astronomy commonly suffers from the radio transmissions of civilisation, that is, radio frequency interference (RFI). An innovative technique for protecting the astronomical signals from RFI was introduced with the installation of PDFB3. This equipment supports an active RFI cancellation system to mitigate strong digital TV interference in the 50-cm band from a broadcast tower 200 km away. A small parabolic dish antenna mounted on a 15-metre tower provides a reference or template signal that is then processed concurrently in PDFB3 with the 64-metre astronomy signal. The template signal is cross-correlated with the astronomy signal and then subtracted, producing a clean astronomy signal.

The pulsar baseband recorder Caltech Parkes Swinburne Recorder Mark 2 (CPSR2) continues to be used, but is expected to be replaced in a year or two by the ATNF Parkes Swinburne Recorder (APSR) baseband system which is currently taking shape.

First test observations with a new 13-beam digital filterbank, the Berkeley Parkes Swinburne Recorder (BPSR), were made toward the end of the year. This system will allow higher time resolution, and much greater spectral resolution, than the analogue 13-beam filterbanks (400 kHz versus 3 MHz) and will also allow more bits of precision in sampling.

See page 50 in the Technology chapter for more information on PDFBs.

Mopra

Operation of the Mopra telescope has continued to be conducted from the Narrabri observatory. As well as being a very attractive single dish for millimetre-wave studies of the southern sky, Mopra continues to act as a platform for experimenting with new modes of operation. Experience gained in operating Mopra will be critical in the design of future operating modes for all ATNF telescopes. From early in 2008 Mopra observers have benefited from the Telescope Operator Alerting Device (TOAD), a software package similar in some respects to the Compact Array program ASSISTANCE, which presents telescope information graphically in an easily interpreted format. TOAD monitors the status of several hundred telescope, network and computing parameters and it alerts observers to any abnormal state and provides suggestions for recovering without consulting staff.

7-mm Receiver

Early in 2008 Mopra was outfitted with a 7-mm receiver. This opens the 30 – 50 GHz band for study with the 8 GHz digital spectrometer MOPS. The new receiver and telescope perform as expected over the 7-mm band, and it seems likely that the useable 7-mm season will be longer than the six-month 3-mm season. In combination with the telescope's 12-mm receiver, this new receiver gives Mopra access to the radio spectrum from 16GHz to 50GHz with only a 4 GHz gap from 26 to 30 GHz.

Summer use of Mopra at 12mm

The HOPS (H_2O Southern Galactic Plane Survey) team undertook a pilot study early in 2007 during the summer months and demonstrated that observations at 12 mm over summer nights could be made productively. During the summer months of early 2008 the team observed over 45 nights and were very pleased with the results; less than three per cent of the time was lost to weather and only a few technical difficulties were encountered.

Mopra Training Day

A Mopra training day was held on 25 March at Marsfield to introduce new users to observing procedures, to create a forum for discussion amongst ATNF staff and expert Mopra users, and to increase the information available by encouraging the speakers to document their Mopra knowledge in the form of presentation slides and tutorial notes. The day, organised by Kate Brooks and Balt Indermuehle, was very successful, and all presentations and tutorial material are available on the ATNF website.

Long Baseline Array

The Australian Long Baseline Array (LBA) operates as a Very Long Baseline Interferometer (VLBI) array using most radio telescopes around Australia. It includes all the ATNF antennas (Parkes, Mopra, ATCA), the Hobart and Ceduna antennas of the University of Tasmania, and antennas of NASA's Canberra Deep Space Communications Complex at Tidbinbilla. It also frequently operates in collaboration with overseas antennas, especially the Hartebeesthoek antenna in South Africa, the Kokee Park antenna in Hawaii, the Kashima antenna in Japan and the Shanghai antenna in China.

Operations

The Hobart and Ceduna VLBI operations continue to be supported under a contract between ATNF and the University of Tasmania, and this contract was reviewed and renewed in 2008. In October 2008, the Hartebeesthoek antenna suffered a major failure of a polar shaft bearing and became unavailable. To compensate for some of the lost transcontinental baselines, some LBA projects started using the 6-m Transportable Integrated Geodetic Observatory (TIGO) antenna in Chile and the 9-m O'Higgins antenna in Antarctica; both are elements of the International VLBI Service (IVS).

Table 1: LBA time allocation.

LBA allocated time	26 days (633 hrs)	
Scheduled proposal time	496 hrs	78%
Disk and network tests	82 hrs	13%
Set-up and fringe checking	~55 hrs	9%
e-VLBI (part of scheduled time)	~47 hrs	10%

Table 2: ATNF antenna observation time and success rates.

Telescope	Parkes	ATCA	Mopra	Hobart	Ceduna	Tidbinbilla	LBA
Hours observed	493	496	492	428	399	112	496
% success	94.5	98	96	97	96	82	92

All recorded LBA data were correlated in software using the Swinburne DiFX package. The contract with Swinburne University of Technology for LBA correlation expired in 2008 and a new contract was signed with the VLBI group at Curtin University of Technology. Additionally, the Curtin group will assist in developing processes and software to streamline the operation of the LBA.

During 2008, Long Baseline Array observations were conducted in five sessions, for a total of 26 days. Thirty-one observations were made and all wavelength bands (20-cm, 13-cm, 6-cm, 3-cm, 1-cm) were used for several observations. These observations were made as part of 19 separate proposals. Although the VLBI community is often perceived as being small in number, it is notable that there were 17 different principal investigators on the 19 proposals: nine from within Australia and eight from overseas. Four of the 31 observations were conducted as e-VLBI observations with the data from the ATCA, Parkes, Mopra and, on some occasions, Hobart telescopes being correlated in real time.

In the total of 26 days allocated to VLBI, significant time (approximately 20%) was devoted to tests, including setup and real-time fringe checking.

Overall the LBA achieved a 92% success rate and most of the telescopes continued with success rates > 95%. Most of the Parkes data loss was due to high winds. Some Tidbinbilla data were lost because of corrupted configuration files. A summary is given in Table 2.

e-VLBI developments

The three ATNF observatories (Parkes, Mopra, ATCA) are connected via the AARNet3 Regional Network with two 1 Gbps optic-fibre links. During 2008 the ATNF continued the development of the real-time VLBI data correlation (e-VLBI) that these links enable. The e-VLBI project aims to make the real-time generation of VLBI visibilities a routine part of LBA operations. Within Australia the University of Tasmania's Hobart antenna can also be used for e-VLBI, but data rates are limited to 128 Mbps by the speed of the Bass Strait link.

At Parkes, the new 18-node quad-processor Swinburne computer cluster (APSR) was used for the DiFX software correlator package, which significantly enhanced e-VLBI correlation capacity. In mid-2008, Curtin University of Technology acquired a new 16-node quad-processor cluster, which was installed at Narrabri. This will be used to further enhance e-VLBI software correlation capabilities.

In June 2008 an e-VLBI observation was organised to be conducted during the Shanghai international e-VLBI workshop. It involved the three ATNF telescopes (ATCA, Mopra, Parkes) and telescopes in China (Shanghai) and Japan (Kashima), all operating at 512 Mbps data rates. The data were streamed to the Parkes software correlator and processed in real time. This was the first time that e-VLBI was demonstrated at a correlator in Australia with data streamed into the country from overseas telescopes. The observation was controlled remotely from the conference room in Shanghai. It ran for more than eight hours, produced valuable science results and attracted considerable publicity in many countries.

Tidbinbilla Single-Dish Astronomy

Access to antennas at the Canberra Deep Space Communications Complex (CDSCC) at Tidbinbilla is provided under the Host Country Agreement with NASA and made available to the astronomical community through the ATNF. The 70-m antenna provides the most sensitive system in the southern hemisphere in the 12-mm band and has been used with considerable success for sensitive single-dish astronomy observations. The new 13-mm receiver at Parkes is three times as sensitive as its predecessor, but remains less sensitive than the Tidbinbilla 70-m antenna. Tidbinbilla single-dish observations are taken in a service-observing mode with typically 200 hours of observing time available in a year.

Following the departure of key staff, the level of support to be provided by the ATNF for single-dish spectroscopy at Tidbinbilla has been reduced until recently. An arrangement has now been implemented in which service observations will be taken by the CDSCC Radio Astronomy Engineer, Shinji Horiuchi, while the ATNF will provide in-kind support. This will include announcements of opportunity and time allocation processes, the maintenance of Tidbinbilla-related web information and engineering support for specialised ATNF equipment. Jimi Green (ATNF) will liaise with and provide advice to Shinji in his role of astronomy support and is now the ATNF point of contact for Tidbinbilla enquiries.

Other Activities

Spectrum Management

Spectrum management relating to the protection of radio astronomy has been an important activity for CSIRO since the 1970s. The ATNF has continued to support such activities and at present is involved in the following areas:

- Participation in national spectrum planning and protection activities through the Australian Communications and Media Authority (ACMA). This involves not only national spectrum planning issues, but also participation in International Telecommunications Union (ITU) study groups and preparations for world radio conferences;
- Participation in regional and international meetings under the auspices of the ITU. The primary activity is the regular meetings of ITU Working Party 7D (Radio Astronomy) in Study Group 7 (Science Services). This group is responsible for all technical studies and ITU recommendations for the protection of radio astronomy;
- Participation in IUCAF (Scientific Committee on the Allocation of Frequencies for Radio Astronomy and Space Sciences), an inter-union committee of the International Astronomical Union, International Union of Radio Science (URSI) and Committee on Space Research (COSPAR). IUCAF has been very active in ITU meetings and has had a significant impact on study group and world radio conference deliberations.
- Participation in the Radio Astronomy Frequency Committee in the Asia Pacific region (RAFCAP), which promotes awareness of radio astronomy and protection of the radio spectrum in the Asia Pacific. RAFCAP works closely with the regional spectrum management group, the Asia Pacific Telecommunity (APT).

After the World Radiocommunications Conference (WRC) in 2007, a new ITU study cycle began which will culminate with WRC2011. In 2008, there were two meetings of ITU Working Party 7D (WP7D), where studies related to WRC2011 agenda items commenced. Many agenda items impact in some way on radio astronomy but the most direct is Agenda Item 1.6 on "Spectrum usage by passive services between 275 and 3000 GHz, and procedures for free-space optical communications links". ATNF is coordinating this agenda item in the Australian processes led by ACMA.

An important item for WP7D is the production of an ITU report on radio quiet zones. Work on this commenced in October 2008 and included two contributions from the ATNF: RALI MS31 described the radio notification zones around present radio telescopes in Australia and RALI MS32 described the radio quiet zone at the Australian candidate SKA site.

In February 2008 a RAFCAP meeting was held in Pune, India, where RAFCAP activities were reviewed and work planned for the new study cycle. At this meeting Australia assumed the chairmanship of RAFCAP.

Australia continued to be active in other international fora, and in 2008 participated in spectrum meetings at the COSPAR assembly (Montreal, July 2008) and the URSI assembly (Chicago, August 2008). Some of these activities were coordinated by IUCAF, and in this period IUCAF was reorganised and ATNF assumed the vice-chairmanship of the organisation.

Outreach and Education

Education, Teacher Workshops and Public Events

ATNF offered a variety of professional development events for teachers across Australia in 2008. Our main event, the three-day *Astronomy from the Ground Up!* workshop, was held at Parkes in May and attracted teachers from several states. They heard talks on a range of astronomical topics from ATNF staff and other presenters. The fine weather allowed participants the chance to ride on "the Dish", tour the telescope and have a successful viewing night.

Astrophysics for Physics Teachers, a one-day workshop, was held at Marsfield in April and focused on the requirements of

Students enjoying the astronomy day activities at Pia Wadjarri Remote Community School, assisted by Mary Mulcahy (CSIRO), Steven Tingay (Curtin University of Technology) and Megan Argo (Curtin University of Technology) respectively. Credit: Rob Hollow, CSIRO.

the NSW Physics course. Scott Fisher, the Gemini Outreach Scientist, presented a very successful *Live from Gemini* session from the Gemini control room at Hilo, Hawaii, via videoconference during the workshop.

Building on the success in 2007 of collaboration with the Victorian Space Science Education Centre (VSSEC), ATNF's Education Officer, Rob Hollow, ran another one-day workshop for Victorian teachers at the VSSEC in April. The Parkes workshop model was also transferred to Queensland in collaboration with the Queensland Department of Education and the University of Southern Queensland for *Mission Astronomy* in August. Rob also presented workshop sessions in collaboration with the SPICE program at the University of Western Australia in Perth and at several other science teacher conferences in Victoria, NSW and Queensland.

In October, Rob and Mary Mulcahy (Communications and Outreach Manager) visited Pia Wadjarri Remote Community School along with astronomers from Curtin University of Technology. Yalgoo Primary School also made the trip to Pia for a busy day of astronomy activities. Unfortunately, cloudy weather prevented the viewing night from going ahead. Rob also visited Northam, Geraldton and Kalgoorlie in November as part of Astronomy WA's regional tour with Professor Fred Watson from the Anglo-Australian Observatory and Pete Wheeler from Scitech. Teacher workshops, public talks and viewing nights were held at each location.

ATNF staff participated in other public events during 2008. Highlights included Professor Ray Norris' involvement in the Garma Indigenous Festival and in the National Science Week Fair at Nhulunbuy in the Northern Territory, and Dr George Hobbs toured the Albury-Wodonga region for their Astronomical Society following *Border Stargaze* in August.

The Compact Array marked its 20th birthday on Saturday 19 July with an open day that drew more than five hundred visitors. Visitors were given guided tours of the antennas, quizzed astronomers in the control room, heard talks on different aspects of astronomy, and yarned with staff about the cosmos. In the two weeks leading up to the open day the Compact Array hosted an Artist-in-Residence, awardwinning artist Christine Hill. During the residency Christine painted pictures of people and daily life at the observatory, held workshops for school children who painted their interpretations of space, and culminated the residency at the open day with an exhibition and interactive public activities.

PULSE@Parkes

Following a successful trial and launch in late 2007, the *PULSE@Parkes* program developed in 2008 with one school group per month visiting Marsfield to observe pulsars remotely using the Parkes telescope. A typical session involves a class of students in Years 10 to 12 having a two-hour observing slot on the telescope. They are able to observe several pulsars in this time and begin their data analysis. Schools receive a pre-observing visit from a project member who introduces them to radio astronomy, pulsars and observing requirements.

Almost 150 Australian students had the opportunity to control the telescope in 2008. One session was held as part of the SPICE program at the University of Western Australia's Centre for Learning Technology, which involved students from four schools from across the state. Sessions in other states are planned for 2009. US high school students also took part via our collaboration with the University of Texas, Brownsville (UTB). Rob Hollow visited UTB and presented several sessions at their summer school for high school students in June after giving a talk about *PULSE@Parkes* at the joint American Astronomical Society/Astronomical Society of the Pacific meeting in St Louis, USA.

Summer Vacation Program

ATNF hosted nine summer vacation scholars in the 2008 – 2009 program, all based at Marsfield. They undertook research projects in astrophysics and engineering under the supervision of ATNF staff.

A four-day observing trip to the Compact Array at Narrabri led by Dr Ángel Rafael López-Sánchez saw each group of three students use a twelve-hour observing slot on the array for an observing project that they had developed.

The program concluded with a joint ATNF and Anglo-Australian Observatory student symposium at which students gave talks about their projects and observations. The talks demonstrated a diverse range of research topics and the dedication of the students to make the most of their experiences. One measure of the ongoing success of the summer vacation program is the number of former scholars currently undertaking PhDs with co-supervision provided by ATNF staff.

Health, Safety and Environment

The ATNF is committed to the zero harm of our staff, students, visitors, clients and the environment, striving for pro-active involvement of all staff and promoting a positive safety culture.

In support of the CSIRO Corporate Health, Safety and Environment Strategic Plan (2007 – 2011), and to achieve our aim of zero injuries and occupational incidents, we focus on:

- Visible executive leadership;
- Appropriate education and training at all levels;
- Identification and elimination or control of hazards;
- Development and ongoing improvement of safe work systems;
- Promoting a positive safety culture, awareness and behaviour;
- Participation in and promotion of health and wellbeing programs;
- Effective contractor management;
- Routine reporting and investigation of hazards and incidents;
- Preparing for and effectively responding to emergencies and crises;
- Ensuring staff recognition.

The ATNF incurred a zero lost time incident rate per million hours worked (indicating zero work time was lost as a result of workplace injuries) for the 2008 period.

Staff commitment to health and wellbeing in the workplace was once again highlighted by the participation of our staff in programs and events including, but not limited to, the following areas:

Environmental Awareness Programs

- Recycling initiatives have been implemented which see a wide variety of waste being recycled including paper and cardboard, batteries, electronic waste, Styrofoam, fluorescent light tubes, plastic and scrap metal;
- Staff assisted in tree planting across all ATNF sites;
- The ATNF purchased new petrol-electric hybrid cars and electric buggies for staff use and implemented a new replacement vehicle policy;

- An extensive rain water harvesting program has been completed at the Parkes Observatory.

Health and Wellbeing Programs

- Staff across ATNF have been putting on their pedometers and competing in the Global Corporate Challenge;
- To raise awareness and funds for the Cancer Council, an *Australia's Biggest Morning Tea* was organised;
- Marsfield held a barbeque to celebrate and thank the staff in HSE Corporate Citizenship roles for their dedication and enthusiasm;
- As a part of the CSIRO Musculoskeletal Strategy, staff have been participating in workstation ergonomic assessments and implementing the "WorkPace" break and exercise software.

Continuous Review and Improvement Initiatives

- Health, Safety and Environment (HSE) modules were implemented across CSIRO which allow the recording and follow-up of incidents and hazards;
- A review was conducted of electrical certification of staff members which led to the implementation of an electrical authorisations process;
- Bi-monthly housekeeping inspections which assist in the identification and control of hazards in the workplace are conducted.

Training and Education

- To ensure all staff are aware of their HSE responsibilities, ongoing induction programs have been implemented for new and transferred staff, visitors and contractors;
- Staff at Parkes underwent safe working at heights and elevated work platform training to reduce the risk of injury and incidents relating to falls from heights;
- A defibrillator was purchased for the Marsfield site;
- Annual training for first aid officers was held, including advanced resuscitation;
- Emergency response training for fire and building wardens was conducted, which included bomb threat training and hands-on fire extinguisher training.

The ATNF will continue to develop and monitor safety in the workplace and strive for zero harm in 2009.

Human Resources

The individual members that comprise ATNF staff are undoubtedly our greatest asset. They are to be commended for their dedication and expertise as this ensures the ATNF's continued provision of world-class facilities for astronomical research and the technological advances required for next generation astronomy.

The ATNF had a staff complement of around 185 people by December 2008. Six post-doctoral fellowships were filled during the year by exceptional individuals from around the world. Our staffing expertise supports our progress towards ASKAP, the development path that aims to achieve the next generation radio telescope, the Square Kilometre Array, in addition to continued excellence in world-class astronomy research.

Our people again adapted extraordinarily well to changes in technology and processes introduced in 2008 as part of CSIRO's ongoing strategic change program. They overcame glitches and frustrations encountered along the way. Science Investment was once again allocated through themes aligned to our strategic direction.

National Facility Operations underwent an organisational restructure in July 2008 to create separate Science Operations and Engineering Operations structures across all sites in readiness for the gradual transition to operation of ASKAP (see page 38 of the Operations chapter for more detail). Continued emphasis is placed on our ongoing ability to attract the high calibre of people we need, when we need them, and to address staff development needs through the CSIRO matrix line management structure to ensure that our future capability is optimally planned, developed, deployed and rewarded in order to meet ATNF's and CSIRO's strategic objectives.

5.
Technology

A next-generation pulsar digital filterbank and 13-mm receiver were installed on the Parkes radio telescope in 2008.

Credit: John Sarkissian, CSIRO.

Technology

Compact Array Broadband Upgrade

The Compact Array Broadband Upgrade (CABB) project is the ATNF's most ambitious and expensive upgrade project. It is aimed at increasing the simultaneous observing bandwidth of the Compact Array sixteen times from 128 MHz to 2 GHz, complementing the existing broadband millimetre-receiving systems. Additionally, CABB is a multi-bit digitising system rather than a traditional 1- or 2-bit radio astronomy system that will allow it to operate in a polluted radio environment.

The project team is on track to install CABB in March 2009 after encountering a number of setbacks during the year. These have included the significant challenges inherent in fabrication of extremely complex circuitry, particularly in the signal processing circuit board, and the supply of incorrect materials.

These setbacks delayed the early implementation of a single-frequency CABB system operating in a piggy-back mode, but this was achieved by July 2008. The antenna and control building hardware, as well as the high speed, high bandwidth data transmission system, were shown to perform well. A comparison of observation results from the 20-year-old Australia Telescope correlator and the interim CABB system engendered great confidence that the new system would perform as required. The interim system also allowed the development and testing of firmware and software, and produced 2 GHz, full polarisation cross-correlated products from five antennas. The correlator operated in continuum mode, while the development of zoom modes and a tied array configuration (required to undertake spacecraft tracking) will continue in 2009.

A parallel and important development is the design and fabrication of modules to interface the signals from the existing suite of centimetre receivers to the CABB system, which will be completed early in 2009. Less signal "massaging" within the modules is necessary at the 3-cm and 6-cm bands than at the longer wavelength 20-cm and 13-cm bands. These latter bands require up-conversion to the CABB input frequency band of 4 – 12 GHz.

In 2009 the project team will focus on delivering and testing major components (digitiser, rear transition module, digital filterbank signal processor, conversion and local oscillator modules) to complete the system's hardware requirements. These will be installed in antennas as they become available to lessen the effort required during the estimated six-week shutdown in March when the "point of no return" is reached and the long-serving Australia Telescope correlator is switched off to make way for the next generation system.

This significant break in observations will enable the removal of many redundant modules from the antennas and the relocation of the antenna CABB rack to its final position.

Refer also to page 39 of the Operations chapter for information on CABB.

Pulsar Digital Filterbank – Parkes

One of the principal scientific objectives of pulsar work at Parkes is high precision timing of millisecond pulsars. Such observations can be used to investigate binary and stellar evolution, test theories of relativistic gravity, establish a pulsar time scale and may make the first direct detection of gravity waves. In order to avoid the perturbing effects of the interstellar medium these observations are best done at high frequencies, but pulsars have steep radio spectra so they are relatively weak radio sources at higher frequencies. Therefore good quality receivers and wide bandwidths are required. The wide bandwidth signals are processed by the generations of pulsar digital filterbanks (PDFBs) that have been developed by the ATNF Engineering Group.

This project reached a major milestone in June 2007 with a 1 GHz bandwidth, multi-channel spectrometer/polarimeter (PDFB2) commissioned at Parkes. In March 2008, an even more powerful version of the system (PDFB3) was installed that uses two CABB signal processing boards to provide more processing power and to allow real-time mitigation of radio frequency interference (RFI) from a known source. Apart from some intermittent failures, the basic folding mode of PDFB3 worked well from the outset. Remaining problems have largely been solved and the system is in routine use. Search mode commissioning took longer but this is now also working satisfactorily with 1-bit, 2-bit, 4-bit and 8-bit modes available.

Real-time adaptive filtering of RFI was first proved in a Marsfield laboratory test and was later installed in PDFB3 and shown to be functional. This technique uses a separate antenna pointed at the RFI source. The RFI signal is correlated with the astronomy data to identify and remove the RFI from the astronomy channels.

The ATNF Parkes Swinburne Recorder, the next-generation baseband system being developed in collaboration with the Swinburne University of Technology group, was commissioned during 2008. This system uses PDFB3 as a front end to digitise the data and form contiguous baseband channels across the total bandwidth. Only one observing mode was available at the end of 2008, and more work will be needed to complete the suite of observing modes required for full functionality and routine observing.

See also page 40 of the Operations chapter for information on PDFBs.

Pulsar Digital Filterbank – External Contracts

The supply of PDFB systems to observatories in Britain, China, Germany and Italy was accomplished in November 2008.

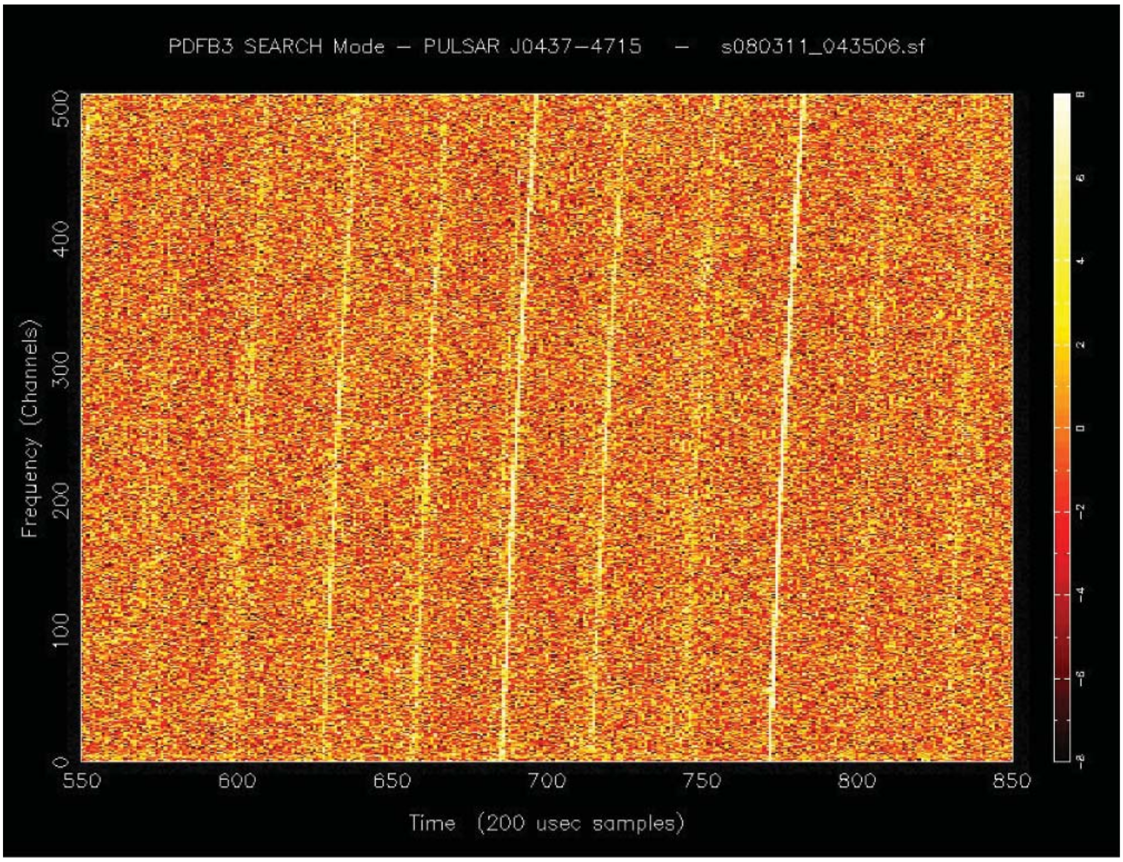
Engineers from a number of these observatories visited Marsfield in October 2008. This allowed the visiting engineers to develop an understanding of the principles of operation as well as gain practical experience in disassembly and reassembly to allow them to commission the instrumentation at their home institutions. Testing in a piggy-back mode with existing instrumentation at Parkes allowed verification of each system's functionality.

ATNF engineers will be available to support the international observatories during commissioning of the PDFB systems.

Parkes 13-mm Receiver

In September 2008 a new 13-mm (K-band) receiver that makes use of devices developed as part of the MNRF program, including low noise amplifiers and an ortho-mode transducer, was deployed on the Parkes telescope replacing the existing 16-year-old system. Initial measurements suggest an improvement of approximately 4 dB (a factor of approximately 2.5) in sensitivity over the old system, heightening expectations that it will open up numerous new science targets and greatly increase observing efficiency and science outcomes in the 18 – 26 GHz band.

A planned mid-2008 installation was delayed by the diversion of effort to other projects that demanded immediate



Pulsar digital filterbank output displaying the varying intensity of received pulses and their dispersion. The signal is visible as the near vertical yellow lines against the noisy orange background. The pulsar period is indicated by the spacing between the lines. The dispersion is evidenced by the deviation of the lines from the vertical indicating a different arrival time as the frequency of signal increases. Credit: Dick Manchester, CSIRO.

Mark Bowen and Ken Reeves during the installation of the new 13-mm (K-band) receiver at the Parkes telescope in September 2008. Credit: Henry Kanoniuk, CSIRO.

attention as well as the detection of an anomaly in the output response of the receiver near 18 GHz. Electromagnetic modelling and experimentation indicated that the anomaly was the result of the geometry of the input waveguide and modifications to the design resulted in a receiver output that matched expectations.

The delay was used to undertake a "dry" run for the eventual installation and many mechanical and electronic interfacing requirements were able to be resolved. This also allowed for "rapid" installation in September followed by a short observing period that resulted in the detection of a new H_2O maser. Preliminary measurements indicate a receiver temperature of approximately 25 Kelvin and system temperature of approximately 60 Kelvin. Construction of spare modules is underway and comprehensive commissioning tests to fully characterise the receiver will be undertaken in 2009.

The receiver was utilised to demonstrate a novel technique to minimise baseline ripple in spectra that result from signal reflections from the telescope structure and which are unavoidable. An up and down cycling of the focus platform around the true focus showed that it is possible to "smear" the ripple and suggests this technique has the potential for improving observations in the place of more expensive and complex schemes.

Technologies Outlook

The development of the technologies required to make the Australian SKA Pathfinder project a success will mean that many of the staff currently involved in the projects highlighted above will transfer their expertise to the challenges associated with the new telescope. As such, the number and size of projects able to be undertaken within the Technology theme will necessarily lessen with priorities being the equipping of the CABB system with greater functionality, and the continued development of a broadband 20-cm and 13-cm system. Additionally, the support of current instrumentation at the ATNF observatories, and the rationalisation and consolidation of this instrumentation, is likely to form a significant part of the focus of the group.

6.
The SKA and the Australian SKA Pathfinder

ASKAP's prototype phased array feed was installed on the Parkes Testbed Facility in July 2008.

Credit: David McClenaghan, CSIRO.

The SKA and the Australian SKA Pathfinder

Development of the Australian Square Kilometre Array Pathfinder (ASKAP) and participation in the international Square Kilometre Array (SKA) program continued to be strategic priorities for the ATNF during 2008.

In June, CSIRO submitted documentation on the ASKAP project to the Commonwealth Parliamentary Standing Committee on Public Works, which is tasked with reviewing proposed expenditure of public money, and preparing and presenting reports and recommendations for Parliament. The hearings took place on 1 October in Geraldton and the Committee's report, expressing support for the ASKAP project as part of the continued development of radio astronomy in Australia, was tabled in the Commonwealth Parliament on 1 December. The motion was approved by Parliament on 3 December.

The progression of the ASKAP project meant that approximately 80 staff (60 full-time equivalents, from the ATNF and CSIRO ICT Centre) spent all or a portion of their time on ASKAP. During the year an ASKAP Regional Manager based in Geraldton, Priscilla Clayton, was appointed. The project continued to be led by the ATNF Assistant Director and ASKAP Theme Leader, Dave DeBoer, and Project Manager Antony Schinckel.

Administratively, ASKAP is divided into three areas:

- ASKAP the telescope, which will develop and demonstrate a large field-of-view, state-of-the-art antenna array and deliver as a National Facility;
- Murchison Radio-astronomy Observatory (MRO), which will develop and demonstrate the site as the premier m/cm-wave radio observatory in the world;
- SKA, which (within its context) will demonstrate Australia's ability to host the SKA and shape its technology.

The Australian Candidate SKA Site

ASKAP will be located at Australia's SKA candidate site, the MRO, in Western Australia's Mid West region.

Further protection for the MRO radio quiet zone was put into place during 2008 with the Western Australian Government adopting the technical standards and assessment procedures recommended by CSIRO to manage its declared Mineral Resource Management Area (MRMA) under the WA Mining Act. The conditions require the licensee or lessee of all new mining leases and licences within 80 km of the centre of the MRO to submit a plan of activities to the Western Australian Government for approval. A duly approved radio quiet management plan must be included with any program of work or mining proposal submitted to government for those mining activities that fall within the MRMA zone. The extremely low population density of the surrounding region and the radio-quietness protection being implemented in Australia will ensure that this pristine area remains preserved for radio astronomy down to the very sensitive levels that will be required for the SKA.

During the course of the year, CSIRO decided to pursue securing the pastoral lease to Boolardy Station (on which the MRO is located), commenced negotiating an Indigenous Land Use Agreement, and started making other site preparations as required by relevant legislation.

Australian SKA Coordination Committee

CSIRO is an active member of the Australian SKA Coordination Committee (ASCC), or "Team Australia", an intergovernmental body of senior officials to coordinate Australia's SKA activities at State and Federal levels. The ASCC Secretariat is hosted by the Science and Research Division of the Commonwealth Government Department of Innovation, Industry, Science and Research (DIISR).

In April, Team Australia hosted two weeks of meetings and events for the international SKA community in Perth. Highlights included the International SKA Forum on 9 April, a major conference on SKA pathfinder science, an SKA Science and Engineering Committee meeting, and the inaugural meetings of the SKA Preparatory Study Working Groups.

Australian Industry Involvement

As the ASKAP project progresses there has been a steady increase in industry engagement activities. The focus of these activities is now shifting from overview and planning briefings for industry to practical engagement and involvement.

Two editions of the *Australian SKA Industry Capabilities Directory*, launched in April, have been published to showcase Australian-based businesses with SKA-relevant capabilities. The Directory is available online with new businesses able to register at any time. More than 350 businesses were included in the Directory at the end of 2008.

In September Senator Kim Carr, Minister for Innovation, Industry, Science and Research, launched the *ASKAP Industry Opportunities Register*, which outlines the technology and infrastructure requirements of ASKAP to 2012 where industry partnerships are needed. The Register and a companion pamphlet, the *Australian Industry Participation Plan*, are also publicly available from the ASKAP website. Both have received very positive feedback from industry and other stakeholders.

The Australian SKA Industry Consortium (ASKAIC), a group of companies with a strong interest in ASKAP and the SKA, continued to support the projects and meet regularly to plan collaborative, self-funded activities to support the Australian SKA bid. In November, ASKAIC hosted a "CEO's dinner"

ASKAP team members at CSIRO's Marsfield site in May 2008. Credit: Tim Morison, Patrick Jones Photographic Studio.

at Parliament House in Canberra, and later in the month 18 ASKAIC members visited Parkes Observatory to view the Parkes Testbed Facility, the 64-m dish and hold a regular ASKAIC steering committee meeting.

General industry briefings have continued and are complemented by regular editions of the ASKAP industry e-newsletter. Copies of all information distributed to industry stakeholders, presentations and updates can be found at www.atnf.csiro.au/projects/askap/industry.html.

ASKAP Science

During the year an ambitious science program for ASKAP was outlined in "Science with ASKAP", a paper published by ATNF staff and key collaborators in the journal *Experimental Astronomy*. The paper examines the seven main science themes that have been identified for ASKAP: extragalactic HI science, continuum science, polarisation science, Galactic and Magellanic science, VLBI science, pulsar science and the radio transient sky.

In order to realise the science goals set for ASKAP, the project team finalised the ASKAP configuration on the MRO site. A visit by Jim Condon (VLA, NRAO) proved useful in optimising the resolution for the ASKAP continuum survey, including considerations of the confusion limits and surface brightness sensitivity.

An ASKAP User Policy Taskforce was set up to determine telescope access policies for both large surveys and smaller general science experiments. In October a Draft User Policy for ASKAP was drawn up after consultation with the general astronomy community as well as specific input from the Australia Telescope Steering Committee.

In November a call for Expressions of Interest (EOI) to submit proposals for an initial set of ASKAP Survey Science Projects was released to the international astronomy community. EOIs are the first of a three-stage process to define large Survey Science Projects that will utilise approximately 75% of ASKAP's observing time during the first five years of its science operations. By the December deadline a total of 38 submissions from 608 investigators in 10 different countries, representing a total requested telescope observing time of over 24 years, had been received. The next stages in the process, to be conducted in 2009, are evaluation of the EOIs and issuing invitations to submit full ASKAP Survey Science Project proposals. The strong response to the call for EOIs has provided an outstanding demonstration of the vibrancy of the international astronomy community, and of the potential for ASKAP to deliver groundbreaking science.

ASKAP System

ASKAP will be a wide field-of-view, survey radio telescope with:

- Total collecting area approximately 4000 m^2, 36 antennas, each 12 metres in diameter;
- System temperature of less than 50 K;

- Frequency range 0.7 to 1.8 GHz;
- 300 MHz instantaneous bandwidth with high-resolution and continuum modes;
- A field-of-view of approximately 30 square degrees;
- Maximum resolution of 8 arcseconds.

The illustration below shows the ASKAP system and data flow. The antennas will be deployed in an optimised 6 km configuration on the MRO grounds adjacent to the control building, which houses the beamformers and correlator. The data will then be transmitted over a dedicated optical fibre link to the processing computer. The processed data products will be archived and accessed via the ASKAP Science Data Archive Facility (ASDAF).

ASKAP project staff are structured into Integrated Project Teams (IPTs) along technical and management lines, with a motivated System Engineering, Integration and Commissioning IPT to keep the focus on the overall system.

Phased Array Feed and Antenna Design

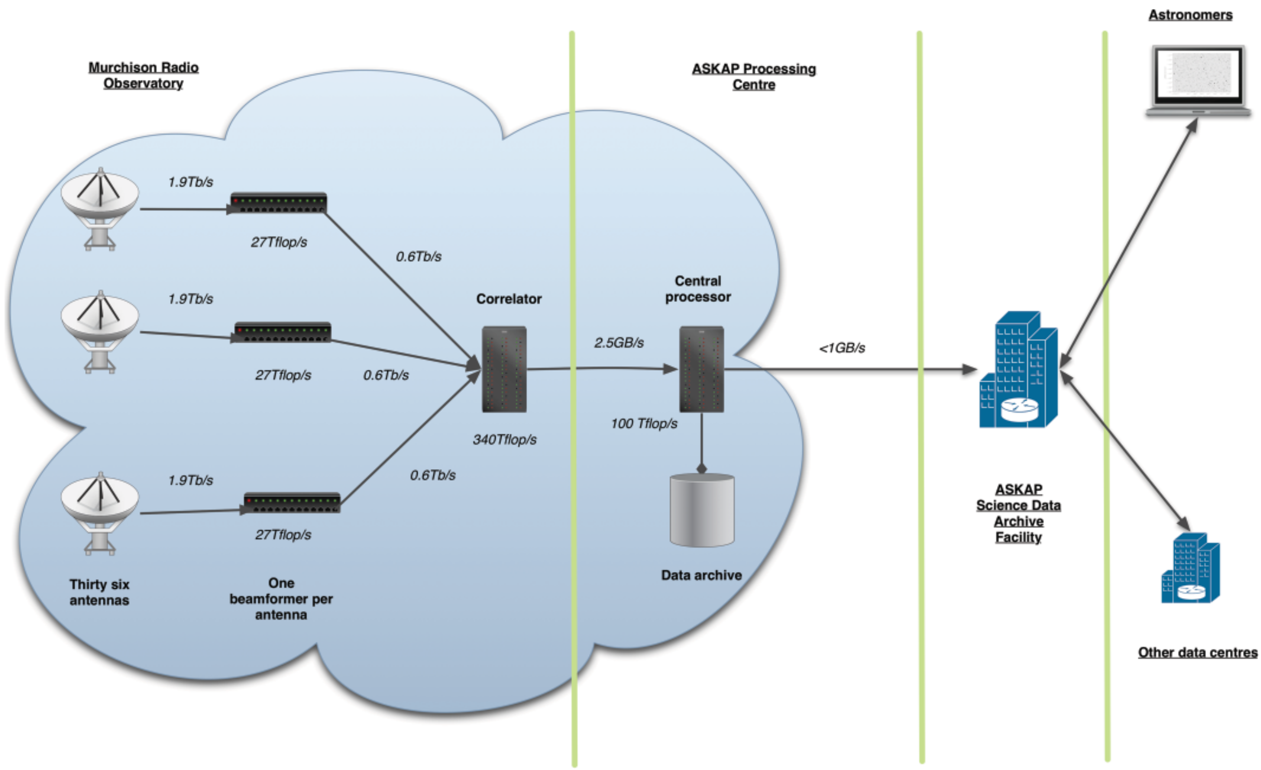
ASKAP is pioneering the use of phased array feeds (PAFs) in dish antennas for radio astronomy.

The PAFs will be receive-only phased arrays used with parabolic reflector dishes to provide an instantaneous wide field-of-view. The aim is to produce the wide field-of-view capacity using multiple simultaneous electronic beams of more than an octave bandwidth, without substantial degradation in antenna gain/efficiency, noise temperature, sidelobes or stability compared to the best single-horn feed with cryogenic cooling in current use for radio astronomy.

ASKAP engineers, led by Dr John O'Sullivan, have modelled and prototyped a "chequerboard" PAF solution, which will use low-noise amplifiers specifically designed for the array, while collaborators in the Netherlands, Canada and the UK are investigating alternative PAF architectures (for example, wideband Vivaldi-type PAFs) that also show great promise.

In August the ASKAP team achieved "first light" with the prototype chequerboard PAF on the newly commissioned 12-m antenna at the Parkes Testbed Facility (see also page 57). The results were very encouraging with a remarkable degree of agreement between the measured and predicted performance, which underlines the team's deep understanding of the physics of these systems. While there are still many challenges to be solved with these systems the results achieved to date are very promising and indicate the retirement of some of the greatest technical risk involved in the ASKAP project.

The tender process for antenna construction was initiated early in 2008. A Request for Tender was formally released through AusTender in mid-March and interested parties



The ASKAP data flow process. Credit: Tim Cornwell, CSIRO.

were invited to an information session at Marsfield where the antenna specifications were presented. The tender period closed in May and an evaluation process was run to the plan set out in the Tender Header Document, with visits being made to shortlisted tenderers.

In November CSIRO announced that the contract for the antennas was awarded to the 54th Research Institute of China Electronics Technology Group Corporation (known as CETC54). CETC54 will supply thirty-six 12-m antennas for under A$10 million, meeting a key cost target of under A$300,000 per antenna.

Parkes Testbed Facility

During 2008 the commissioning of the Parkes Testbed Facility (PTF), a 12-m diameter prime focus antenna built by Patriot Antenna Systems at Parkes Observatory, continued in preparation for ASKAP. Although the functional specification and design of the 12-m antenna differs from that for the actual ASKAP antennas it will provide a single dedicated system to test successive generations of PAFs in readiness for ASKAP itself.

The antenna is equipped with a feed rotator at the prime focus to allow the PAF to maintain a constant parallactic angle during observations. This "de-rotation" of the sky means that the data stream from the PAF will be significantly easier to process in the imaging software. An ASKAP-style beamformer, antenna control and monitoring systems are all housed in the PTF pedestal, and a trial earth–air heat exchange ventilation system provides cooling to these sensitive components.

In February the 12-m antenna pedestal, feedleg structure and reflector were assembled on site, approximately 400m east of the 64-m Parkes radio telescope. A significant milestone was met in July when a prototype PAF was hoisted onto the antenna. Shortly afterwards, the ASKAP team captured signals from eight of the total 40 elements and "first light" was declared. In September, successful interferometry was conducted between the 12-m antenna and the Parkes 64-m dish using all 40 elements of the PAF, a major step in demonstrating that the array performs as expected. The PAF was returned to Marsfield in late November for refitting with upgraded components.

ASKAP Processing and Computing

In 2008, a number of third-party software platforms were systematically evaluated against the telescope's requirements. The Experimental Physics and Industrial Control System (EPICS) was adopted for telescope monitor and control, and Message Passing Interface/Internet Communication Engine (MPI/ICE) adopted for the high performance computing pipelines. Several possibilities were also assessed for the

Construction of the Parkes Testbed Facility in February 2008. Credit: John Sarkissian, CSIRO.

high performance hardware platform including multi-core chips, the Cell processor, a field-programmable gate array based co-processor, and graphics processing units. While the more specialised processors have substantial improvements in capability, in some scenarios they require substantial software development. A final decision on selection of the high performance hardware platform will be made as the project progresses.

A further area of attention was the development and benchmarking of the processing pipelines. A distributed imager capable of running on multiple computers in a cluster was developed and benchmarking enabled development of a quantitative model for the computing costs for ASKAP. This model will be refined further in the future but it did give initial estimates of the computer size required for ASKAP (about 10,000 cores).

In addition to the calibration and imaging distributed processing, a distributed version of the Duchamp source fitting was developed for forming catalogues of objects from the ASKAP images and spectral cubes.

Planning and design of a telescope operating system based on EPICS also started. This will be first tested on the Parkes Testbed Facility in 2009.

Great strides were made in developing the detailed design of hardware and firmware for the ASKAP digital system, and excellent feedback was received from the international panel that conducted a preliminary design review of the system in December 2008. New devices continue to be explored for reducing cost and power consumption in order to achieve an overall saving to the project.

An updated version of the ASKAP data and signal transport system diagram was developed, and the team worked on all of the "glue" in the system. Identifying and testing the best means for the analog transport from the feed was a priority, and coaxial cable was selected. Investigating "RF over fibre" continued for potential use in ASKAP's systems and also in the SKA.

Collaborator Projects

Three radio astronomy experiments are already making use of the superb radio-quiet environment at the MRO's Early Research Area: the Murchison Widefield Array (MWA), the Cosmological Reionization Experiment (CoRE), and Precision Array to Probe Epoch of Reionization (PAPER).

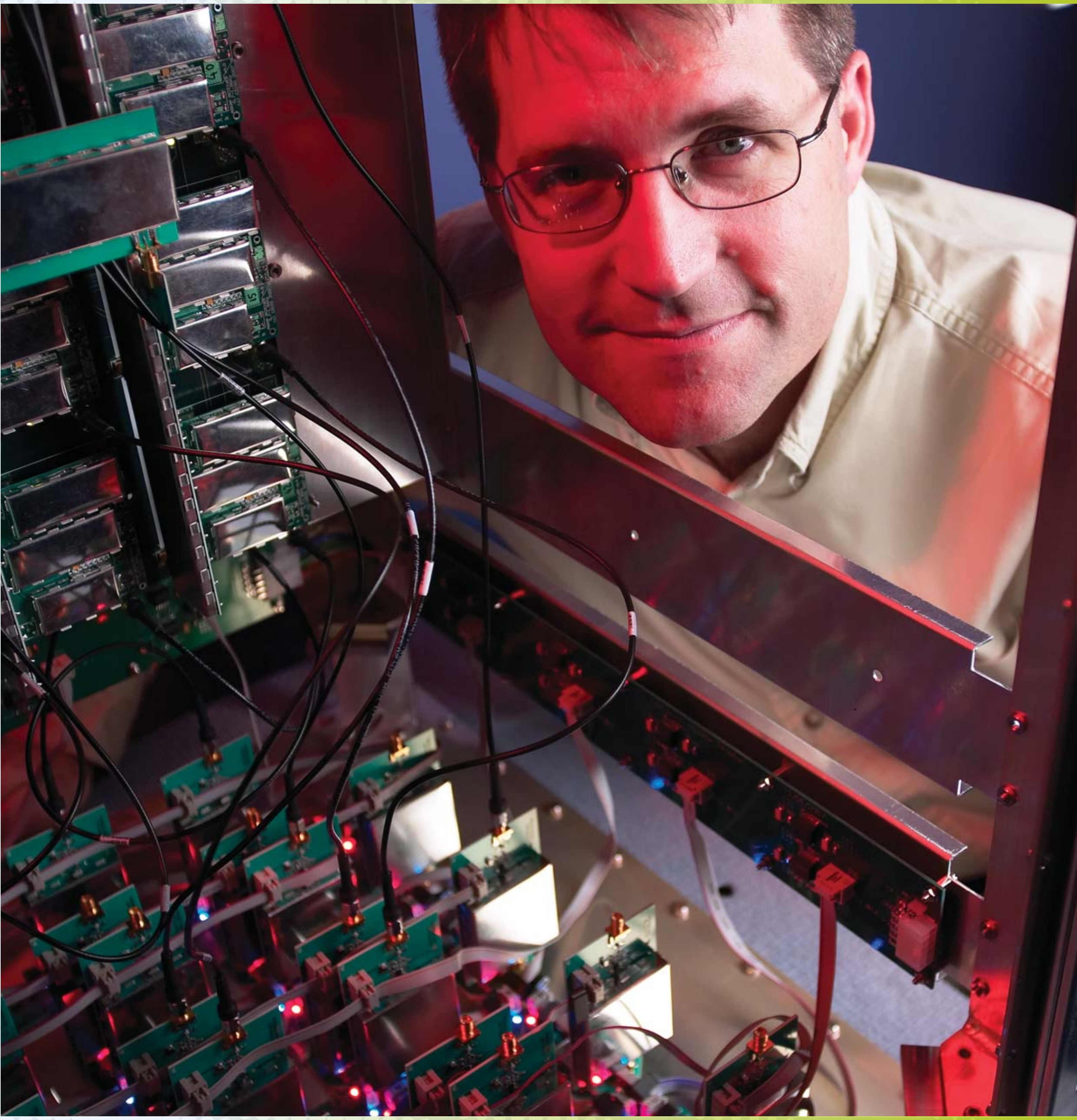
The MWA is an international collaboration between US, Australian and Indian institutions, including CSIRO, to build a wide-field dipole array concentrating on the low frequency range of the SKA specifications. The goal of the project is to develop powerful new capabilities for radio astronomy and heliospheric science at frequencies from 80 to 300 MHz, optimised for extremely wide fields-of-view and unprecedented sensitivity at those frequencies.

CoRE uses a unique log-spiral antenna to measure the sky spectrum with 1 mK relative accuracy over redshifts from 5.2 to 13.2. The aim of this experiment is to detect the redshifted 21-cm line of neutral hydrogen from the early Universe. This would indicate when the first stars and galaxies switched on. This is a joint project involving researchers from CSIRO, University of Sydney and Raman Research Institute, India.

PAPER is a growing collaboration between researchers in the US (the University of California, Berkeley, NRAO and University of Virginia) and Australia (Curtin University of Technology). The long-term goal of this experiment is to unveil the era in the history of the expanding Universe when the first stars formed about a billion years after the Big Bang. The intense ultraviolet and X-ray radiation from these stars heated the surrounding neutral hydrogen gas and caused it to glow at 21-cm wavelength, the electron/proton "spin-flip" emission line. The 21-cm emission is "stretched" by a factor of 10 in the expanding Universe such that present day detection of this relic radiation requires observation at 2-m wavelength.

During 2008 ATNF staff also continued their close collaboration with the University of Sydney on the Square Kilometre Array Molonglo Prototype (SKAMP) project, which aims to test and develop new technology for the SKA by producing a completely new digital signal pathway on the existing mechanical superstructure of the Molonglo Observatory Synthesis Telescope. There is strong collaboration between the SKAMP, ASKAP and MWA projects because of the underlying common correlation module, which is the heart of the signal processing system.

7. Appendices



ASKAP Theme Leader Dave DeBoer with a prototype receiver for the Parkes Tested Facility's focal plane array.

Credit: David McClenaghan, CSIRO.

A: Committee Membership

ATNF Steering Committee in 2008

Chair

Mr Brett Biddington, Cisco Systems

Members

Ex-Officio

Dr Matthew Colless, Director, Anglo-Australian Observatory

Dr Alex Zelinsky, CSIRO Group Executive, Information and Communications Sciences and Technology, and Director, CSIRO ICT Centre

Astronomers

Professor Anne Green, School of Physics, University of Sydney*

Professor Matthew Bailes, Swinburne University of Technology*

Professor Bryan Gaensler, School of Physics, University of Sydney

International Advisers

Professor Rajaram Nityananda, National Centre for Radio Astrophysics, Tata Institute of Fundamental Research, India*

Professor Mike Garrett, General Director ASTRON, Netherlands

Dr Anthony Beasley, Chief Operating Officer, NEON Inc, USA

Industry

Dr Bob Frater, Vice-President Innovation, ResMed*

Invited

Dr Brian Boyle, Director, CSIRO Australia Telescope National Facility

* These members agreed to continue to provide advice to the ATNF Director beyond the formal end of their term.

Australia Telescope User Committee in 2008

Chair

Dr Elaine Sadler, University of Sydney

Secretary

Dr Stacy Mader, CSIRO Australia Telescope National Facility (May 2008 – December 2011)

Members

Dr Stuart Ryder, Anglo-Australian Observatory (December 2005 – May 2009)

Dr Sarah Maddison, Swinburne University of Technology (October 2006 – June 2009)

Dr George Hobbs, CSIRO Australia Telescope National Facility (October 2006 – June 2009)

Dr Andrew Walsh, James Cook University (November 2007 – October 2010)

Dr Hayley Bignall, Curtin University (October 2008 – June 2011)

Dr Tara Murphy, University of Sydney (October 2008 – June 2011)

Dr James Urquhart, CSIRO Australia Telescope National Facility (October 2008 – June 2011)

Student Members

Daniel Yardley, University of Sydney (October 2008 – May 2009)

Clancy James, University of Adelaide (October 2008 – May 2009)

The Australia Telescope Steering Committee appoints members to ATUC. The new members usually start their first meeting in October/November and finish their three-year term after the May/June ATUC meeting in their last year. Students are appointed for one year (two meetings). Dates of first and last meetings are given.

Australia Telescope Time Assignment Committee in 2008

Chair

Dr Andrew Hopkins, University of Sydney

Members

Ex-Officio

Dr David McConnell, CSIRO Australia Telescope National Facility

Dr John Reynolds, CSIRO Australia Telescope National Facility

Dr Philip Edwards, CSIRO Australia Telescope National Facility

Dr Jessica Chapman, CSIRO Australia Telescope National Facility

Voting Members

Professor Matthew Bailes, Swinburne University of Technology

Dr Michael Burton, University of New South Wales

Dr Naomi McClure-Griffiths, CSIRO Australia Telescope National Facility

Dr Stuart Wyithe, University of Melbourne

Dr Baerbel Koribalski, CSIRO Australia Telescope National Facility

Dr Ray Norris, CSIRO Australia Telescope National Facility

Dr Indra Bains, Swinburne University of Technology

B: Financial Summary

The table below summarises the revenue and expenditure applied to CSIRO's radio astronomy activities, primarily within the ATNF but including the activities resourced from the ICT Centre.

	Year Ending 30 June 2008 (A$'000)	Year Ending 30 June 2007 (A$'000)
Revenue		
External	5,252	10,305
Appropriation	29,741	22,516
Total Revenue	34,993	32,821
Expenses		
Salaries	13,959	12,546
Travel	1,123	827
Other Operating	7,756	9,085
Corporate Support Services	5,131	5,516
Depreciation & Amortisation	3,452	3,350
Doubtful Debt Expense	0	0
Total Expenses	31,421	31,324
Profit/(Loss) on Sale of Assets	(222)	1
Operating Result	3,350	1,497

C: Staff List, January to December 2008

CANBERRA		
Jauncey	David	Astrophysics
MARSFIELD		
Allen	Graham	Engineering
Amy	Shaun	Operations
Axtens	Peter	Engineering
Ball	Lewis	Deputy Director ATNF
Barends	Anne	Executive Secretary to ATNF Director
Barnes	Caroline	Project Support Group
Bateman	Tim	Engineering
Beresford	Ronald	Engineering
Bolton	Russell	Engineering
Bonvino	Phillip	Engineering
Bourne	Michael	Engineering
Bowen	Mark	Engineering
Boyle	Brian	Director ATNF
Braun	Robert	Assistant Director: Astrophysics
Brooks	Kate	Astrophysics
Brown	Andrew	Engineering
Calabretta	Mark	Software Development
Carrad	Graeme	Assistant Director: Engineering
Castillo	Santiago	Engineering
Caswell	James	Astrophysics
Champion	David	Astrophysics
Chapman	Jessica	Operations
Chatterjee	Shami	Astrophysics
Chekkala	Raja	Engineering
Cheng	Wanxiang	Engineering
Chippendale	Aaron	Engineering
Chung	Yoon	Engineering
Clements	Peter	Engineering
Cook	Geoffrey	Engineering
Cooper	Paul	Engineering
Cornwell	Tim	Research Program Leader: Software Development
Crosby	Phil	Business Strategist
Cunningham	Shaun	Engineering
Davis	Evan	Engineering
De Souza	Ludovico	Engineering
Death	Michael	Engineering
DeBoer	Dave	Assistant Director: ASKAP
Dennis	Trish	Project Support Group
Doherty	Paul	Engineering
Drazenovic	Victoria	Operations
Dunning	Alexander	Engineering
Ekers	Ron	Astrophysics, Federation & CSIRO Fellow
Elton	Troy	Engineering
Emonts	Bjorn	Astrophysics
Feain	Ilana	Astrophysics
Ferris	Richard	Engineering
Forsyth	Ross	Engineering
Fraser	Vicki	Project Support Group
Frost	Gabriella	Project Specialist
Gain	Daniel	Engineering

Gale	Paul	Health, Safety and Environment Manager
Gough	Russell	Engineering
Green	James	Astrophysics
Gupta	Neeraj	Astrophysics
Guzman	Juan-Carlos	Software Development
Hakvoort	Eliane	Engineering
Hall	Peter	Engineering
Hampson	Grant	Engineering
Hobbs	George	Astrophysics
Hollow	Robert	Communications and Outreach
Humphreys	Benjamin	Software Development
Huynh	Minh	Engineering
Jackson	Suzanne	Engineering
Jackson	Carole	Project Specialist
Jeganathan	Kanapathippillai	Engineering
Johnston	Simon	Astrophysics, CSIRO Science Leader
Kachwalla	Elsa	Operations
Kanoniuk	Henry	Engineering
Kedziora-Chudczer	Lucyna	Astrophysics
Keith	Michael	Astrophysics
Kesteven	Michael	Engineering
Khoo	Jonathan	Astrophysics
Kiraly	Dezso	Engineering
Koenig	Ronald	Engineering
Koribalski	Baerbel	Astrophysics
Kosmynin	Arkadi	Operations
Langdon	Robyn	Operations
Lauter	Benjamin	Engineering
Leach	Mark	Engineering
Lee	Jennifer	Project Support Group
Lenc	Emil	Astrophysics
Lie	Jennifer	Engineering
Londish	Diana	Communications and Outreach
Lopez-Sanchez	Angel	Astrophysics
Mackay	Simon	Engineering
Magri	Simone	Engineering
Maher	Anthony	Software Development
Manchester	Dick	Astrophysics, Federation & CSIRO Fellow
Marquarding	Malte	Software Development
Mazaheri	Miad	Engineering
McClure-Griffiths	Naomi	Astrophysics, CSIRO Science Leader
McConnell	David	Assistant Director: Operations
McIntyre	Vincent	Operations
Moncay	Ray	Engineering
Mulcahy	Mary	Communications and Outreach Manager
Muller	Erik	Astrophysics
Nakanashi	Hiroyuki	Astrophysics
Newton-McGee	Katherine	Operations
Ng	Alan	Project Specialist
Norris	Ray	Astrophysics
O'Sullivan	John	Engineering
Phillips	Chris	Operations
Pope	Nathan	Operations
Reilly	Leslie	Engineering
Roberts	Paul	Engineering

Sanders	Aaron	Engineering
Schinckel	Antony	Project Specialist
Schnitzler	Dominic	Astrophysics
Shields	Matthew	Engineering
Sim	Helen	Communications and Outreach
Smith	David	Astrophysics
Storey	Michelle	Policy Strategist
Sweetnam	Tony	Project Specialist
Sykes	Patrick	Engineering
Tesoriero	Julie	Project Support Group
Tuthill	John	Engineering
Tzioumis	Tasso	Operations
Urquhart	James	Astrophysics
Vera	Jeffrey	Engineering
Voronkov	Maxim	Software Development
Vynogradov	Sergey	Engineering
Weltevrede	Patrick	Astrophysics
Westmeier	Tobias	Astrophysics
Whiting	Matthew	Software Development
Wilson	Warwick	Engineering
Wormnes	Kjetel	Engineering
MARSFIELD Research Support		
Blyth	Barbara	Canteen
Clark	Sylvia	Canteen
Collins	Jim	CSIRO Finance
Damiano	Agostino	CSIRO Finance
D'Amico	Andy	Stores
Derwent	Neil	CSIRO In-Business Finance Manager
Duffy	Christine	Reception
Dwyer	Elissa	CSIRO P&C
Hodges	Cheryl	Reception
Jones	Alison	CSIRO In-Business P&C Manager
Joos	Arianna	CSIRO Library
Lambert	Ken	Stores
Lee	Olivia	CSIRO Finance
Randell	Sandra	CSIRO Finance
Taylor	Breeana	CSIRO P&C
Van der Leeuw	Christine	CSIRO Library
Wilson	Briony	CSIRO Finance
Wrbik	Bev	Canteen
NARRABRI		
Adamson	Belinda	Operations
Alexander	Pauline	Operations
Brem	Christoph	Operations
Brennan	Donna	Operations
Brodrick	David	Operations
Cummins	Cathy	Operations
Dahlem	Michael	Operations
Darcey	Eric	Operations
Dodd	Susan	Operations
Edwards	Philip	Operations
Forbes	Kylee	Operations
Hill	Michael	Operations
Hiscock	Brett	Operations
Hiscock	Jennifer	Operations
Houldsworth	Joanne	Operations

Indermuehle	Balthasar	Operations
Kelly	Pamela	Operations
Kelly	Rosslyn	Operations
Lennon	Brett	Operations
McFee	John	Operations
McFee	Margaret	Operations
Mirtschin	Peter	Operations
Munting	Scott	Operations
Rees	Margaret	Operations
Sunderland	Graeme	Operations
Tomlinson	Rod	Operations
Tough	Bruce	Operations
Troup	Euan	Operations
Wark	Robin	Operations
Webster	Norman	Operations
Wieringa	Mark	Operations
Wilson	Christine	Operations
Wilson	John	Operations
Wilson	Tim	Operations
NARRABRI Research Support		
Johnson	Brian	CSIRO Property Services
Leven	Clarence	CSIRO Property Services
Wieringa	Jacquie	CSIRO Library
PARKES		
Armstrong	Brett	Operations
Cole	Janette	Operations
Crocker	Jonathan	Operations
Dawson	Brett	Operations
Evans	Anne	Operations
Freeman	Geoffrey	Operations
Hockings	Julia	Operations
Hollingdrake	Chris	Communications and Outreach
Hoyle	Simon	Operations
Hunt	Andrew	Operations
Ingram	Shirley	Operations
Lees	Tom	Operations
Mader	Stacy	Operations
McFarland	Matthew	Operations
Milgate	Lynette	Operations
Preisig	Brett	Operations
Reeves	Ken	Operations
Reynolds	John	Operations
Ruckley	Timothy	Operations
Sarkissian	John	Operations
Smith	John	Communications and Outreach
Smith	Malcolm	Operations
Spratt	Gina	Operations
Trim	Tricia Lee	Communications and Outreach
Turner	Barry	Operations
Unger	Karin	Communications and Outreach
Williams	Lesley	Communications and Outreach
Wilson	Beverley	Communications and Outreach
PARKES Research Support		
Brady	Scott	CSIRO Property Services
GERALDTON WA		
Clayton	Priscilla	Project Specialist

D: Observing Programs

Observations made with the Australia Telescope Compact Array

October 2007 to September 2008

Observers	Affiliations	Program	No.
Dahlem, Edwards, Sadler, Brooks, Indermuehle	ATNF, ATNF, USyd, ATNF, ATNF	ATCA calibrators	C007
Staveley-Smith, Gaensler, Ng, Manchester, Ball, Kesteven, Tzioumis, Zanardo	UWA, USyd, USyd, ATNF, ATNF, ATNF, ATNF, UWA	SNR 1987A	C015
Ryder, Boettcher, Smith	AAO, URice	The 1978 Supernova in NGC 1313	C184
Brocksopp, Fender, Corbel, Tzioumis	MSSL, USouth, UParis7, ATNF	Radio jets in recurrent and new black hole X-ray transients	C989
Wright, Maddison, Lommen, Bourke, Wilner, van Dishoeck	ADFA, Swinb, LO, SAO, CfA, LO	Imaging planet signatures in the HD100546 disk	C996
Hunstead, Bryant, Johnston, Sadler, Broderick	USyd, USyd, USyd, USyd, USyd	High-redshift radio galaxies from SUMSS	C1000
Ekers, Burke, Jackson, Kesteven, Murphy, Partridge, Phillips, Ricci, Sadler, Calabretta, Staveley-Smith	ATNF, Swinb, ATNF, ATNF, USyd, Haverford, ATNF, ATNF, USyd, ATNF, UWA	The last 20-GHz follow-up of the AT20G survey	C1049
Maddison, Lommen, Wright, Bourke, van Dishoeck, Wilner	Swinb, LO, ADFA, SAO, LO, CfA	Finding pebbles in protoplanetary disks	C1173
Corbel, Fender, Tzioumis, Kaaret, Tomsick, Orosz, Coriat	UParis7, USouth, ATNFUCSD, SDSU	Large scale radio/X-ray jets in microquasars	C1199
Subrahmanyan, Ekers, Saripalli, Sadler	RRI, ATNF, RRI, USyd	The low-surface-brightness radio source population	C1261
Koribalski, Staveley-Smith, Lopez-Sanchez, Jerjen, Kirby, Bonne, van Eymeren, Karachentsev, Ott, de Blok	ATNF, UWA, ATNF, RSAA, ATNF, ANU, URuhr, RAS, NRAO, UCT	The Local Volume HI Survey (LVHIS)	C1341
Sadler, Ekers, Ricci, Sault	USyd, ATNF, UCal, UMelb	The radio-source population at 100 GHz	C1392
Massardi, Ekers, Ellis	SISSA, ATNF, AAO	Observation of the SZE in a high-z galaxy cluster	C1422
Fuller, Caswell, Burton, Chrysostomou, Brooks, Diamond, Ellingsen, Gray, Green, Hoare, Masheder, McClure-Griffiths	UMan, ATNF, UNSW, UHerts, ATNF, JBO, UTas, UMan, JBO, ULeeds, UBr, ATNF	Accurate positions for methanol masers from the MMB Survey	C1462
Li, Shen, Miyazaki, Miyoshi, Tsutsumi, Tsuboi, Sault	SHAO, SHAO, NAOJ, NAOJ, NAOJ, ISA, UMelb	ATCA monitoring of IDV in Sgr A* at 3 mm and 7 mm wavelengths	C1477
Fender, Uttley, Tzioumis, Bell	USouth, USouth, ATNF, USouth	Testing black hole unification: Simultaneous radio and X-ray observations of NGC 7213	C1532
Walsh, McIntyre, Stark, Crawford, Mohr	CfA, ATNF, SAO, UChig, Uil	Dark energy from clusters: ATCA preliminaries	C1563
Lopez-Sanchez, Koribalski, Esteban, van Eymeren, Garcia-Rojas	ATNF, ATNF, IAC, URuhr, UNAM	Neutral and ionized gas dynamics in blue compact dwarf galaxies	C1577
Payne, Filipovic, White, Stootman	UWS, UWS	Radio-continuum study of PNe within the MCs: Part 3	C1604
Dahlem, Pompei, Iovino	ATNF, ESO, OABrera	HI observations of a complete sample of southern compact groups of galaxies	C1620
Norris, Boyle, Cornwell, Ekers, Feain, Gaensler, Jackson, Middelberg	ATNF, ATNF, ATNF, ATNF, ATNF, USyd, ATNF, AIR	A deep 13 cm survey of the ATLAS fields	C1621

Feain, Cornwell, Norris, Ott, Middelberg, Johnston-Hollitt, Bland-Hawthorn, Ekers	ATNF, ATNF, ATNF, NRAO, AIR, UTas, AAO, ATNF	A long overdue synthesis image of Centaurus A	C1624
Ekers, James, McFadden, Phillips, Protheroe, Roberts	ATNF, UAd, UMelb, ATNF, UAd, ATNF	Radio Cerenkov Emission from UHE Neutrinos	C1637
Feain, Miley, Norris, Ekers, Braun	ATNF, LO, ATNF, ATNF, ATNF	CO in in z~2-5 radio galaxies	C1654
Dawson, McClure-Griffiths, Fukui	UNag, ATNF	High resolution study of the 'Carina Flare' Supershell - an HI-H2 galactic chimney: Continuation of project C1657	C1657
Prandoni, Ricci, Parma, Gregorini, De Ruiter, Ekers	UCal, UBol, INAF, ATNF	Assessing the AGN component of the faint radio population	C1661
Kedziora-Chudczer, Gliozzi, Papadakis, Brinkmann	USyd, GMU	Radio monitoring of the radio-loud NLSI Galaxy PKS 0558-504	C1678
Longmore, Burton, Indermuehle	CfA, UNSW, ATNF	Uncovering the formation mechanism of massive stars	C1680
Roberts, Johnston, Terrier, Djannati-Atai	Eureka, ATNF, UParis7, UParis7	The Kookaburra's northern wing: PWN or SNR?	C1684
Torstensson, van Langevelde, Phillips, Vlemmings, Bartkiewicz, Hill	LO, JIVE, ATNF, JBO, NCAC, LO	The exciting sources of methanol masers	C1686
Beuther, Walsh	MPIA, JCU	A flattened hot massive accretion disk?	C1687
Casassus, Nyman, Roche, Burton, Dickinson, Indermuehle	UChi, ESO, UOx, UNSW, Caltech, ATNF	The cm-wave continuum in PNe	C1705
Muller, Hollow, Chapman	ATNF, ATNF, ATNF	Summer Vacation Program 2007/2008	C1726
Macquart, Marrone, Sjouwerman, Ekers	NRAO, NRAO, NRAO, ATNF	The 3.5 mm polarisation and the rotation measure of Sgr A*	C1727
Anderson, Slane, Kaplan, Muno, Brogan, Lazio, Steeghs, Benjamin, Drew, Grindlay, Gaensler	USyd, CfA, MIT, Caltech, NRAO, NRLUWis, ImCol, CfA, USyd	ChIcAGO: Chasing the identification of ASCA galactic objects	C1728
Tingay, Ojha, Murphy, Kadler, Edwards, Lovell, Gehrels	Swinb, USNO, JPL, GSFC, ATNF, UTas, GSFC	Monitoring of gamma-ray loud AGN in preparation for GLAST	C1730
Koerding, Fender, Tzioumis, Knigge, Rupen, Dhawan	USouth, USouth, ATNF, USouth, NRAO, NRAO	Search for radio emission of nova-like cataclysmic variables	C1732
Gouliermis, Beuther, Vlemmings	MPIA, MPIA, UBonn	Studying triggered star formation in the Small Magellanic Cloud	C1737
Michalowski, Watson, Hjorth, Castro Ceron, Malesani, Tanvir, van der Horst, Wiersema, Fynbo	UCOP, UCOP, UCOP, UCOP, UCOP, UCOP, NASA, ULeic, UCOP	Star formation of an unbiased sample of gamma-ray burst host galaxies	C1741
Araya, Phillips, Hofner	NMIMT, ATNF, NMIMT	An ATCA survey for H2CO masers toward rich maser environments	C1744
Bruenken, Mueller, Feain, McCarthy, Menten, Thaddeus	CfA, UKOELN, ATNF, CfA, MPIfR, CfA	A search for molecules containing refractory elements towards Sgr B2 (M)	C1745
McClure-Griffiths, Pisano, Lockman, Staveley-Smith	ATNF, NRAO, NRAO, UWA	The interaction of the Magellanic Leading Arm and the Galactic plane	C1747
Breen, Ellingsen, Caswell	UTas, UTas, ATNF	Water masers towards 1.2 mm dust clumps	C1750
Longmore, Kurtz, Burton	UNSW, UNAM, UNSW	The birth of HII regions	C1751
Stanway, Bremer, Birkinshaw, Lintott, Lehnert, Douglas	UBr, UBr, UBr, UOx, OPM, UBr	Characterising the cool gas at z>5	C1753
Farrell, Tingay, Barret, Skinner	CESR, UCurt, CESR, GSFC	Searching for transient jets in 4U 1636-536	C1754
Kedziora-Chudczer, Gliozzi	USyd, GMU	Radio observations of naked active galactic nuclei	C1756
Westmeier, Braun, Koribalski	ATNF, ATNF, ATNF	High-velocity clouds in the Sculptor Group: Relics of structure formation?	C1757

Chatterjee, Ng, Gaensler, Johnston	USyd, USyd, USyd, ATNF	Mapping the structure and magnetic field of a pulsar wind nebula	C1759
Caswell, Breen, Ellingsen	ATNF, UTas, UTas	Spectra and variability for 'blind' water maser surveys	C1762
Hieret, Menten, Schilke, Wyrowski, Lo, Longmore	MPIfR, MPIfR, MPIfR, MPIfR, UNSW, CfA	Multi frequency continuum observations of three luminous hot cores	C1764
Chhetri, Ekers, Ricci	UNSW, ATNF, UCal	Searching for gravitational lenses using the AT20G Survey	C1766
Taylor, Allison, Jones, Sadler, Rawlings	UOx, UOx, UOx, USyd, UOx	32GHz point source observations for decontaminating CBI2 CMB and SZE cluster fields - 2	C1767
Cunningham, Jones, Lo, Godfrey, Purcell, Walsh	UNSW, UNSW, UNSW, Monash, UMan	Organic molecules in space: The next level of complexity	C1768
Lo, Cunningham, Bains, Burton	UNSW, UNSW, Swinb, UNSW	High resolution imaging of SiO in a massive cold dense core	C1769
Lumsden, Hoare, Oudmaijer, Urquhart	ULeeds, ULeeds, ULeeds, ULeeds	Resolving the kinematic distance ambiguity for a complete sample of compact HII regions	C1772
Lommen, van Dishoeck, Maddison, van Langevelde, Wright, Bourke	LO, LO, Swinb, JIVE, ADFA, SAO	A multi-wavelength study of grain growth in protoplanetary disks	C1794
Looney, Wong, Chen, Chu, Gruendl, Ott, Seale	UIl, UIl, UIl, UIl, UIl, NRAO, UIl	The LMC as a massive star formation laboratory: The case of N44	C1795
Gaensler, Kronberg, Tanna, Harvey-Smith	USyd, USyd, USyd, USyd	Probing cosmic magnetic fields over ten billion years	C1797
Lommen, Merin, van Dishoeck, Wright, Maddison, Brown, Bottinelli, van Langevelde	LO, ESTEC, LO, ADFA, Swinb, Caltech, LO, JIVE	Imaging the gap in the disk around CS Cha	C1798
Murphy, Gaensler, Hunstead, Chatterjee, Green	USyd, USyd, USyd, USyd, USyd	Transients and variables from the Molonglo Galactic Plane Survey	C1799
Maddison, Wright	Swinb, ADFA	The first mm ATCA observations of debris disk beta Pictoris	C1800
Beuther, Walsh, Longmore, Fallscheer	MPIA, JCU, CfA, MPIA	Massive accretion disks: ATCA's potential for deep impact	C1801
Moin, Tingay, Phillips, Taylor, Wieringa, Martin	Swinb, UCurt, ATNF, UNM, ATNF	A southern sky survey to monitor radio afterglows associated with recently detected gamma-ray bursts	C1802
Tingay, Kadler, Tueller, Gehrels, Angelakis, Fuhrmann, Ros, Zensus, Readhead, Mushotzky, Cheung	UCurt, GSFC, GSFC, GSFC, MPIfR, MPIfR, MPIfR, MPIfR, Caltech, GSFC, NASA	Measuring the radio spectra of a complete sample of AGN based on the Swift/ BAT Hard X-ray All-Sky Survey	C1803
Bains, Cunningham, Redman, Lo, Burton, Jones	Swinb, UNSW, NUI, UNSW, UNSW, UNSW	Ouflows, infall and disks in the G333 cloud	C1808
Yusef-Zadeh, Wardle, Tzioumis, Edwards, Roberts	NWU, UMac, ATNF, ATNF, NWU	Simultaneous sub-mm, radio, near-IR and X-ray monitoring of flare emission from Sgr A*	C1812
Randall, Edwards	ATNF, ATNF	Confirmation of new candidate CSS and GPS sources	C1813
Caswell, Ellingsen, Breen	ATNF, UTas, UTas	Second epoch Galactic Centre water maser survey	C1817
Edwards, Ojha, Kadler	ATNF, USNO, GSFC	ATCA follow-up of the first GLAST detections	C1819
Voronkov, Caswell, Ellingsen, Sobolev, Salii	ATNF, ATNF, UTas, USU, USU	Class I methanol masers and shocks	C1820
Stanway, Bremer, Birkinshaw, Lintott, Lehnert, Douglas, Davies	UBr, UBr, UBr, UOx, OPM, UBr, UBr	Characterising the cool gas at z>5	C1821

Eckart, Kunneriath, Schoedel, Sjouwerman, Straubmeier, Markoff, Morris, Mauerhan, Baganoff, Meyer, Witzel	UKOELN, UKOELN, UKOELN, NRAO, UKOELN, UAm, UCLA, UCLA, MIT, UKOELN, UKOELN,	Coordinated observations of Sgr A*	C1825
Bacmann, Pagani	OBordeaux	Inner kinematics of a pre-stellar core: Fast infall?	C1827
Lo, Cunningham, Bains, Burton, Cotera, Simpson	UNSW, UNSW, Swinb, UNSW, SETI, SETI	High spatial resolution imaging of an unusual Spitzer GLIMPSE object	C1829
Loenen, Ott, Spaans, Baan	KI, NRAO, KI, NFRA	Diagnostics of the star-forming ISM in nearby galactic nuclei	C1831
Sakai, Sakai, Hirota, Burton, Yamamoto	UTOKYO, NRO, NAOJ, UNSW, UTOKYO	Origin of gaseous CO_2 in low-mass star-forming regions	C1832
Thompson, Weights, Burton, Chrysostomou, Ellingsen, Fuller, Longmore, Morgan, Pestalozzi, Voronkov, Yates	UHerts, UHerts, UNSW, UHerts, UTas, UMan, CfA, GBT, UHerts, ATNF, UCL	Are methanol masers associated with hypercompact HII regions?	C1836
Hoare, Jimenez-Serra, Urquhart, Lumsden, Purcell, Voronkov	ULeeds, ULeeds, ULeeds, ULeeds, UMan, ATNF	Testing fast in-beam phase calibration schemes for massive YSO disc observations	C1838
Tarchi, Surcis, Ott, Castangia, Tingay	CAO, NRAO, MPIfR, UCurt	Water maser in the merger galaxy NGC3256: Disk or nuclear maser?	C1841
Merello, Garay, Bronfman, Brooks, Nyman	UChi, UChi, UChi, ATNF, ESO	Resolving the massive molecular outflow G331.512-0.103	C1842
Keto, Longmore	CfA, CfA	Cluster scale accretion flows	C1846
Norris, Feain, Mao, Middelberg, Boyle	ATNF, ATNF, UTas, AIR, ATNF	Using CO to probe the radio-FIR correlation - a pilot project for the ATLAS CO study	C1850
Norris, Feain	ATNF, ATNF	Confirming the detection of CO in a z=0.33 ULIRG	C1851
Harvey-Smith, Gaensler, Kronberg	USyd, USyd	Faraday shadows as probes of galaxy magnetic fields at $0.3<z<2$	C1853
Guzman, Garay, Brooks	UChi, UChi, ATNF	Search for jets towards high-mass YSOs	C1862
Testi, Santangelo, Walmsley, Gregorini, Vanzi, Feain	Acretri, ESO, Acretri, UBol, ESO, ATNF	The molecular environment of super star clusters in He2-10	C1865
Emonts, Sadler, Morganti, Oosterloo, Villar-Martin, Tadhunter	UClmba, USyd, NFRA, NFRA, USheff	Cold gas in high-z radio galaxies with giant Ly-alpha halos	C1867
Cunningham, Jones, Godfrey, Remijan, Muller, McNaughton, Walsh, Thorwirth, Purcell, Schilke, Lo, Bains	UNSW, UNSW, Monash, NRAO, ATNF, Monash, JCU, MPIfR, UMan, MPIfR, UNSW, Swinb	Organic molecules in the interstellar medium: A pilot study with CABB	C1870
Pillai, Wyrowski, Zhang	CfA, MPIfR, SAO	Internal structure of high mass pre-protocluster cores	C1871
Ekers, Sault, McFadden, Protheroe, James	ATNF, UMelb, UMelb, UAd, UAd	Lunar polarisation studies to assist in the detection of UHE neutrinos	C1878
Edwards	ATNF	NASA tracking	C1883

Observations made with the Parkes Telescope

October 2007 to September 2008

Observers	Affiliations	Program	No.
Kaspi, Manchester, Bassa	ATNF, UMcGill	Renewed observations of PSR J0045-7319	P138
Bailes, Verbiest, Bhat, van Straten, Burke, Hobbs, Manchester, Sarkissian	Swinb, Swinb, Swinb, Swinb, Swinb, ATNF, ATNF, ATNF	Precision pulsar timing	P140
Han, Manchester, van Straten	NAOBei, ATNF, Swinb	Polarisation and rotation measures of recently discovered pulsars	P236

Freire, Lyne, Lorimer, Camilo, Manchester, D'Amico, Kramer	AO, JBO, JBO, UCImba, ATNF, CAO, JBO	Timing and searching for pulsars in 47 Tucanae	P282
Bailes, Bhat, Verbiest, van Straten, Hotan, Ord	Swinb, Swinb, Swinb, Swinb, UTas, CfA	Studies of relativistic binary pulsars	P361
Kramer, O'Brien, Lyne, McLaughlin, Manchester, Lorimer	JBO, JBO, JBO, WVU, ATNF, JBO	A new class of pulsar-like neutron stars	P417
D'Amico, Lyne, Possenti, Manchester, Corongiu, Camilo, Burgay, Sarkissian	CAO, JBO, CAO, ATNF, CAO, UCImba, CAO, ATNF	Timing and searching millisecond pulsars in globular clusters	P427
Burgay, Kramer, Stairs, Manchester, Lorimer, McLaughlin, Lyne, D'Amico, Possenti, Ferdman	CAO, JBO, UBC, ATNF, JBO, WVU, JBO, CAO, CAO, UBC	Timing and geodetic precession in the double pulsar and two relativistic binaries	P455
Manchester, Bailes, Jenet, Hobbs, Verbiest, Sarkissian, Bhat, van Straten, Hotan, You, Yardley, Burke	ATNF, Swinb, UTex, ATNF, Swinb, ATNF, Swinb, Swinb, UTas, NAOBei, ATNF, Swinb	A millisecond pulsar timing array	P456
Lyne, D'Amico, Burgay, McLaughlin, Possenti, Kramer, Lorimer, Manchester, Hobbs, Camilo, Stairs, Keith	JBO, CAO, CAO, WVU, CAO, JBO, JBO, ATNF, ATNFUBC, JBO	The 'Perseus Arm' Multibeam Pulsar Survey	P477
Titov, Jauncey, Dickey, Reynolds, Tingay, Fey, Lovell, Ellingsen	ATNF, UTas, ATNF, UCurt, USNO, UTas, UTas	Improving the terrestrial and celestial reference frame through southern hemisphere geodetic VLBI observations	P483
Kramer, Lyne, Manchester, Hobbs, Stairs, Lorimer, Faulkner, D'Amico, Possenti, Burgay, McLaughlin, Eatough	JBO, JBO, ATNF, ATNF, UBC, JBO, JBO, CAO, CAO, CAO, WVU, JBO	Timing of binary and millisecond PKSMB/PH pulsars	P501
Fuller, Caswell, Burton, Chrysostomou, Brooks, Cox, Diamond, Ellingsen, Gray, Green, Hoare, Masheder	UMan, ATNF, UNSW, UHerts, ATNF, UCardiff, JBO, UTas, UMan, JBO, ULeeds, UBr	A multibeam survey of the Galaxy for methanol masers	P502
McLaughlin, Lyne, Lorimer, Kramer, O'Brien, Manchester, Stairs, Camilo, Faulkner	WVU, JBO, JBO, JBO, JBO, ATNF, UBC, UCImba, JBO	Continued monitoring observations of rotating radio transients	P511
Johnston, O'Brien, Kramer, Lyne, Lorimer, McLaughlin, Hobbs, Possenti, Burgay, D'Amico, Bailes	ATNF, JBO, JBO, JBO, JBO, WVU, ATNF, CAO, CAO, CAO, Swinb	A methanol multibeam pulsar survey	P512
Johnston, Karastergiou, Kramer, Mitra, Manchester, Gupta, Noutsos	ATNF, JBO, NCRA, ATNF, NCRA, AAO	A census of pulsar emission	P535
Eatough, Keith, Lyne, Kramer, Manchester, Hobbs, Stairs, D'Amico, Possenti, Burgay, Camilo	JBO, JBO, JBO, JBO, ATNF, ATNF, UBC, CAO, CAO, CAO, UCImba	New pulsars from re-analysis of the Parkes Multibeam Pulsar Survey	P559
Carretti, Staveley-Smith, Haverkorn, Cortiglioni, Gaensler, kesteven, Bernardi, Poppi	INAF, UWA, NRAO, USyd, ATNF, KI	S-band Polarisation All Sky Survey (S-PASS)	P560
Masters, Macri, Crook, Staveley-Smith, Jarrett, Koribalski, Jones, Springob, Huchra	Harvard, NOAO, MIT, UWA, IPAC, ATNF, ANU, NRL, Harvard	Mapping matter in the nearby Universe with 2MASS	P561
Camilo, Ransom, Reynolds, Halpern, Johnston	NRAO, ATNF, ATNF	Studying the magnetar XTE J1810-197	P564
Possenti, Burgay, Rea, Israel, Perna, Colpi	CAO, CAO, UAm, OARome, JILA, UMILAN	Searching for radio pulsations from the transient AXP in Westerlund 1	P573

Weltevrede, Johnston, Manchester, Hobbs, Romani, Thompson, Thorsett, Roberts, Possenti, Kramer	ATNF, ATNF, ATNF, ATNF, GSFC, UCSC, Eureka, CAO, JBO	Pulsar timing and the GLAST and AGILE missions	P574
Karastergiou, Hotan, Johnston, McLaughlin	UOx, UTas, ATNF, WVU	The polarisation of rotating radio transients	P584
Haverkorn, Bock, McClure-Griffiths, McConnell, Gaensler, Green	NRAO, CARMA, ATNF, ATNF, USyd, USyd	Magnetic fields in known and unknown SNRs: Vela and the unidentified magnetic shell G279-0.5	P588
Braun, Popping, Koribalski, Sadler, Webster, Bland-Hawthorn, Westmeier, Lopez-Sanchez, Barnes	ATNF, ATNF, ATNF, USyd, UMelb, AAO, ATNF, ATNF, Swinb	Galaxy accretion and feedback at red-shift zero (GAF@RZ)	P593
Weltevrede, Johnston	ATNF, ATNF	A search for main-interpulse correlations in pulsars	P594
Hobbs, Hollow, Champion, Jenet, Amy, Chapman, Mulcahy, van Straten, Burke	ATNF, ATNF, ATNF, UTex, ATNF, ATNF, ATNF, Swinb, Swinb	PULSE@Parkes (Pulsar Student Exploration online at Parkes)	P595
Crawford, Williams, Lorimer	Haverford, UII, JBO	Radio search of a new SMC X-ray point source	P597
Crawford, Lorimer	Haverford, JBO	Nulling behaviour in the LMC Pulsar J0529-6652	P598
Bailes, Burke, Johnston, van Straten, Bhat, Barnes	Swinb, Swinb, ATNF, Swinb, Swinb, Swinb	Extragalactic radio bursts	P599
Linz, Beuther, Henning, Stecklum, Vasyunina	MPIA, MPIA, MPIA	Parkes observations of ammonia in southern infrared dark clouds	P600
Camilo, Reynolds, Johnston, Halpern, Ransom	UClmba, ATNF, ATNF, UClmba, NRAO	Two radio magnetars	P602
Vlemmings	UBonn	The Zeeman splitting of southern 6.7 GHz methanol masers	P614
Suarez, Gomez, Miranda, Guerrero, Rizzo, Palau	IAAC, IAAC, IAAC, ESA Villafranca	A survey for water masers in optically obscured PNe and post-AGB stars	P616
Wolleben, Dickey, Fletcher, Gaensler, Han, Haverkorn, Carretti, Landecker, Leahy, McClure-Griffiths, McConnell, Reich	DRAO, UTas, UNT, USyd, NAOBei, NRAO, INAF, DRAO, UMan, ATNF, ATNF, MPIfR	Parkes 300 to 900 MHz Rotation Measure Survey: Pilot study	P617
Hill, Burton, Cunningham, Minier	LO, UNSW, UNSW, CEA	NH3 observations of southern cold cores	P618
Johnston, Kramer, Weltevrede, Keith, Stappers	ATNF, JBO, ATNF, JBO	High-frequency search for pulsars in EGRET error boxes	P619
Stappers, Kramer, Lyne, Weltevrede, Smits	JBO, JBO, ATNF, UMan	A stirring pulsar	P622
Greenhill, Carilli, Briggs, Braun, Datta, Mitchell, Ord, Wayth	CfA, NRAO, RSAA, ATNF, NMIMT, SAO, CfA, CfA	First limits to the neutral IGM during cosmic reionization using the Hydrogen 2p-2s transition in absorption	P623
Haverkorn, Carretti, Gaensler, Heiles, Kesteven, McClure-Griffiths, McConnell	NRAO, INAF, USyd, UCB, ATNF, ATNF, ATNF	The Southern Twenty-centimetre All-sky Polarisation Survey (STAPS)	P624
Breen, Ellingsen, Caswell	UTas, UTas, ATNF	12 GHz methanol masers towards Parkes methanol multibeam 6.7 GHz maser detections	P625
Israel, Burgay, Possenti, Rea	OARome, CAO, CAO, UAm	Searching for radio pulsations triggered by the X-ray outburst of magnetars	P626
Johnston, DeBoer	ATNF, ATNF	Testing of focal plane array technologies for ASKAP	P628
Bailes, Johnston, Kramer, Possenti, Keith, Stappers, Burgay, van Straten, Bhat, Burke, Bates	Swinb, ATNF, JBO, CAO, JBO, CAO, Swinb, Swinb, Swinb, UMan	The high time resolution universe	P630

Battersby, Jackson, Chambers, Finn, Stojimirovic	UBos, UBos, UBos, UBos, UBos	Ammonia temperatures of high-mass protostellar IRDC cores	P632
Dawson, McClure-Griffiths, Fukui, Harvey-Smith	UNag, ATNF, UNag, USyd	6.7 GHz methanol masers in the 'Carina Flare' Supershell: Seeking the footprint of triggered massive star formation	P633
Pen, Chang, Peterson, Bandura, Staveley-Smith	UTor, ASIAA, UWA	HI surface brightness mapping	P641

Observations made with the Mopra Telescope

October 2007 to September 2008

Observers	Affiliations	Program	No.
Burton, Jones, Cunningham, Walsh, Menten, Schilke, Belloche, Leurini, Requena-Torres, Martin-Pintado, Ott	UNSW, UNSW, UNSW, JCU, MPIfR, MPIfR, MPIfR, ESO, NRAO	The central molecular zone of the Galaxy	M170
Walsh, White, Burton, Purcell, Longmore, Lo, Phillips, Brooks, Hyland	UNSW, UMan, UNSW, UNSW, ATNF, ATNF, JCU	HOPS (the H2O Southern Galactic Plane Survey)	M207
Rathborne, Lada, Muench	CfA, CfA, SAO	Dense cores in the Pipe Nebula	M227
Yamamoto, Nakamura, Ishigami, Kawamura, Mizuno, Onishi, Mizuno, Fukui	UNag, UNag, UNag, UNag, UNag, UNag, UNag, UNag	The detailed study of the aligned molecular clouds in the Galactic plane	M231
Kurtz, Pomares, Deharveng, Zavagno, Cunningham, Jones	UNAM, OMs, UNSW, UNSW	Massive-star formation triggered by HII regions: Physical conditions in molecular condensations adjacent to HII regions	M233
Fujishita, Torii, Kudo, Horachi, Yamamoto, Nozawa, Matsumoto, Machida, Kawamura, Onishi, Fukui	UNag, UNag, UNag, UNag, UNag, CHIBAU, NAOJ, UNag, UNag, UNag	A detailed study of the molecular loops in the Galactic Centre with Mopra	M235
Loenen, Baan, Spaans	KI, NFRA, KI	Molecular diagnostics of Galactic star-formation regions	M266
Sakai, Hirota, Burton, Yamamoto, Sakai	UTOKYO, NAOJ, UNSW, UTOKYO, NRO	Search for warm carbon-chain chemistry in southern star-forming regions	M267
Matthews, Staveley-Smith, Muller	UWA, ATNF	Search for CO in the Magellanic Stream	M268
Hieret, Longmore, Menten, Schilke, Wyrowski	MPIfR, UNSW, MPIfR, MPIfR, MPIfR	Extended emission in three luminous hot cores	M269
Hoare, Urquhart, Lumsden, Purcell	ULeeds, ULeeds, ULeeds, Uman	Masers and warm molecular gas towards massive young stars	M270
Koo, Burton, Moon	SNATU, UNSW, Utor	Unveiling the mysterious infrared source IRAS 15099-5856	M286
Kramer, Brooks, Mueller	ATNF, UKOELN	Chemical complexity in photon-dominated regions: A deep-integration 3 mm line survey towards the Carina Nebula	M287
Benedettini, Caselli, Molinari, Pezzuto, Saraceno, Testi, Viti, Burton	ULeeds, Acretri, UCL, UNSW	Looking for star forming dense cores in the Lupus 1 molecular cloud	M288
Zijlstra, Lagadec, Fuller, Mauron, Wood, Josselin, Greg, Whitelock	UMan, UMan, UMan, ANU, Cornell, UCT	Determination of the expansion velocities and mass-loss rates of low metallicity newly discovered halo carbon stars through CO observations	M289
Hill, Cunningham, Burton, Minier	LO, UNSW, UNSW, CEA	An SiO, HCN, HNC and HCO+ study of massive cores – are they forming stars?	M290
Walsh, Fama, Beuther, Longmore, De Buizer	JCU, JCU, MPIA, CfA	A search for outflows towards massive YSO disk candidates	M291
Fuller, Pratap, Green, Quinn	UMan, MIT, JBO, UMan	An unbiased survey for class I methanol masers	M292

Wakeling, Walsh, Burton, Chapman, Wardle, Thorwirth	JCU, JCU, UNSW, UMac, UMac, MPIfR	A detailed line survey of G327.3-0.6	M294
Tachihara, Miyamoto, Takeda, Niwa, Oasa, Itoh, Yonekura	UKOBE, UKOBE, UKOBE, UKOBE, UKOBE, UKOBE, OsPU	Search for dense cores in the Musca Filamentary Cloud	M295
Wong, Hughes, Muller, Ott, Pineda Galvez, Fukui, Kawamura, Mizuno, Maddison, Bernard, Chu, Henkel	UII, Swinb, ATNF, NRAO, RAIUB, UNag, UNag, UNag, Swinb, CESR, UII, MPIfR	MAGMA: The Magellanic Mopra Assessment	M300
Fuller, Burton, Tideswell, Purcell, Millar	UMan, UNSW, UMan, UMan, QUB	A search for hot cores in the LMC	M301
Khanzadyan, Cunningham, Jones, Lo, Bains, Redman	NUI, UNSW, UNSW, UNSW, Swinb, NUI	Chemical and dynamical processes in a cold massive infalling core	M303
Loenen, Baan, Spaans, Martin-Pintado	KI, NFRA, KI	Probing shocks in nearby Galactic nuclei: SiO and HNCO	M305
Thompson, Parsons, Weights, Chrysostomou	UHerts, UHerts, UHerts, UHerts	Infrared dark clouds in the SCUBA Legacy Archive - a bimodal population?	M306
Bourke, Caselli, Jorgensen, Myers, Di Francesco, Gutermuth, Walsh, Longmore	SAO, ULeeds, CfA, SAO, NRCC, CfA, JCU, CfA	The initial conditions for star formation in clusters	M308
Vasyunina, Linz, Beuther, Henning, Stecklum	MPIA, MPIA, MPIA	Mapping the molecular content of southern infrared dark clouds	M311
Riquelme, Amo-Baladron, Martin-Pintado, Mauersberger, Bronfman, Morris	IRAM-S, IRAM-S, UChi, UCLA	Kinematics and physical conditions of molecular clouds at the 'foot point' of two Galactic molecular loops.	M312
Keto, Longmore	CfA, CfA	Cluster scale accretion flows	M313
Finn, Jackson, Chambers, Battersby, Stojimirovic	UBos, UBos, UBos, UBos, UBos	Reconciling the differences between the first and fourth quadrant IRDC distributions	M316
Jackson, Chambers, Stojimirovic, Finn, Battersby	UBos, UBos, UBos, UBos, UBos	The chemical evolution of infrared dark cloud cores	M317
Rowell, Fukui, Burton, Takeuchi, Nakashima, Furukawa, Dawson, Fujishita, Yamamoto	UAd, UNag, UNSW, UNag, UNag, UNag, UNag, UNag, UNag	Dense gas in the W28 SNR-GMC: Massive star formation in the high energy environment	M318
Braun, Combes, Brooks	ATNF, OPM, ATNF	Star formation at intermediate red-shift	M319
Liu, Wang, Gao, Zhang	PMO, PMO, PMO	Line survey toward NGC253 and NGC1068 from 80GHz to 110GHz with the Mopra	M322
Russeil, Bontemps, Walsh, Motte, Schneider, Zavagno	OMs, OBordeaux, JCU, CEA, CEA, OMs	Nature of high-mass dense cores in NGC6334/6357	M324
Kawachi, Yamaguchi, Edwards, Oka, Yamazaki, Bamba	UKyoto, ATNF, UTOKYO, ISA	Mapping dense interstellar matter in the environment of RCW86	M325
Jimenez-Serra, Caselli, Martin-Pintado, Bourke	ULeeds, ULeeds, SAO	On the search of the magnetic precursor of C-type shocks in young molecular outflows	M326
Wyrowski, Brooks, Schuller, Schilke, Menten, Beuther, Bontemps, Deharveng, Garay, Motte, Walmsley, Zavagno	MPIfR, ATNF, MPIfR, MPIfR, MPIfR, MPIA, OBordeaux, UChi, CEA, Acretri, OMs	Molecular fingerprints of an unbiased sample of Galactic massive star forming clumps	M327
Edge, Feain, Wilman, Salome, Hatch	UDur, ATNF, UOx, IRAM-F, LO	A search for CO in cluster cooling flows	M328
Furukawa, Dawson, Dame, Kawamura, Yonekura, Fukui	UNag, UNag, CfA, UNag, OsPU, UNag	Massive star formation in Westerlund 2 and strange molecular clouds toward the associated TeV source HESS J1023-575	M329
Masque, Girart, Beltran, Estalella	UBARC, UBARC, UBARC	Observations of the contracting dense core ahead of HH 80N using deuterated species	M330

VLBI Observations

October 2007 to September 2008

Observers	Affiliations	Program	No.
Ryder, Tingay, Smith	AAO, Swinb, URice	LBA imaging of SN 1978K in NGC 1313	V157
Guirado, Marcaide, Reynolds, Jauncey, Lestrade, Marti-Vidal, Preston, Jones	UVal, UVal, ATNF, ATNF, OPM, UVal, JPL, JPL	Follow-up observations of ABDoradus: A possible radio binary in ABDorB	V186
Deller, Tingay, Bailes	Swinb, UCurt, Swinb	Improving the VLBI astrometry of PSR 0437-4715	V190
Benaglia, Phillips, Dougherty, Koribalski, Tzioumis	IAR, ATNF, DRAO, ATNF, ATNF	A wind-collision region in the massive O-star binary HD 93129A?	V191
Lenc, Tingay, Argo	ATNF, UCurt, UCurt	Monitoring of supernova remnants in NGC 253 and NGC 4945: Determining the supernova rate	V209
Ryder, Perez Torres, Tingay, Vaisanen, Mattila	AAO, IAAC, UCurt, SAAO, UTURK	Supernova 2004ip in the Luminous Infrared Galaxy IRAS 18293-3413	V212
Johnston, Tingay, Deller, Bailes, Dodson	ATNF, Swinb, Swinb, Swinb, OANMad	VLBI of the PSR B1259-63 system	V234
Hurley, Norris, Phillips, Conway, Appleton, Parra	OSO, ATNF, ATNF, OSO, Caltech, UChi	The AGN-Starburst connection in COLA galaxies	V250
Tingay, Sadler, Hancock, Phillips, Deller	Swinb, USyd, USyd, ATNF, Swinb	e-VLBI observations of a low luminosity GHz-peaked spectrum sample from the AT20G survey	V251
Ojha, Kadler, Tingay, Monitoring Team	USNO, UCurt	Physics of gamma ray emitting AGN	V252
Phillips, Deller, Tingay, Ellingsen, Edwards, Tzioumis, Jauncey, Sadler, Murphy, Reynolds, Lovell	ATNF, Swinb, Swinb, UTas, ATNF, ATNF, ATNF, USyd, USyd, ATNF, UTas	Southern hemisphere VLBI calibrator list	V254
Ellingsen, Phillips, Rivera Castillo, Walsh, Reid, Voronkov, Goedhart, Caswell	UTas, ATNF, JCU, SAO, ATNF, HartRAO, ATNF	Proper motion and parallax of methanol masers	V255
Birkinshaw, Worrall, Bliss, Lovell, Tananbaum, Murray	UBr, UBr, UBr, UTas, CfA, CfA	The core of J2310-4347	V257
Phillips	ATNF	EXPReS e-VLBI demonstration	V259
Petrov, Phillips, Bertarini, Fomalont, Tzioumis, Pogrebenko, Murphy, Sadler, Burke, Kim, Ekers, Booth	ATNF, MPIfR, NRAO, ATNF, JIVE, USyd, USyd, Swinb, ATNF, HartRAO	LBA calibrator survey	V271
Burke, Manchester, Ekers, Phillips, Lovell, Bailes	Swinb, ATNF, ATNF, ATNF, UTas, Swinb	Direct detection of supermassive black hole binaries using VLBI	V275
Brunthaler, Ott, Staveley-Smith, Tingay, Beasley	MPIfR, NRAO, UWA, UCurt, NRAO	The proper motion of the Large Magellanic Cloud	V276
Camilo, Deller, Reynolds	UCImba, Swinb, ATNF	Measuring the proper motion of a magnetar with the LBA	V277
Booth, Bietenholz, Phillips, Hungwe	HartRAO, HartRAO, ATNF, HartRAO	VLBI measurements to select southern sources VLBI calibrators at 2.3GHz	V278

Tidbinbilla Observations

October 2007 to September 2008

Observers	Affiliations	Program	No.
Burton, Walsh, Purcell, Wardle, Chapman, Millar, Lovell	UNSW, UMan, UMac, UMac, QUB, UTas	Could cyanodiacteylene (HC5N) also be a hot core molecule?	T060

E: Postgraduate Students Co-supervised by the ATNF in 2008

Name	University	Project Title
Keith Bannister	University of Sydney	Archival and future searches for radio transients
Shari Breen	University of Tasmania	Masers as evolutionary traces of star formation
Nino Bukilic	Curtin University of Technology	Extremely wide bandwidth focal plane array receivers for radioastronomy
Sarah Burke-Spolaor	Swinburne University	Surveys for supermassive binary black holes and fast radio transients
Rajan Chhetri	University of New South Wales	The study of the large scale mass distribution in the Universe using gravitational lensing
Aaron Chippendale	University of Sydney	High dynamic range imaging with many baseline synthesis interferometry
Joanne Dawson	Nagoya University, Japan	Supershells as molecular cloud factories in the evolving ISM
Adam Deller	Swinburne University of Technology	Software correlation for advanced very long baseline interferometry, with applications in pulsar and extragalactic astrophysics
Alyson Ford	Swinburne University of Technology	GASS: The Galactic All-Sky Survey
Leith Godfrey	Australian National University	Dynamics of large-scale extragalactic jets: A multi-wavelength study of X-ray bright jets
Andres Guzman	Universidad de Chile, Chile	Ionised jets in massive young star objects as sign of accretion dominated process in their formation
Chris Hales	University of Sydney	Radio polarisation and the origin of galactic and intergalactic magnetic fields
Paul Hancock	University of Sydney	A deep survey of the SCP at 20 GHz, part of the AT20G
Douglas Hayman	Macquarie University	Densely packed focal plane arrays
Annie Hughes	Swinburne University of Technology	Molecular gas in the interstellar medium of the Large Magellanic Cloud
Rossa Hurley	Chalmers University of Technology, Sweden	Radio and millimetre observations of galaxies
Suzy Jackson	Macquarie University	Integrated systems for next generation telescopes
Emma Kirby	Australian National University	Turning the time arrow: The evolutionary history of the local Universe
Emil Lenc	Swinburne University of Technology	Studies of radio galaxies, starburst galaxies, and gravitational lenses using wide-field, high spatial resolution radio imaging
Nadia Lo	University of New South Wales	The dynamics of molecular gas in the Milky Way Galaxy
Elizabeth Mahony	University of Sydney	Understanding the high-frequency radio source population
Minnie Mao	University of Tasmania	Cosmic evolution of radio sources
Sui-Ann Mao	University of Sydney/ Harvard University, USA	Magnetic fields in the Milky Way, the Magellanic Clouds and beyond
Deanna Matthews	La Trobe University	High velocity clouds around the Galaxy
Jamie McCallum	University of Tasmania	A study of H2O megamasers in AGN

Rebecca McFadden	University of Melbourne	Radio Cerenkov emission from UHE neutrinos
Aquib Moin	Curtin University of Technology	e-VLBI Science with LBA: Exploring science application for the long baseline component of ASKAP
Katherine Newton-McGee	University of Sydney	The magnetic Universe
Attila Popping	Kapteyn Astronomical Institute, The Netherlands	Kinematic imaging of the cosmic HI web
Kate Randall	University of Sydney	Discriminating between active galactic nuclei and star forming galaxies in the Australia Telescope Large Area Survey
Urvashi Rao-Venkata	New Mexico Institute of Mining and Technology, USA	Parameterized deconvolution in radio synthesis imaging
Robert Reinfrank	University of Adelaide	High-energy astrophysics using radio telescopes
Cliff Senkbeil	University of Tasmania	A study of interstellar scintillation and intraday radio variability of active galactic nuclei
Joris Verbiest	Swinburne University of Technology	High precision pulsar timing
Natasa Vranesevic	University of Sydney	Galactic distribution and evolution of pulsars
Daniel Yardley	University of Sydney	Pulsar timing arrays and their applications
Matthew Young	University of Western Australia	An investigation of pulsar dynamics using improved methods of time series analysis

F: PhD Theses of Students Co-supervised by ATNF Staff in 2008

Martin Leung (University of Sydney; July 2008). "A wideband feed for a cylindrical radio telescope".

Marcella Massardi (SISSA/ISAS, Trieste; October 2008). "The extragalactic sources at mm wavelengths and their role as CMB foregrounds".

Vicky Safouris (ANU; June 2008). "Environmental influence on the evolution of jets from active galactic nuclei".

Janine van Eymeren (Bochum University, Germany; June 2008). "Gas kinematics in the haloes of nearby irregular dwarf galaxies".

G: Publications

Papers using ATNF data, published in refereed journals

* Indicates publication with ATNF staff

C = Compact Array data, M = Mopra data, P = Parkes data, T = Tidbinbilla data, V = VLBI data

ARCHIBALD, A.M., KASPI, V.M., LIVINGSTONE, M.A. & McLAUGHLIN, M.A. "No detectable radio emission from the magnetar-like pulsar in Kes 75". ApJ, 688, 550-554 (2008). (P)

BAUER, F.E., DWARKADAS, V.V., BRANDT, W.N., IMMLER, S., SMARTT, S., BARTEL, N. & BIETENHOLZ, M.F. "Supernova 1996cr: SN 1987A's wild cousin?". ApJ, 688, 1210-1234 (2008). (C)

*BELLOCHE, A., MENTEN, K.M., COMITO, C., MULLER, H.S., SCHILKE, P., OTT, J., THORWIRTH, S. & HIERET, C. "Detection of amino acetonitrile in Sgr B2(N)". A&A, 482, 179-196 (2008). (C)

BEUTHER, H. et al. "ATCA 3-mm observations of NGC 6334I and I(N): Dense cores, outflows, and an UCH II region". A&A, 481, 169-181 (2008). (C)

BEUTHER, H. & WALSH, A.J. "Kinematics of a hot massive accretion disk candidate". ApJ, 673, L55-L58 (2008). (C)

BHAT, N.D.R., BAILES, M. & VERBIEST, J.P.W. "Gravitational-radiation losses from the pulsar white-dwarf binary PSR J1141-6545". Phys. Rev. D, 77, 124017 (2008). (P)

BHAT, N.D.R., TINGAY, S.J. & KNIGHT, H.S. "Bright giant pulses from the Crab Nebula pulsar: Statistical properties, pulse broadening, and scattering due to the Nebula". ApJ, 676, 1200-1209 (2008). (C)

*BRONFMAN, L., GARAY, G., MERELLO, M., MARDONES, D., MAY, J., BROOKS, K.J., NYMAN, L.-A. & GUSTEN, R. "Discovery of an extremely high velocity, massive, and compact molecular outflow in Norma". ApJ, 672, 391-397 (2008). (C)

*CAMILO, F., REYNOLDS, J., JOHNSTON, S., HALPERN, J.P. & RANSOM, S.M. "The magnetar 1E 1547.0-5408: Radio spectrum, polarimetry, and timing". ApJ, 679, 681-686 (2008). (C, P)

CASSAM-CHENAI, G., HUGHES, J.P., REYNOSO, E.M., BADENES, C. & MOFFETT, D. "Morphological evidence for azimuthal variations of the cosmic-ray ion acceleration at the blast wave of SN 1006". ApJ, 680, 1180-1197 (2008). (C)

*CASWELL, J.L. & PHILLIPS, C.J. "Water maser 353.273+0.641, the prime example of a class dominated by a blueshifted outflow". MNRAS, 386, 1521-1526 (2008). (C)

CERRIGONE, L., HORA, J.L., UMANA, G. & TRIGILIO, C. "IC 4406: A radio-infrared view". ApJ, 682, 1047-1054 (2008). (C)

CHEN, X. et al. "ATCA and Spitzer observations of the binary protostellar systems CG 30 and BHR 71". ApJ, 683, 862-875 (2008). (C)

CRAWFORD, E.J. et al. "Radio-continuum study of the supernova remnants in the Large Magellanic Cloud: An SNR with a highly polarised breakout region - SNR J0455-6838". Serb. AJ, 177, 61 (2008). (C)

CRAWFORD, E.J., FILIPOVIC, M.D. & PAYNE, J.L. "Radio-continuum study of the Large Magellanic Cloud - SNR J0519-6926". Serb. AJ, 176, 59-63 (2008). (C)

*CURRAN, S.J., KORIBALSKI, B.S. & BAINS, I. "The large-scale atomic and molecular gas in the Circinus galaxy". MNRAS, 389, 63-74 (2008). (C)

*CURRAN, S.J., WHITING, M.T. et al. "A survey for redshifted molecular and atomic absorption lines. II. Associated H I, OH and millimetre lines in the z >~ 3 Parkes quarter-Jansky flat-spectrum sample". MNRAS, 391, 765-784 (2008). (T)

*DAWSON, J.R., MIZUNO, N., ONISHI, T., McCLURE-GRIFFITHS, N.M. & FUKUI, Y. "The 'Carina Flare' supershell: probing the atomic and molecular ISM in a Galactic chimney". MNRAS, 387, 31-44 (2008). (P, C)

*DELLER, A.T., VERBIEST, J.P., TINGAY, S.J. & BAILES, M. "Extremely high precision VLBI astrometry of PSR J0437-4715 and implications for theories of gravity". ApJ, 685, L67-L70 (2008). (V)

DICKEN, D., TADHUNTER, C., MORGANTI, R. et al. "The origin of the infrared emission in radio galaxies. I. New mid- to far-infrared and radio observations of the 2 Jy sample". ApJ, 678, 712-728 (2008). (C)

DODSON, R. "First VLBI observations of methanol maser polarisation, in G339.88-1.26". A&A, 480, 767-773 (2008). (V)

*DODSON, R., FOMALONT, E.B., WIIK, K., HORIUCHI, S., HIRABAYASHI, H., EDWARDS, P.G. et al. "The VSOP 5 GHz Active Galactic Nucleus Survey. V. Imaging results for the remaining 140 sources". ApJS, 175, 314-355 (2008). (V)

DUBNER, G., GIACANI, E. & DECOURCHELLE, A. "High resolution radio study of the pulsar wind nebula within the supernova remnant G0.9+0.1". A&A, 487, 1033-1040 (2008). (C)

EMONTS, B.H., MORGANTI, R., OOSTERLOO, T.A. et al. "Enormous disc of cool gas surrounding the nearby powerful radio galaxy NGC612 (PKS0131-36)". MNRAS, 387, 197-208 (2008). (C)

ESAMDIN, A. et al. "Timing observations of rotating radio transient J1819-1458 at Urumqi Observatory". MNRAS, 389, 1399-1404 (2008). (P)

FILIPOVIC, M.D. et al. "New XMM-Newton observations of supernova remnants in the Small Magellanic Cloud". A&A, 485, 63-70 (2008). (C)

*FORD, H.A., McCLURE-GRIFFITHS, N.M., LOCKMAN, F.J., BAILIN, J., CALABRETTA, M.R., KALBERLA, P.M., MURPHY, T. & PISANO, D.J. "HI clouds in the lower halo. I. The Galactic All-Sky Survey pilot region". ApJ, 688, 290-305 (2008). (P)

GHISELLINI, G. et al. "Ultra-high energy cosmic rays, spiral galaxies and magnetars". MNRAS Lett., 390, L88-L92 (2008). (P)

*GRANET, C. & GOUGH, R.G. "Design of three prime-focus 12-mm wavelength horns for the Parkes radio telescope". Microw. Opt. Tech. Lett., 50, 2537-2543 (2008). (P)

*GREEN, J. A., CASWELL, J. L., FULLER, G. A., AVISON, A., BREEN, S. L., BROOKS, K., BURTON, M. G., CHRYSOSTOMOU, A., COX, J., DIAMOND, P. J., ELLINGSEN, S. P., GRAY, M. D., HOARE, M. G., MASHEDER, M. R. W., McCLURE-GRIFFITHS, N.M., PESTALOZZI, M., PHILLIPS, C., QUINN, L., THOMPSON, M. A., VORONKOV, M.A. et al. "The 6-GHz multibeam maser survey. I. Techniques". MNRAS, 392, 783-794 (2008). (P)

*GREEN, J. A., CASWELL, J. L., FULLER, G. A., BREEN, S. L., BROOKS, K., BURTON, M. G., CHRYSOSTOMOU, A., COX, J., DIAMOND, P. J., ELLINGSEN, S. P., GRAY, M. D., HOARE, M. G., MASHEDER, M. R. W., McCLURE-GRIFFITHS, N., PESTALOZZI, M., PHILLIPS, C., QUINN, L., THOMPSON, M. A., VORONKOV, M. et al. "Multibeam maser survey of methanol and excited OH in the Magellanic Clouds: new detections and maser abundance estimates". MNRAS, 385, 948-956 (2008). (P, C)

*HALPERN, J.P., GOTTHELF, E.V., REYNOLDS, J., RANSOM, S.M. & CAMILO, F. "Outburst of the 2 s anomalous X-ray pulsar 1E 1547.0-5408". ApJ, 676, 1178-1183 (2008). (P)

*HAVERKORN, M., BROWN, J.C., GAENSLER, B.M. & McCLURE-GRIFFITHS, N.M. "The outer scale of turbulence in the magnetoionized galactic interstellar medium". ApJ, 680, 362-370 (2008). (C)

*HOBBS, G. "Gravitational wave detection using high precision pulsar observations". Classical & Quantum Gravity, 25, 114032 (2008). (P)

*HUYNH, M.T., JACKSON, C.A., NORRIS, R.P. & FERNANDEZ-SOTO, A. "Radio observations of the Hubble Deep Field South region. IV. Optical properties of the faint radio population". AJ, 135, 2470-2495 (2008). (C)

JACKSON, J.M. et al. "The Galactic distribution of infrared dark clouds". ApJ, 680, 349-361 (2008). (M)

JAMES, C.W. & PROTHEROE, R.J. "The directional dependence of apertures, limits and sensitivity of the lunar Cherenkov technique to a UHE neutrino flux". Astropart. Phys., 31, 392-398 (2008). (P, S)

*JOHNSTON, S., KARASTERGIOU, A., MITRA, D. & GUPTA, Y. "Multifrequency integrated profiles of pulsars". MNRAS, 388, 261-274 (2008). (P)

JOHNSTON-HOLLITT, M., SATO, M., GILL, J.A., FLEENOR, M.C. & BRICK, A.-M. "Radio observations of the Horologium-Reticulum supercluster. I. A3158: excess star-forming galaxies in a merging cluster?". MNRAS, 390, 289-303 (2008). (C)

*JONES, D.I., PROTHEROE, R.J. & CROCKER, R.M. "Search for synchrotron emission from secondary leptons in dense cold starless cores". PASA, 25, 161-166 (2008). (C)

JONES, P.A., BURTON, M.G. et al. "Spectral imaging of the Sagittarius B2 region in multiple 3-mm molecular lines with the Mopra telescope". MNRAS, 386, 117-137 (2008). (M)

KAMP, I., FREUDLING, W., ROBBERTO, M., CHENGALUR, J. & KETO, E. "Probing protoplanetary disk evolution with the HI 21 cm line". Physica Scripta, T130, 14013 (2008). (C)

KARACHENTSEV, I. et al. "Optical identifications of 230 HIPASS radio sources". Astron. Lett., 34, 832-838 (2008). (P)

*KEITH, M.J., JOHNSTON, S., KRAMER, M., WELTEVREDE, P., WATTERS, K.P. & STAPPERS, B.W. "A high-frequency search for radio pulsars in three EGRET error boxes". MNRAS, 389, 1881-1884 (2008). (P, C)

*KERN, K.M., KILBORN, V.A., FORBES, D.A. & KORIBALSKI, B.S. "HI mapping of galaxies in six Group Evolution Multiwavelength Study groups". MNRAS, 384, 305-315 (2008). (C)

KOBULNICKY, H.A. & SKILLMAN, E.D. "Inflows and outflows in the dwarf starburst galaxy NGC 5253: High-resolution HI observations". AJ, 135, 527-537 (2008). (P)

*KRAMER, M. & JOHNSTON, S. "High-precision geometry of a double-pole pulsar". MNRAS, 390, 87-92 (2008). (P)

KRAMER, M. & STAIRS, I.H. "The double pulsar". Ann. Rev. A&A, 46, 541-572 (2008). (P)

LANDT, H. & BIGNALL, H.E. "On the relationship between BL Lacertae objects and radio galaxies". MNRAS, 391, 967-985 (2008). (C)

*LOVELL, J.E.J., RICKETT, B.J., MACQUART, J.-P., JAUNCEY, D.L. et al. "The Micro-Arcsecond Scintillation-Induced Variability (MASIV) Survey. II. The first four epochs". ApJ, 689, 108-126 (2008). (V)

*MAO, S.A., GAENSLER, B.M., STANIMIROVIC, S., HAVERKORN, M., McCLURE-GRIFFITHS, N.M., STAVELEY-SMITH, L. & DICKEY, J.M. "A radio and optical polarisation study of the magnetic field in the Small Magellanic Cloud". ApJ, 688, 1029-1049 (2008). (C)

MARSEILLE, M. et al. "Evolution of massive protostars: The IRAS 18151-1208 region". A&A, 488, 579-595 (2008). (M)

*MASSARDI, M., EKERS, R.D., MURPHY, T., RICCI, R., SADLER, E.M., BURKE, S., DE ZOTTI, G., EDWARDS, P.G., HANCOCK, P.J, JACKSON, C.A., KESTEVEN, M.J., MAHONY, E., PHILLIPS, C.J., STAVELEY-SMITH, L., SUBRAHMANYAN, R., WALKER, M.A. & WILSON, W.E. "The Australia Telescope 20 GHz (AT20G) Survey: The bright source sample". MNRAS, 384, 775-802 (2008). (C)

*McCLURE-GRIFFITHS, N.M., STAVELEY-SMITH, L., LOCKMAN, F.J., CALABRETTA, M.R., FORD, H.A., KALBERLA, P.M.W., MURPHY, T., NAKANISHI, H. & PISANO, D.J. "An interaction of a Magellanic leading arm high-velocity cloud with the Milky Way disk". ApJ, 673, L143-L146 (2008). (C)

McDONNELL, K.E., WARDLE, M. & VAUGHAN, A.E. "A search for OH 6 GHz maser emission towards supernova remnants". MNRAS, 390, 49-58 (2008). (P)

MEYER, M.J., ZWAAN, M.A., WEBSTER, R.L., SCHNEIDER, S.E. & STAVELEY-SMITH, L. "Tully-Fisher relations from an HI-selected sample". MNRAS, 391, 1712-1728 (2008). (P)

*MIDDELBERG, E., NORRIS, R.P., CORNWELL, T.J., VORONKOV, M.A., SIANA, B.D., BOYLE, B.J., CILIEGI, P., JACKSON, C.A., HUYNH, M.T. et al. "Deep Australia Telescope Large Array Survey radio observations of the European Large Area ISO Survey S1/Spitzer wide-area infrared extragalactic field". AJ, 135, 1276-1290 (2008). (C)

*MIDDELBERG, E., NORRIS, R.P., TINGAY, S., MAO, M.Y., PHILLIPS, C.J. & HOTAN, A.W. "The first VLBI image of an infrared-faint radio source". A&A, 491, 435-439 (2008). (C, V)

MIETTINEN, O. et al. "Radio continuum imaging of the R Coronae Austrinae star-forming region with the ATCA". A&A, 486, 799-806 (2008). (C)

*MIGNANO, A., PRANDONI, I., GREGORINI, L., PARMA, P., DE RUITER, H.R., WIERINGA, M.H., VETTOLANI, G. & EKERS, R.D. "The ATESP 5 GHz radio survey. II. Physical properties of the faint radio population". A&A, 477, 459-471 (2008). (C)

*MORGANTI, R., OOSTERLOO, T., STRUVE, C. & SARIPALLI, L. "A circumnuclear disk of atomic hydrogen in Centaurus A". A&A, 485, L5-L8 (2008). (C)

MOSQUERA CUESTA, H.J. & BONILLA QUINTERO, C.A. "Gravitational wave signal of the short rise fling of galactic runaway pulsars". J. Cosmology & Astropart. Phys., 11, 006 (34 pp.) (2008). (P)

*NG, C.-Y., GAENSLER, B.M., STAVELEY-SMITH, L., MANCHESTER, R.N., KESTEVEN, M.J., BALL, L. & TZIOUMIS, A.K. "Fourier modelling of the radio torus surrounding SN 1987A". ApJ, 684, 481-497 (2008). (C)

*NOUTSOS, A., JOHNSTON, S., KRAMER, M. & KARASTERGIOU, A. "New pulsar rotation measures and the Galactic magnetic field". MNRAS, 386, 1881-1896 (2008). (P)

*O'BRIEN, J.T., JOHNSTON, S., KRAMER, M., LYNE, A.G., BAILES, M., POSSENTI, A., BURGAY, M., LORIMER, D.R., McLAUGHLIN, M.A., HOBBS, G. et al. "PSR J1410-6132: A young, energetic pulsar associated with the EGRET source 3EG J1410-6147". MNRAS Lett., 388, L1-L5 (2008). (P)

*OTT, J., WONG, T., PINEDA, J.L., HUGHES, A., MULLER, E. et al. "The molecular ridge close to 30 Doradus in the Large Magellanic Cloud". PASA, 25, 129-137 (2008). (M, C)

*PAPADOPOULOS, P.P., FEAIN, I.J., WAGG, J. & WILNER, D.J. "A new twist to an old story: HE 0450-2958 and the ULIRG optically bright QSO transition hypothesis". ApJ, 684, 845-852 (2008). (C)

PAYNE, J.L. et al. "Optical spectra of radio planetary nebulae in the Small Magellanic Cloud". Serb. AJ, 176, 65-70 (2008). (C)

PAYNE, J.L. et al. "Optical spectra of radio planetary nebulae in the Large Magellanic Cloud". Serb. AJ, 177, 53-59 (2008). (C)

PAYNE, J.L., WHITE, G.L. & FILIPOVIC, M.D. "Long-slit optical spectroscopy of Large Magellanic Cloud radio supernova remnants". MNRAS, 383, 1175-1194 (2008). (C, P)

PINEDA, J.L. et al. "Submillimeter line emission from LMC N159W: a dense, clumpy PDR in a low metallicity environment". A&A, 482, 197-208 (2008). (M)

*PINER, B.G., PANT, N. & EDWARDS, P.G. "The parsec-scale jets of the TeV blazars H1426+428, 1ES 1959+650, and PKS 2155-304: 2001-2004". ApJ, 678, 64-77 (2008). (V)

*PROTHEROE, R.J., OTT, J., EKERS, R.D., JONES, D.I. & CROCKER, R.M. "Interpretation of radio continuum and molecular line observations of Sgr B2: free-free and synchrotron emission, and implications for cosmic rays". MNRAS, 390, 683-692 (2008). (C)

*ROY, A.L., GOSS, W.M. & ANANTHARAMAIAH, K.R. "Detection of the H92a recombination line from the starbursts in the Circinus galaxy and NGC 1808". A&A, 483, 79-88 (2008). (C)

ROY, S., PRAMESH RAO, A. & SUBRAHMANYAN, R. "Magnetic field near the central region of the Galaxy: Rotation measure of extragalactic sources". A&A, 478, 435-442 (2008). (C)

*SADLER, E.M., RICCI, R., EKERS, R.D., SAULT, R.J., JACKSON, C.A. & DE ZOTTI, G. "The extragalactic radio-source population at 95 GHz". MNRAS, 385, 1656-1672 (2008). (C)

*SAFOURIS, V., SUBRAHMANYAN, R., BICKNELL, G.V. & SARIPALLI, L. "PKS B1545-321: Bow shocks of a relativistic jet?". MNRAS, 385, 2117-2135 (2008). (C)

SESANA, A., VECCHIO, A. & COLACINO, C.N. "The stochastic gravitational-wave background from massive black hole binary systems: Implications for observations with pulsar timing arrays". MNRAS, 390, 192-209 (2008). (P)

SHANKLAND, P.D. et al. "Further constraints on the presence of a debris disk in the multiplanet system Gliese 876". AJ, 135, 2194-2198 (2008). (V, C)

*SLEE, O.B., ANDERNACH, H., McINTYRE, V.J. & TSAREVSKY, G. "A radio survey of seven southern X-ray luminous clusters of galaxies". MNRAS, 391, 297-319 (2008). (C)

*SLEE, O.B., WILSON, W. E. & RAMSAY, G. "The coherent radio emission from the RS CVn binary HR 1099". PASA, 25, 94-104 (2008). (C)

SMITH, A.G., HOPKINS, A.M., HUNSTEAD, R.W., SCHMIDT, S.J., AFONSO, J., GEORGAKAKIS, A.E., CRAM, L.E., MOBASHER, B. & SULLIVAN, M. "The PHOENIX Deep Survey: Extremely red galaxies and cluster candidates". AJ, 136, 358-366 (2008). (C)

*SMITH, D.A., GUILLEMOT, L., CAMILO, F., COGNARD, I., DUMORA, D., ESPINOZA, C., FREIRE, P.C., GOTTHELF, E.V., HARDING, A.K., HOBBS, G.B., JOHNSTON, S., KASPI, V.M., KRAMER, M., LIVINGSTONE, M.A., LYNE, A.G., MANCHESTER, R.N. et al. "Pulsar timing for the Fermi Gamma-Ray Space Telescope". A&A, 492, 923-931 (2008). (P)

STANWAY, E.R., BREMER, M.N., DAVIES, L.J., BIRKINSHAW, M., DOUGLAS, L.S. & LEHNERT, M.D. "Large-scale structure traced by molecular gas at high redshift". ApJ, 687, L1-L4 (2008). (C)

TIAN, W.W., LEAHY, D.A., HAVERKORN, M. & JIANG, B. "Discovery of the radio and X-ray counterpart of TeV g-ray source HESS J1731-347". ApJ, 679, L85-L88 (2008). (C, P)

*TINGAY, S.J., LENC, E., BRUNETTI, G. & BONDI, M. "A high resolution view of the jet termination shock in a hot spot of the nearby radio galaxy Pictor A: Implications for X-ray models of radio galaxy hot spots". AJ, 136, 2473-2482 (2008). (C)

TRIGILIO, C., LETO, P., UMANA, G., BUEMI, C.S. & LEONE, F. "The radio lighthouse CU Virginis: The spin-down of a single main-sequence star". MNRAS, 384, 1437-1443 (2008). (C)

*TUDOSE, V., FENDER, R.P., TZIOUMIS, A.K., SPENCER, R.E. & VAN DER KLIS, M. "A decade of radio imaging the relativistic outflow in the peculiar X-ray binary Circinus X-1". MNRAS, 390, 447-464 (2008). (C)

UMANA, G., TRIGILIO, C., CERRIGONE, L., BUEMI, C.S. & LETO, P. "ATCA observations of the very young planetary nebula SAO 244567". MNRAS, 386, 1404-1410 (2008). (C)

URQUHART, J.S., BUSFIELD, A.L., HOARE, M.G., et al. "The RMS survey: 13CO observations of candidate massive YSOs in the northern Galactic plane". A&A, 487, 253-264 (2008). (M)

*VERBIEST, J.P., BAILES, M., VAN STRATEN, W., HOBBS, G.B., EDWARDS, R.T., MANCHESTER, R.N., BHAT, N.D.R., SARKISSIAN, J.M. et al. "Precision timing of PSR J0437-4715: An accurate pulsar distance, a high pulsar mass, and the limit on the variation of Newton's gravitational constant". ApJ, 679, 675-680 (2008). (P)

*WALSH, A.J., LO, N., BURTON, M.G., WHITE, G.L., PURCELL, C.R., LONGMORE, S.N., PHILLIPS, C.J. & BROOKS, K.J. "A pilot survey for the H2O Southern Galactic Plane Survey". PASA, 25, 105-113 (2008). (M)

*WELTEVREDE, P. & JOHNSTON, S. "The population of pulsars with interpulses and the implications for beam evolution". MNRAS, 387, 1755-1760 (2008). (P)

*WELTEVREDE, P. & JOHNSTON, S. "Profile and polarisation characteristics of energetic pulsars". MNRAS, 391, 1210-1226 (2008). (P)

WERK, J.K., PUTMAN, M.E., MEURER, G.R. et al. "Isolated OB associations in stripped HI gas clouds". ApJ, 678, 888-906 (2008). (C)

*WESTMEIER, T. & KORIBALSKI, B.S. "The scattered debris of the Magellanic Stream". MNRAS Lett., 388, L29-L33 (2008). (P)

* WONG, T., LADD, E.F., BRISBIN, D., BURTON, M.G., BAINS, I., CUNNINGHAM, M.R., LO, N., JONES, P.A., THOMAS, K.L., LONGMORE, S.N. et al. "Molecular line mapping of the giant molecular cloud associated with RCW 106. II. Column density and dynamical state of the clumps". MNRAS, 386, 1069-1084 (2008). (M)

WYROWSKI, F. et al. "APEX and ATCA observations of the southern hot core G327.3-0.6 and its environs". Astrophys. Space Sci., 313, 69-72 (2008). (C)

*YAMAMOTO, H., ITO, S., ISHIGAMI, S., FUJISHITA, M., KAWASE, T., KAWAMURA, A., MIZUNO, N., ONISHI, T., MIZUNO, A., McCLURE-GRIFFITHS, N.M. & FUKUI, Y. "Aligned molecular clouds towards SS 433 and L=348o.5: Possible evidence for a galactic "vapor trail" created by a relativistic jet". PASJ, 60, 715-729 (2008). (P)

Papers using ATNF data published in conference proceedings, and other publications with ATNF authors

* Indicates publication with ATNF staff

C = Compact Array data, M = Mopra data, P = Parkes data, O = Other papers by ATNF staff

*BEKHTI, N.B., MURPHY, M., RICHTER, P. & WESTMEIER, T. "Ca II and Na I absorption signatures from the circumgalactic gas of the Milky Way". In: Galaxies in the Local Volume, Sydney, NSW, 8-13 July 2007, Astrophys. & Space Sci. Proc., 273-274 (2008). (eds. B. Koribalski, H. Jerjen) (O)

*BEKHTI, N.B., RICHTER, P., WESTMEIER, T. & MURPHY, M.T. "Ca II and Na I absorption signatures from extraplanar gas in the halo of the Milky Way". A&A, 487, 583-594 (2008). (O)

*BEKKI, K., CHIBA, M. & McCLURE-GRIFFITHS, N.M. "The Magellanic impact: Collision between the outer Galactic H I disk and the leading arms of the Magellanic Stream". ApJ, 672, L17-L20 (2008). (O)

*BENAGLIA, P., VINK, J.S., MAIZ APELLANIZ, J., MARTI, J., KORIBALSKI, B.S. & CROWTHER, P.A. "Radio study on the mass loss bi-stability jump". In: Massive Stars: Fundamental Parameters and Circumstellar Interactions, Buenos Aires, Argentina, 11-14 December 2006, RevMexAA Ser. Conf., 33, 65-67 (2008). (eds. P. Benaglia, G. Bosch, C. Cappa) (O)

*BENAGLIA, P., VINK, J.S., MARTI, J., MAIZ-APPELLANIZ, J., KORIBALSKI, B.S. & JOHNSTON, S. "Radio evidence on the mass loss bistability jump". In: Mass Loss from Stars and the Evolution of Stellar Clusters, Lunteren, The Netherlands, May 29 - June 1, 2006, ASP Conf. Ser., 388, 141-142 (2008). (eds. A. de Koter, L. Smith, L. Waters) (C)

*BHATNAGAR, S., CORNWELL, T.J., GOLAP, K. & USON, J.M. "Correcting direction-dependent gains in the deconvolution of radio interferometric images". A&A, 487, 419-429 (2008). (O)

CARRETTI, E. "Limits on CMBP B-mode measurements by galactic synchrotron observations". In: Cosmology, Galaxy Formation and Astroparticle Physics on the Pathway to the SKA, Oxford, Eng., 10-12 April 2006, 61-64 (2008). (eds. H.-R. Kloeckner et al.) (P, S)

*CHAMPION, D.J. et al. "An eccentric binary millisecond pulsar in the Galactic plane". Science, 320, 1309-1312 (2008). (O)

*CHAMPION, D.J. et al. "The discovery of an eccentric millisecond pulsar in the Galactic plane". In: 40 Years of Pulsars: Millisecond Pulsars, Magnetars and More, Montreal, Que., 12-17 August, 2007, AIP Conf. Proc., 983, 448-452 (2008). (eds. C. Bassa et al.) (O)

*CLUVER, M.E., JARRETT, T.H., APPLETON, P.N., KRAAN-KORTEWEG, R.C., WOUDT, P.A., KORIBALSKI, B.S. et al. "The hidden HI-massive luminous infrared galaxy HIZOA J0836-43: Inside-out galaxy formation". ApJ, 686, L17-L20 (2008). (O)

*CORNWELL, T.J. "Multiscale CLEAN deconvolution of radio synthesis images". IEEE J. Select. Topics Sign. Process., 2, 793-801 (2008). (O)

*CORNWELL, T.J., GOLAP, K. & BHATNAGAR, S. "The noncoplanar baselines effect in radio interferometry: The W-projection algorithm". IEEE J. Select. Topics Sign. Process., 2, 647-657 (2008). (O)

*CORONGIU, A., POSSENTI, A., D'AMICO, N., BURGAY, M., LYNE, A.G., MANCHESTER, R.N., CAMILO, F. & SARKISSIAN, J.M. "Parkes observations of radio pulsars in globular clusters". In: 40 Years of Pulsars: Millisecond Pulsars, Magnetars and More, Montreal, Que., 12-17 August, 2007, AIP Conf. Proc., 983, 601-603 (2008). (eds. C. Bassa et al.) (P)

*CORTESE, L., MINCHIN, R.F., AULD, R.R., DAVIS, J.I., CATINELLA, B., MOMJIAN, E., ROSENBERG, J.L., TAYLOR, R., GAVAZZI, G., O'NEIL, K., BAES, M., BOSELLI, A., BOTHUN, G., KORIBALSKI, B.S., SCHNEIDER, S. & VAN DRIEL, W. "The Arecibo Galaxy Environment Survey. II. A HI view of the Abell cluster 1367 and its outskirts". MNRAS, 383, 1519-1537 (2008). (O)

CRAWFORD, F. HESSELS, J.W. & KASPI, V.M. "A search for single radio pulses and bursts from southern AXPs". In: 40 Years of Pulsars: Millisecond Pulsars, Magnetars and More, Montreal, Que., 12-17 August, 2007, AIP Conf. Proc., 983, 259-261 (2008). (eds. C. Bassa et al.) (P)

*CUNNINGHAM, M.R., LO, N., KRAMER, C., BAINS, I., JONES, P.A., BURTON, M.G., MULLER, E. & OSSENKOPF, V. "Large scale structure and turbulence: The Mopra G333 Survey". In: Far-Infrared and Submillimeter Emission of the Interstellar Medium Workshop, Bad Honnef, Germany, 5-7 November 2007, EAS Pub. Ser., 31, 9-14 (2008). (eds. C. Kramer, S. Aalto, R. Simon) (M)

DA COSTA, G.S., JERJEN, H. & BOUCHARD, A. "ESO540-032: a transition-type dwarf in the Sculptor group". In: Galaxies in the Local Volume, Sydney, NSW, 8-13 July 2007, Astrophys. & Space Sci. Proc., 123-126 (2008). (eds. B. Koribalski, H. Jerjen) (P, C)

*DOBASHI, K., BERNARD, J.-P., HUGHES, A. et al. "Extinction and dust/gas ratio in LMC molecular clouds". A&A, 484, 205-223 (2008). (O)

ECKART, A. et al. "Prospects for observing the Galactic Centre: Combining LBT LINC-NIRVANA observations in the near-infrared with observations in the mm/sub-mm wavelength domain". In: Optical and Infrared Interferometry, Marseille, France, 23 June 2008, Proc. SPIE, 7013, 70134L (2008). (eds. M. Scholler et al.) (C)

*ELLINGSEN, S.W., HAMPSON, G.A. & CHILDERS, R.K. "Argus: An L-band all-sky astronomical surveillance system". IEEE Trans. Antenn. Propag., 56, 294-302 (2008). (O)

*ENOMOTO, R., HIGASHI, Y., YOSHIDA, T., TANIMORI,T., BICKNELL, G.V., CLAY, R.W., EDWARDS, P.G. et al. "CANGAROO-III search for gamma rays from Kepler's supernova remnant". ApJ, 683, 383-388 (2008). (O)

FAUCHER-GIGUERE, C.-A. & KASPI, V.M. "Birth and evolution of isolated radio pulsars". In: 40 Years of Pulsars: Millisecond Pulsars, Magnetars and More, Montreal, Que., 12-17 August, 2007, AIP Conf. Proc., 983, 607-609 (2008). (eds. C. Bassa et al.) (P)

*FEAIN, I.J., CORNWELL, T.J., EKERS, R.D., NORRIS, R.P., GAENSLER, B.M., OTT, J., JOHNSTON-HOLLITT, M., MURPHY, T., MIDDELBERG, E. & BLAND-HAWTHORN, J. "A long overdue synthesis image of Centaurus A". In: Galaxies in the Local Volume, Sydney, NSW, 8-13 July 2007, Astrophys. & Space Sci. Proc., 287-288 (2008). (eds. B. Koribalski, H. Jerjen) (C, P)

*FERDMAN, R.D., STAIRS, I.H., KRAMER, M., MANCHESTER, R.N. et al. "The double pulsar: Evolutionary constraints from the system geometry". In: 40 Years of Pulsars: Millisecond Pulsars, Magnetars and More, Montreal, Que., 12-17 August, 2007, AIP Conf. Proc., 983, 474-478 (2008). (eds. C. Bassa et al.) (P)

*FREUDLING, W., CATINELLA, B., CALABRETTA, M. et al. "The ALFA Ultra Deep Survey (AUDS)". In: The Evolution of Galaxies Through the Neutral Hydrogen Window, Arecibo Observatory, Puerto Rico, 1-3 February 2008, AIP Conf. Proc., 1035, 242-245 (2008). (eds. R. Minchin, E. Momjian) (O)

*GAENSLER, B.M., TANNA, A., SLANE, P.O., BROGAN, C.L., GELFAND, J.D., McCLURE-GRIFFITHS, N.M. , CAMILO, F., NG, C.-Y., & MILLER, J.M. "(Re-)discovery of G350.1-0.3: A young, luminous supernova remnant and its neutron star". ApJ, 680, L37-L40 (2008). (O)

*GELBORD, J.M., MARSHALL, H.L., SCHAWRTZ, D.A., LOVELL, J.E., MURPHY, D.W., WORRALL, D.M., BIRKINSHAW, M., PERLMAN, E.S., GODFREY, L., GEORGANOPOULOS, M. & JAUNCEY, D.L. "A Chandra survey of quasar jets: Latest results". In: Extragalactic Jets: Theory and Observation from Radio to Gamma Ray, Girdwood, Alaska, 21-24 May 2007, ASP Conf. Ser., 386, 203-209 (2008). (eds. T. Rector, D. De Young) (O)

*GIROLETTI, M., GIOVANNINI, G., COTTON, W.D., TAYLOR, G.B., PEREZ-TORRES, M.A., CHIABERGE, M. & EDWARDS, P.G. "The jet of Markarian 501 from millions of Schwarzschild radii down to a few hundreds". A&A, 488, 905-914 (2008). (O)

*GONZALEZ-NUEVO, J., MASSARDI, M. et al. "Statistical properties of extragalactic sources in the New Extragalactic WMAP Point Source (NEWPS) catalogue". MNRAS, 384, 711-718 (2008). (O)

GRCEVICH, J., PUTMAN, M. & PEEK, J.E.G. "HI in local group dwarf galaxies". In: The Evolution of Galaxies Through the Neutral Hydrogen Window, Arecibo Observatory, Puerto Rico, 1-3 February 2008, AIP Conf. Proc., 1035, 159-162 (2008). (eds. R. Minchin, E. Momjian) (O)

*HAY, S.G. & O'SULLIVAN, J.D. "Analysis of common-mode effects in a dual-polarized planar connected-array antenna". Radio Sci., 43, RS6S04 (2008). (O)

*HAY, S.G., O'SULLIVAN, J.D. & MITTRA, R. "Analysis of connected patch arrays using the characteristic basis function method". In: IEEE International Symposium on Antennas and Propagation (AP-S 2008), San Diego, Calif., 5-12 July 2008, 4619541, (2008). (O)

*HENKEL, C., BRAATZ, J.A., MENTEN, K.M. & OTT, J. "The kinetic temperature of a molecular cloud at redshift 0.9: Ammonia in the gravitational lens PKS 1830-211". A&A, 485, 451-456 (2008). (O)

*HENNING, P.A., SPRINGOB, C.M., DAY, F., MINCHIN, R., MOMJIAN, E., CATINELLA, B., MULLER, E., KORIBALSKI, B.S. et al. "The ALFA Zone of Avoidance Survey". In: The Evolution of Galaxies Through the Neutral Hydrogen Window, Arecibo Observatory, Puerto Rico, 1-3 February 2008, AIP Conf. Proc., 1035, 246-248 (2008). (eds. R. Minchin, E. Momjian) (O)

*HESSELS, J.W., NICE, D.J., GAENSLER, B.M., KASPI, V.M., LORIMER, D.R., CHAMPION, D.J. et al. "PSR J1856+0245: Arecibo discovery of a young, energetic pulsar coincident with the TeV gamma-ray source HESS J1857+026". ApJ, 682, L41-L44 (2008). (O)

*HIGASHI, Y., KUBO, H., YOSHIDA, T., ENOMOTO, R., TANIMORI, T., EDWARDS, P.G. et al. "Observation of very high energy gamma rays from HESS J1804-216 with CANGAROO-III telescopes". ApJ, 683, 957-966 (2008). (O)

*HOBBS, G. "Gravitational wave detection using high precision pulsar observations". In: 7th Edoardo Amaldi Conference on Gravitational Waves (Amaldi7), Sydney, NSW, 8-14 July 2007, J. Phys.: Conf. Ser., 122, 12003 (2008). (P)

*HOBBS, G., JENET, F., LOMMEN, A., COLES, W., VERBIEST, J.P. & MANCHESTER, R.N. "Using pulsars to limit the existence of a gravitational wave background". In: 40 Years of Pulsars: Millisecond Pulsars, Magnetars and More, Montreal, Que., 12-17 August, 2007, AIP Conf. Proc., 983, 630-632 (2008). (eds. C. Bassa et al.) (P)

*HOLLOW, R., HOBBS, G., CHAMPION, D.J., AMY, S., KHOO, J., CHAPMAN, J., MULCAHY, M., ALEM, L., KRUMM-HELLER, A., McKINNON, D., DANAIA, L., JENET, F. & CARR, M. "PULSE@Parkes: Pulsar observing for high school students". In: Preparing for the 2009 International Year of Astronomy: a Hands-On Symposium, St. Louis, Mo., 1-5 June 2008, ASP Conf. Ser., 400, 190-196 (2008). (eds. M.G. Gibbs et al.) (P)

*HOPKINS, A.M., McCLURE-GRIFFITHS, N.M. & GAENSLER, B.M. "Linked evolution of gas and star formation in galaxies over cosmic history". ApJ, 682, L13-L16 (2008). (O)

*HUGHES, A., WONG, T., OTT, J., MULLER, E., PINEDA, J.L. & MIZUNO, Y. "Atomic gas associated with GMCs in the LMC". In: Galaxies in the Local Volume, Sydney, NSW, 8-13 July 2007, Astrophys. & Space Sci. Proc., 293-294 (2008). (eds. B. Koribalski, H. Jerjen) (C, P, M)

JONES, P.A., BURTON, M.G. & CUNNINGHAM, M.R. "A 3-mm molecular line study of the central molecular zone". In: Far-Infrared and Submillimeter Emission of the Interstellar Medium Workshop, Bad Honnef, Germany, 5-7 November 2007, EAS Pub. Ser., 31, 77-80 (2008). (eds. C. Kramer, S. Aalto, R. Simon) (M)

JONES, P.A., BURTON, M.G. & LOWE, V. "A 3-mm molecular line study of the central molecular zone of the Galaxy". In: IAU 251: Organic Matter in Space, Hong Kong, 18-22 Feb. 2008, Proc. IAU, 4, 257-262 (2008). (eds. S. Kwok, S. Sandford) (M)

JONES, P.A., CUNNINGHAM, M.R. & STANIMIROVIC, S. "The CO outflow from IRAS 18316-0602 in G25.65+1.05". In: Science with the Atacama Large Millimeter Array: a New Era for Astrophysics, Madrid, Spain, 13-17 November, 2006 CD appendix (2008). (eds. R. Bachiller & J. Cernicharo) (M)

*JUETT, A.M., SARAZIN, C.L., CLARKE, T.E., ANDERNACH, H., EHLE, M., FUJITA, Y., KEMPNER, J.C., ROY, A.L., RUDNICK, L. & SLEE, O.B. "A Chandra observation of Abell 13: Investigating the origin of the radio relic". ApJ, 672, 138-145 (2008). (O)

KALEMCI, E., TOMSICK, J.A., MIGLIARI, S., CORBEL, S. & MARKOFF, S. "Galactic black holes in the hard state, a multiwavelength view of accretion and ejection". In: Observational Evidence for Black Holes in the Universe: Proc. 2nd Kolkata Conf., Kolkata, India, 10-15 February 2008, AIP Conf. Ser., 1053, 201-208 (2008). (eds. S. Chakrabarti, A.S. Majumdar) (C)

*KATAOKA, J., MADEJSKI, G., SIKORA, M., ROMING, P., CHESTER, M.M., GRUPE, D., TSUBUKU, Y., SATO, R., KAWAI, N., TOSTI, G., IMPIOMBATO, D., KOVALEV, Y.Y., KOVALEV, Y.A., EDWARDS, P.G. et al. "Multiwavelength observations of the powerful gamma-ray quasar PKS 1510-089: Clues on the jet composition". ApJ, 672, 787-799 (2008). (O)

*KATAOKA, J., STAWARZ, L., HARRIS, D.E., SIEMIGINOWSKA, A., OSTROWSKI, M., SWAIN, M.R., HARDCASTLE, M.J., GOODGER, J.L., IWASAWA, K. & EDWARDS, P.G. "Chandra reveals twin X-ray jets in the powerful FR II radio galaxy 3C 353". ApJ, 685, 839-857 (2008). (O)

*KIRBY, E.M., JERJEN, H., RYDER, S.D. & DRIVER, S.P. "Deep near-infrared surface photometry of 57 galaxies in the Local Sphere of Influence". AJ, 136, 1866-1888 (2008). (O)

*KOMUGI, G., SOFUE, Y., KOHNO, K., NAKANISHI, H. et al. "Molecular gas distribution in barred and nonbarred galaxies along the Hubble sequence". ApJS, 178, 225-246 (2008). (O)

*KORIBALSKI, B.S. & LVHIS TEAM. "The Local Volume HI Survey (LVHIS)". In: Galaxies in the Local Volume, Sydney, NSW, 8-13 July 2007, Astrophys. & Space Sci. Proc., 41-44 (2008). (eds. B. Koribalski, H. Jerjen) (C)

*KRAAN-KORTEWEG, R.C., SHAFI, N., KORIBALSKI, B.S. et al. "Outlining the local void with the Parkes HI ZOA and Galactic Bulge surveys". In: Galaxies in the Local Volume, Sydney, NSW, 8-13 July 2007, Astrophys. & Space Sci. Proc., 13-16 (2008). (eds. B. Koribalski, H. Jerjen) (P)

*LAZIO, T.J., OJHA, R., FEY, A.L., KEDZIORA-CHUDCZER, L., CORDES, J.M., JAUNCEY, D.L. & LOVELL, J.E.J. "Angular broadening of intraday variable AGNs. II. Interstellar and intergalactic scattering". ApJ, 672, 115-121 (2008). (O)

LI, J., SHEN, Z.-Q., MIYAZAKI, A., HUANG, L., SAULT, R.J. et al. "The variability of Sagittarius A at 3-millimeters". In: The Universe Under the Microscope - Astrophysics at High Angular Resolution, Bad Honnef, Germany, 21-28 April 2008, J. Phys.: Conf. Ser., 131, 120071 (2008). (eds. R. Schodel et al.) (C)

LI, J., SHEN, Z.-Q., MIYAZAKI, A., MIYOSHI, M., TSUTSUMI, T., TSUBOI, M., HUANG, L. & SAULT, R.J. "The 3-mm flux density monitoring of Sagittarius A with the ATCA". In: IAU 248 : A Giant Step: from Milli- to Micro-Arcsecond Astrometry, Shanghai, China, 15-19 October 2007 248, 204-205 (2008). (eds. W. Jin et al.) (C)

LONGMORE, S.N., BURTON, M.G., PURCELL, C.R. & OTT, J. "Determining the relative evolutionary stages of very young massive star formation regions". In: Massive Star Formation: Observations Confront Theory, Heidelberg, Germany, 10-14 September, 2007, ASP Conf. Ser., 387, 58-70 (2008). (eds. H. Beuther, H. Linz, T. Henning) (C)

*LOPEZ-SANCHEZ, A.R. & ESTEBAN, C. "Interactions and star formation activity in Wolf-Rayet galaxies". In: Galaxies in the Local Volume, Sydney, NSW, 8-13 July 2007, Astrophys. & Space Sci. Proc., 299-300 (2008). (ed. B. Koribalski, H. Jerjen) (O)

*LOPEZ-SANCHEZ, A.R. & ESTEBAN, C. "Interaction and star formation activity in Wolf-Rayet galaxies". In: Young Massive Star Clusters: Initial Conditions and Environments, Granada, Spain, 11-14 September 2007, (2008). (eds. E. Perez, R. de Grijs, R. Gonzalez-Delgado) (O)

*LOPEZ-SANCHEZ, A.R. & ESTEBAN, C. "Massive star formation in Wolf-Rayet galaxies. I. Optical and NIR photometric results". A&A, 491, 131-156 (2008). (O)

*LOPEZ-SANCHEZ, A.R., KORIBALSKI, B.S., ESTEBAN, C. & GARCIA-ROJAS, J. "Ionized and neutral gas in the starburst galaxy NGC 5253". In: Galaxies in the Local Volume, Sydney, NSW, 8-13 July 2007, Astrophys. & Space Sci. Proc., 53-56 (2008). (eds. B. Koribalski, H. Jerjen) (C)

*LOPEZ-SANCHEZ, A.R., KORIBALSKI, B.S., ESTEBAN, C. & HIBBARD, J. "Interactions and starburst activity in galaxy groups: The case of Tol 9 in Klemola 13 group". In: Galaxies in the Local Volume, Sydney, NSW, 8-13 July 2007, Astrophys. & Space Sci. Proc., 301-302 (2008). (eds. B. Koribalski, H. Jerjen) (C)

LYNE, A.G. "Parkes 20-cm Multibeam Pulsar Surveys". In: 40 Years of Pulsars: Millisecond Pulsars, Magnetars and More, Montreal, Que., 12-17 August, 2007, AIP Conf. Proc., 983, 561-566 (2008). (eds. C. Bassa et al.) (P)

*MANCHESTER, R.N. "The Parkes Pulsar Timing Array Project". In: 40 Years of Pulsars: Millisecond Pulsars, Magnetars and More, Montreal, Que., 12-17 August, 2007, AIP Conf. Proc., 983, 584-592 (2008). (eds. C. Bassa et al.) (P)

MASTERS, K.L. "Mapping mass in the local Universe". In: Frontiers of Astrophysics: A Celebration of NRAO's 50th Anniversary, Charlottesville, Va., 18-21 June 2007, ASP Conf. Ser., 395, 137-146 (2008). (eds. A. Bridle, J. Condon, G. Hunt) (P)

*MATTHEWS, D., STAVELEY-SMITH, L., DYSON, P., McCLURE-GRIFFITHS, N. & MULLER, E. "Characterising Magellanic Stream turbulent HI". In: Galaxies in the Local Volume, Sydney, NSW, 8-13 July 2007, Astrophys. & Space Sci. Proc., 309-310 (2008). (eds. B. Koribalski, H. Jerjen) (C, P)

*McFADDEN, R., BHAT, N.D.R., EKERS, R.D., JAMES, C.W., JONES, D., TINGAY, S.J., ROBERTS, P., PHILIPS, C.J. & PROTHEROE, R.J. "Developments in nanosecond pulse detection methods & technology". In: 30th International Cosmic Ray Conference, Merida, Mexico, 3-11 July, 2007, 5, 1549-1552 (2008). (eds. R. Caballero et al.) (C)

MEURER, G.R., WONG, O.I. & HANISH, D.J. "The HI-star formation connection: Open questions". In: The Evolution of Galaxies Through the Neutral Hydrogen Window, Arecibo Observatory, Puerto Rico, 1-3 February 2008, AIP Conf. Proc., 1035, 119 (2008). (eds. R. Minchin, E. Momjian) (P)

*MINAMIDANI, T., MIZUNO, N., MIZUNO, Y., KAWAMURA, A., ONISHI, T., HASEGAWA, T., TATEMATSU, K., IKEDA, M., MORIGUCHI, Y., YAMAGUCHI, N., JURGEN, O., WONG, T., MULLER, E. et al. "Submillimeter observations of giant molecular clouds in the Large Magellanic Cloud: Temperature and density as determined from J=3-2 and J=1-0 transitions of CO". ApJS, 175, 485-508 (2008). (O)

*MINAMIDANI, T., MIZUNO, N., MIZUNO, Y., KAWAMURA, A., ONISHI, T., HASEGAWA, T., TATEMATSU, K., IKEDA, M., MORIGUCHI, Y., YAMAGUCHI, N., OTT, J., WONG, T., MULLER, E. et al. "An observational study of the GMCs in the Magellanic Clouds in millimeter and submillimeter wavelengths". In: Galaxies in the Local Volume, Sydney, NSW, 8-13 July 2007, Astrophys. & Space Sci. Proc., 311-312 (2008). (eds. B. Koribalski, H. Jerjen) (M)

*MOOREY, G.G., BOLTON, R., BOWEN, M., DUNNING, A., GOUGH, R.G., KANONIUK, H., REILLY, L. & ROBERTS, P. "Cryogenically cooled 30-50 GHz receiver systems for the Australia Telescope". In: Workshop on Applications of Radio Science (WARS 2008), Broadbeach, Qld, 10-12 February 2008, 8 pp. (2008). (C)

*MOOREY, G.G., BOLTON, R.J., BOWEN, M.A., CARRAD, G.J., DUNNING, A., GOUGH, R.G., GRAVES, G.R., KANONIUK, H.P. & REILLY, L.J. "Cryogenically cooled millimetre-wave front ends for the Australia Telescope". In: 38th European Micowave Conference (EuMC 2008), Amsterdam, The Netherlands, 28-31 October, 2008, 155-158 (2008). (C)

*MULLER, E. & STAVELEY-SMITH, L. "Foreword: The Magellanic System". PASA, 25, 115 (2008). (O)

*NAKAMORI, T., KUBO, H., YOSHIDA, T., TANIMORI, T., ENOMOTO, R., BICKNELL, G.V., CLAY, R.W., EDWARDS, P.G. et al. "Observation of an extended very high energy gamma-ray emission from MSH 15-52 with CANGAROO-III". ApJ, 677, 297-305 (2008). (O)

*NAKANISHI, H. et al. "Kiso Outer Galaxy Survey: Stellar radial distribution of the Galaxy". In: Galaxies in the Local Volume, Sydney, NSW, 8-13 July 2007, Astrophys. & Space Sci. Proc., 315-316 (2008). (eds. B. Koribalski, H. Jerjen) (O)

NIDEVER, D.L., MAJEWSKI, S.R. & BURTON, W.B. "The origin of the Magellanic Stream and its leading arm". In: Galaxies in the Local Volume, Sydney, NSW, 8-13 July 2007, Astrophys. & Space Sci. Proc., 243-246 (2008). (eds. B. Koribalski, H. Jerjen) (O)

*NORRIS, R.P. "Emu Dreaming". Australas. Sci., 29 (4), 16-19 (2008). (O)

*OHISHI, M., MORI, M., ADACHI, Y., ASAHARA, A., BICKNELL, G.V., CLAY, R.W., DOI, Y., EDWARDS, P.G. et al. "Very high energy gamma-ray observations of the Galactic Plane with the CANGAROO-III telescopes". Astropart. Phys., 30, 47-53 (2008). (O)

OTT, J., HENKEL, C., WEISS, A. & WALTER, F. "Dense molecular gas in nearby southern starburst galaxies". In: Galaxies in the Local Volume, Sydney, NSW, 8-13 July 2007, Astrophys. & Space Sci. Proc., 147-150 (2008). (eds. B. Koribalski, H. Jerjen) (C)

*OTT, J., SKILLMAN, E., DALCANTON, J., WALTER, F., STILP, A., KORIBALSKI, B.S., WEST, A. & WARREN, S. "Connecting gas dynamics and star formation histories in nearby galaxies: the VLA - ANGST Survey". In: The Evolution of Galaxies Through the Neutral Hydrogen Window, Arecibo Observatory, Puerto Rico, 1-3 February 2008, AIP Conf. Proc., 1035, 105-111 (2008). (eds. R. Minchin, E. Momjian) (O)

*OTT, J., SKILLMAN, E., DALCANTON, J., WALTER, F., WEST, A., KORIBALSKI, B.S. & WEISZ, D. "VLA-ANGST: Star formation history and ISM feedback in nearby galaxies". In: Galaxies in the Local Volume, Sydney, NSW, 8-13 July 2007, Astrophys. & Space Sci. Proc., 321-322 (2008). (eds. B. Koribalski, H. Jerjen) (O)

*POPPING, A. & BRAUN, R. "The standing wave phenomenon in radio telescopes: Frequency modulation of the WSRT primary beam". A&A, 479, 903-913 (2008). (O)

*PURSIMO, T., OJHA, R., JAUNCEY, D.L., LOVELL, J.E., DUTKA, M., BIGNALL, H., MACQUART, J.-P., RICKETT, B. & KEDZIORA-CHUDCZER, L. "The Micro-Arcsecond Scintillation-Induced Variability (MASIV) Survey: Detection of angular broadening at high redshift?". In: Extragalactic Jets: Theory and Observation from Radio to Gamma Ray, Girdwood, Alaska, 21-24 May 2007, ASP Conf. Ser., 386, 517-521 (2008). (eds. T. Rector, D. De Young) (O)

REYNOSO, E.M., CASTELLETTI, G., MOFFETT, D.A. & HUGHES, J.P. "Mass loss from the progenitor of SN 1006?". In: Massive Stars: Fundamental parameters and Circumstellar Interactions, Buenos Aires, Argentina, 11-14 December 2006, RevMexAA Ser. Conf., 33, 157-158 (2008). (eds. P. Benaglia, G. Bosch, C. Cappa) (C)

*RICH, J.W., DE BLOK, W.J.G., CORNWELL, T.J., BRINKS, E., WALTER, F., BAGETAKOS, I. & KENNICUTT, R.C. "Multi-scale CLEAN: A comparison of its performance against classical CLEAN on galaxies using THINGS". AJ, 136, 2897-2920 (2008). (O)

*RODRIGUEZ, L.F., MORAN, J.M., FRANCO-HERNANDEZ, R., GARAY, G., BROOKS, K.J. & MARDONES, D. "The collimated jet source in IRAS 16547-4247: Time variation, possible precession, and upper limits to the proper motions along the jet axis". AJ, 135, 2370-2379 (2008). (O)

*SAKAMOTO, Y., NISHIJIMA, K., MIZUKAMI, T., YAMAZAKI, E., KUSHIDA, J., ENOMOTO, R., OHISHI, M., BICKNELL, G.V., CLAY, R.W., EDWARDS, P.G. et al. "CANGAROO-III observations of the 2006 outburst of PKS 2155-304". ApJ, 676, 113-120 (2008). (O)

*SCHWARTZ, D.A., SIEMIGINOWSKA, A., WORRALL, D.M., BIRKINSHAW, M., JAUNCEY, D.L. et al. "A deep Chandra observation of the PKS 1055+201 jets, lobes, and hotspots". In: Extragalactic Jets: Theory and Observation from Radio to Gamma Ray, Girdwood, Alaska, 21-24 May 2007, ASP Conf. Ser., 386, 63-69 (2008). (eds. T. Rector, D. De Young) (O)

*SENKBEIL, C.E., ELLINGSEN, S.P., LOVELL, J.E.J., MACQUART, J.P., CIMO, G. & JAUNCEY, D.L. "A compact extreme scattering event cloud toward AO 0235+164". ApJ, 672, L95-L98 (2008). (O)

STRUVE, C., MORGANTI, R. & OOSTERLOO, T.A. "Centaurus A: Morphology and kinematics of the HI disk". In: Formation and Evolution of Galaxy Disks, Rome, Italy, 1-5 October 2007, ASP Conf. Ser., 396, 161-162 (2008). (eds. J. Funes, E. Corsini) (C)

*SUBRAHMANYAN, R., SARIPALLI, L., SAFOURIS, V. & HUNSTEAD, R.W. "On the relationship between a giant radio galaxy MSH 05-22 and the ambient large-scale galaxy structure". ApJ, 677, 63-78 (2008). (O)

*SUBRAHMANYAN, R., SARIPALLI, L., SAFOURIS, V. & HUNSTEAD, R.W. "WHIM environment of giant radio galaxies". In: Frontiers of Astrophysics: A Celebration of NRAO's 50th Anniversary, Charlottesville, Va, 18-21 June 2007, ASP Conf. Ser., 395, 380 (2008). (eds. A. Bridle, J. Condon, G. Hunt) (O)

THOMPSON, D.J. "Gamma-ray pulsar studies with GLAST". In: 40 Years of Pulsars: Millisecond Pulsars, Magnetars and More, Montreal, Que., 12-17 August, 2007, AIP Conf. Proc., 983, 56-63 (2008). (eds. C. Bassa et al.) (P)

*TRINCHIERI, G., IOVINO, A., POMPEI, E., DAHLEM, M. et al. "Detection of a hot intergalactic medium in the spiral-only compact group SCG0018-4854". A&A, 484, 195-203 (2008). (O)

*VAN EYMEREN, J., MARCELIN, M., KORIBALSKI, B.S. et al. "A kinematic study of the irregular dwarf galaxy NGC 2366 using HI and Ha observations". A&A, 493, 511-524 (2008). (O)

VRTILEK, S.D. "Multiwavelength studies of X-ray binaries". In: A Population Explosion: The Nature and Evolution of X-ray Binaries in Diverse Environments, St.Petersburg Beach, FL., 28 October-2 November 2007, AIP Conf. Ser., 1010, 18-22 (2008). (eds. R. Bandyopadhyay et al.) (C)

WALSH, A.J. "Southern surveys of hot cores". In: Massive Star Formation: Observations Confront Theory, Heidelberg, Germany, 10-14 September, 2007, ASP Conf. Ser., 387, 109 (2008). (eds. H. Beuther, H. Linz, T. Henning) (M)

*WANG, N., YAN, Z., MANCHESTER, R.N. & WANG, H.X. "Daily observations of interstellar scintillation in PSR B0329+54". MNRAS, 385, 1393-1401 (2008). (O)

*WELTEVREDE, P., RANKIN, J., STAPPERS, B. & WRIGHT, G. "Pulsar B0656+14: Highly unusual emission properties and a local RRAT". In: 40 Years of Pulsars: Millisecond Pulsars, Magnetars and More, Montreal, Que., 12-17 August, 2007, AIP Conf. Proc., 983, 79-81 (2008). (eds. C. Bassa et al.) (O)

*WELTEVREDE, P., STAPPERS, B. & EDWARDS, R.T. "The subpulse modulation properties of pulsars and its frequency dependence". In: 40 Years of Pulsars: Millisecond Pulsars, Magnetars and More, Montreal, Que., 12-17 August, 2007, AIP Conf. Proc., 983, 43-46 (2008). (eds. C. Bassa et al.) (O)

*WENDT, H., ORCHISTON, W. & SLEE, O.B. "W.N. Christiansen and the development of the solar grating array". J. Astron. History & Heritage, 11, 173-184 (2008). (O)

*WENDT, H., ORCHISTON, W. & SLEE, O.B. "W.N. Christiansen and the initial Australian investigation of the 21-cm hydrogen line". J. Astron. History & Heritage, 11, 185-193 (2008). (O)

*WESTMEIER, T., BRAUN, R., BRUNS, C., KERP, J. & THILKER, D.A. "The relics of structure formation: High-velocity clouds around M31". In: Galaxies in the Local Volume, Sydney, NSW, 8-13 July 2007, Astrophys. & Space Sci. Proc., 235-238 (2008). (eds. B. Koribalski, H. Jerjen) (O)

*WESTMEIER, T., BRAUN, R., BRUNS, C., KERP, J. & THILKER, D.A. "The relics of structure formation: Extraplanar gas and high-velocity clouds around M31". In: New Horizons in Astronomy: Frank N. Bash Symposium 2007, Austin, Texas, 14-16 October 2007, ASP Conf. Ser., 393, 283 (2008). (eds. A. Frebel et al.) (O)

*WESTMEIER, T., BRUNS, C. & KERP, J. "Relics of structure formation: Extra-planar gas and high-velocity clouds around the Andromeda galaxy". MNRAS, 390, 1691-1709 (2008). (O)

*WHITING, M.T. "Astronomers! Do you know where your galaxies are?". In: Galaxies in the Local Volume, Sydney, NSW, 8-13 July 2007, Astrophys. & Space Sci. Proc., 343-344 (2008). (eds. B. Koribalski, H. Jerjen) (O)

*WHITNEY, B.A. et al. "Spitzer SAGE Survey of the Large Magellanic Cloud. III. Star formation and ~1000 new candidate young stellar objects". AJ, 136, 18-43 (2008). (O)

*WONG, O.I., WEBSTER, R.L., WAUGH, M., KILLBORN, V.A. & STAVELEY-SMITH, L. "Near-infrared properties of NOIRCAT". In: Galaxies in the Local Volume, Sydney, NSW, 8-13 July 2007, Astrophys. & Space Sci. Proc., 347-348 (2008). (eds. B. Koribalski, H. Jerjen) (O)

* WU, J.H.P., CHIUEH, T.H. et al., KESTEVEN, M.J., WILSON, W. et al. "AMiBA: First-year results for Sunyaev-Zel'dovich effect". Mod. Phys. Lett. A, 23 (17-20), 1675-1686 (2008). (O)

*YARDLEY, D.R.B. "Correlations in the Parkes Pulsar Timing Array". In: 40 Years of Pulsars: Millisecond Pulsars, Magnetars and More, Montreal, Que., 12-17 August, 2007, AIP Conf. Proc., 983, 636-638 (2008). (eds. C. Bassa et al.) (P)

*YOU, X.-P., HOBBS, G., COLES, W.A., MANCHESTER, R.N. & HAN, J. "The effect of interstellar and interplanetary medium on precision pulsar timing". In: Astrophysics of Compact Objects: International Conference, Huangshan City, China, 1-7 July 2007, AIP Conf. Ser., 968, 181-184 (2008). (eds. Y.-F. Yuan et al.) (P)

*ZOU, W.Z., WANG, N., MANCHESTER, R.N., URAMA, J.O., HOBBS, G., LIU, Z.Y. & YUAN, J.P. "Observations of six glitches in PSR B1737-30". MNRAS, 384, 1063-1068 (2008). (O)

H: ATNF Media Releases 2008

Gas ‘finger’ points to galaxies’ future (5 February)

http://www.csiro.au/news/GasFinger.html

Australia and Germany strengthen technical links for SKA (5 March)

http://www.csiro.au/news/PlansForSKA.html

CSIRO astronomers to join “private data highway” across USA (23 April)

http://www.csiro.au/news/ATNFAwardedPrivateDataHighway.html

Strange star stumps astronomers (16 May)

http://www.csiro.au/news/EccentricPulsar.html

“Astronomy without borders” on show in China (18 June)

http://www.csiro.au/news/AstronomyWithoutBorders.html

I: Abbreviations

AAL	Astronomy Australia Ltd
AAO	Anglo-Australian Observatory
AARNet	Australia's Academic and Research Network
ADASS	Astronomical Data and Software Systems
AGN	Active Galactic Nuclei
AIPS	Astronomical Image Processing System
ALFA	Arecibo L-band Feed Array
ALMA	Atacama Large Millimetre Array
APSR	ATNF Parkes Swinburne Pulsar Recorder
ARC	Australian Research Council
ASCC	Australian SKA Coordination Committee
ASDAF	ASKAP Science Data Archive Facility
ASKAIC	Australian SKA Industry Consortium
ASKAP	Australian SKA Pathfinder
ATCA	Australia Telescope Compact Array
ATLAS	Australia Telescope Large Area Survey
ATNF	Australia Telescope National Facility
ATSC	ATNF Steering Committee
ATUC	Australia Telescope User Committee
CABB	Compact Array Broadband Backend
CALOSIS	Centaurus A Synthesis Imaging Survey
CDSCC	Canberra Deep Space Communication Complex
CDF-S	Chandra Deep Field South
CMIS	CSIRO Mathematical and Information Sciences
CSOF	CSIRO Officer
CONRAD	Convergent Radio Astronomy Demonstrator
CoRE	Cosmological Reionization Experiment
COSMOS	Cosmological Evolution Survey
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAS	Data Acquisition Systems
DFB	Digital Filterbank
DIISR	Department of Innovation, Industry, Science and Research
DoIR	Department of Industry and Resources
DSN	Deep Space Network
ELAIS	European Large Area ISO Survey
e-MERLIN	Extended Multi-Element Radio Linked Interferometer
EPICS	Experimental Physics and Industrial Control System
ESO	European Southern Observatory
EU SKADS	European SKA Design Study
FARADAY	Focal-plane Arrays for Radio Astronomy: Design, Access and Yield
FIR	Far Infrared
FITS	Flexible Image Transport System
FPA	Focal Plane Array
FPGA	Field Programmable Gate Arrays
FTE	Full Time Equivalent
GASS	Galactic All Sky Atomic Hydrogen Survey
GW	Gravitational Wave
HEMT	High Electron Mobility Transistor
HI	Neutral Hydrogen
HIPASS	HI Parkes All Sky Survey
HIZOA	HI Zone of Avoidance
HPC	High Performance Computing
HSE	Health, Safety and Environment
HVC	High Velocity Clouds
IAU	International Astronomical Union
ICIP	Industry Cooperative Innovation Programme
ICTC	Information and Communications Technology Centre
IEEE	Institute of Electrical and Electronics Engineers
IFRS	Infrared Faint Radio Sources

InP	Indium Phosphide
ISM	Interstellar Medium
ISSC	International SKA Steering Committee
IT	Information Technology
IVS	International VLBI Service
JIVE	Joint Institute for VLBI in Europe
JPL	Jet Propulsion Laboratory
KAT	Karoo Array Telescope
LBA	Long Baseline Array, used for Australian VLBI observations
LFD	Low Frequency Demonstrator
LNA	Low Noise Amplifier
LO	Local Oscillator
LOFAR	Low Frequency Array
LOFAR DMT	Low Frequency Array Dark Matter Telescope
LVHIS	Local Volume HI Survey
MASIV	Micro-Arcsecond Scintillation-Induced Variability
MIRIAD	Multichannel Image Reconstruction Image Analysis and Display
MIT	Massachusetts Insitute of Technology
MMBS	Methanol Multibeam Survey
MMIC	Monolithic Microwave Integrated Circuit
MNRAS	Monthly Notices of the Royal Astronomical Society
MNRF	Major National Research Facilities
MOPS	Mopra Spectrometer
MRO	Murchison Radio-astronomy Observatory
MSF	MRO Support Facility
MSP	Millisecond Pulsar
MWA	Murchison Widefield Array
NASA	National Aeronautics and Space Administration
NCRIS	National Collaborative Research Infrastructure Strategy
NRAO	National Radio Astronomy Observatory
NRC-HIA	National Research Council Canada - Herzberg Institute of Astrophysics
NOT	Nordic Optical Telescope, Spain
NSF	National Science Foundation
OCE	CSIRO's Office of the Chief Executive
PAF	Phased Array Feed
PAPER	Precision Array to Probe Epoch of Reionization
PDFB	Pulsar Digital Filterbank
PMPS	Parkes Multibeam Pulsar Survey
PPTA	Parkes Pulsar Timing Array
PTF	Parkes Testbed Facility
RFI	Radio Frequency Interference
RSAA	Research School of Astronomy and Astrophysics
SCG	Southern Compact Group
SEST	Swedish-ESO Submillimetre Telescope, Chile
SINGS	Spitzer Infrared Nearby Galaxies Survey
SKA	Square Kilometre Array
SKAMP	SKA Molonglo Prototype
TAC	Time Assignment Committee
THEA	Thousand Element Array
TIGO	Transportable Integrated Geodetic Observatory
UCSD	University of California, San Diego
UNSW	University of New South Wales
URSI	International Union of Radio Science
USNO	United States Naval Observatory
VLA	Very Large Array
VLBI	Very Long Baseline Interferometry
VO	Virtual Observatory
VSOP	VLBI Space Observatory Program
WDM	Wavelength Division Multiplexed
WLAN	Wireless Local Area Network

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