ATNF News

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FEATURES IN THIS ISSUE

Transient pulsed radio emission from a magnetar

On 18 March 2006 an extraordinary new radio pulsar was detected at Parkes. An observation of the anomalous X-ray pulsar (AXP) XTE J1810–197 revealed very strong pulses repeating every 5.54 seconds. This observation marked the first detection of magnetospheric pulsed radio emission from a magnetar and, among other implications, establishes a link between ordinary radio pulsars and magnetars.

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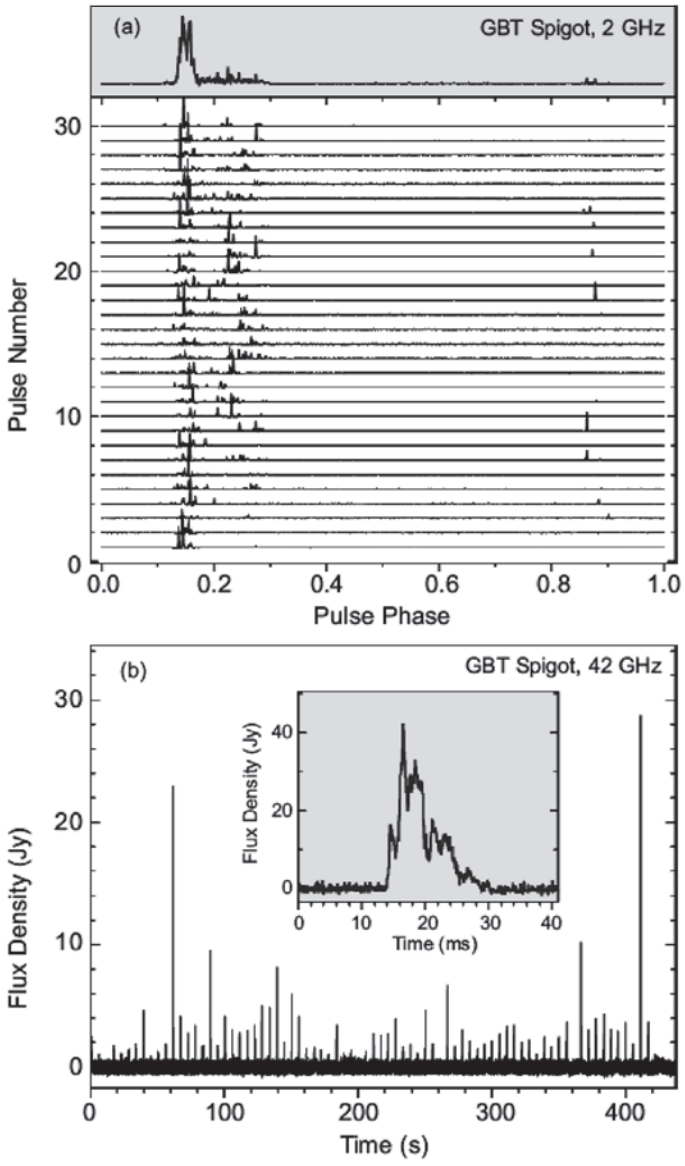

Figure 1: Single pulses from XTE J1810–197 observed with the Green Bank Telescope (GBT) using the Spigot spectrometer. (a) Thirty consecutive single pulses (about 165 seconds of data) from one observation at 2 GHz, where each row represents the full pulse phase. The sum of all 30 pulses is displayed at the top. Sub-pulses with typical width approximately ≤10 ms arrive at different phases and gradually build up the average profile—which however varies from day to day. (b) Train of about 77 consecutive single pulses detected at a frequency of 42 GHz. Inset: A 40 ms-long detail of the brightest pulse from the main panel.

Editorial

Welcome to the October 2006 edition of the ATNF News.

Once again we bring you articles and news items from the ATNF. Thank you to all our contributors!

Our cover article, by John Reynolds, describes the detection and follow-up observations of the now famous magnetar J1810–197. The second science article about molecular gas in Ara OB1, contributed by Annie Hughes, shows the potential for multi-line observations with Mopra's new 8-GHz bandwidth spectrometer backend, MOPS.

Several new technical milestones are presented in articles in this issue associated with the development of the new Compact Array Broadband Backend (CABB) and the xNTD focal plane array. A major development over the past four months is the commencement of remote observing with the Mopra telescope from Narrabri as its default mode of operation. An account of its inception is given by Dion Lewis and Phil Edwards.

In other news, we congratulate Naomi McClure-Griffiths on winning the Malcolm McIntosh prize, an outstanding achievement!

This issue also highlights the ATNF's prominent role in education and public outreach. Several major events recently have been an ATNF-led school program in Western Australia, a week-long Synthesis Imaging School and an Open Day held at Narrabri, a group of work experience students from Melbourne also hosted at Narrabri, and a science teacher workshop held at Parkes.

We hope you enjoy the newsletter! As always your comments and suggestions are welcome. The web version of this and previous issues can be found at *www.atnf.csiro.au/news/newsletter*. For those who like to print their own copy of the newsletter, the website now provides all issues, from February 2006, in PDF format.

Michael Dahlem, Jessica Chapman and Joanne Houldsworth
The ATNF Newsletter Production Team
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Contents

News

From the Director

It is always a great pleasure to summarise recent ATNF activities and this is no exception. It is easy to find items of note, hard to cover everything, and often remarkable to see just how much is being achieved.

I am writing this as Acting Director as Brian Boyle is in the US meeting with the National Science Foundation and the US SKA community. Brian's role as facilitator of the NCRIS (National Collaborator Research Infrastructure Strategy) concluded at the end of October after submission of an investment plan that includes A$19.6m of new funding up to 2011 for radio astronomy infrastructure aligned with the Australian SKA development path. A decision by the Commonwealth Science Minister, Julie Bishop, on NCRIS funding is expected over the next couple of months.

I would particularly like to congratulate Naomi McClure-Griffiths for her achievement in being awarded the Prime Minister's Malcolm McIntosh Prize for Physical Scientist of the Year. This is one of the pre-eminent prizes in Australian science and Naomi is the youngest recipient to date. The prize provides well-deserved recognition for the outstanding contributions Naomi has made, and will continue to make, to astronomy.

Another individual achievement to note is Simon Johnston's appointment as a CSIRO Science Leader. The Science Leader program is a CSIRO-wide initiative aimed at attracting and retaining world-class scientists to lead outstanding research teams. The appointments include resources for a small team to support the leader's research, and are funded jointly by the Division (ATNF in this case) and CSIRO's Office of the Chief Executive. Simon is the first Science Leader appointed in the ATNF. He will continue to lead research into pulsar astrophysics and as xNTD Project Scientist will lead the ATNF's activities in defining the science priorities for the xNTD and its other SKA-related developments.

The variety of outreach activities reported in this newsletter is very pleasing. The effort and resources that the ATNF puts into hosting the Synthesis Imaging School has been shown to be very much appreciated with more students attending this year than ever before.

The implementation of remote operations of the Mopra telescope from Narrabri, taking advantage of the new AARNET high-bandwidth optical fibre connections to each of the ATNF observatories, is a fantastic development. In combination with the world-leading capabilities of the MOPS instrument, this builds on a range of steps taken over the past couple of years to make Mopra more productive. The increase in scientific impact is being realised with a continued rise in publications based on Mopra data, and increasing demand for Mopra observing time. The new links are also facilitating exciting advances in VLBI, with real-time eVLBI having been demonstrated successfully very soon after the links were first turned on.

Lister Staveley-Smith has recently left the ATNF to take up a position as the Western Australian Premier's Research Fellow in Radio Astronomy at the University of Western Australia. Lister's contribution to the ATNF over the past 17 years has been tremendous and we look forward to continuing close connections with Lister in his new role. Colin Jacka will retire within a week, after approximately 25 years in CSIRO. Both have contributed enormously to the ATNF and we are sorry to see them go. Nevertheless, I am looking forward to working with David DeBoer, who will take up Colin's former role of Assistant Director: xNTD & SKA Phase 1 on 1 December, and Robert Braun, who will be Assistant Director: Astrophysics from mid February 2007, a role previously filled by Lister.

Finally, we were saddened to hear today of the death of Jim Cohen from Jodrell Bank. Jim made significant scientific contributions to the ATNF through his collaborations with staff here. In recent months, he had become a familiar visitor as a result of his leading and expert role in the methanol multibeam maser survey at Parkes. He will be greatly missed.

Lewis Ball
ATNF Deputy Director
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xNTD / SKA developments

Photos: Tony Sweetnam

The THEA tile being mounted on the eastern New Technology Demonstrator antenna.

Antenna feeds

As foreshadowed in the June newsletter (ATNF News, issue 59), the thousand element array (THEA) tile, after being modified to reduce the effects of radio frequency interference from local television transmissions, has now been mounted in the eastern New Technology Demonstrator (NTD) antenna. In September it achieved a milestone in radio astronomy, being used to create the first digitally beamformed signals from a focal plane array mounted in a parabolic dish. We are now analysing the beamforming performance.

We have also developed a prototype 5 x 1 phased array of a new design (a periodically loaded, linearly connected array). This is now being evaluated in one of the antenna range chambers operated by the CSIRO ICT Centre for its performance with regard to polarisation, stability, bandwidth and efficiency.

Antennas

Meeting the cost constraints of the extended New Technology Demonstrator (xNTD) and Square Kilometre Array (SKA) antennas will be a big challenge. Three separate feasibility studies were undertaken earlier this year for the xNTD antennas and some detailed design projects will be undertaken during the next 12 months, with a major design review scheduled for September 2007. We have had considerable interest from companies both within Australia and overseas for participation in this work, and we are considering various options for collaborative research and development in this area. We have also recently completed an open tender process aimed at procuring a 12-m diameter antenna suitable as a testbed for our focal plane array development to be constructed at Parkes and used in conjunction with the 64-m antenna. We are still negotiating for the procurement of this antenna. This installation is scheduled for the second half of 2007.

Mileura infrastructure

The Mileura site in Western Australia has been subject to detailed scrutiny, and we have identified 60 or so sites for individual antennas: the present prospect is for only 30 antennas to be funded, but the extra sites will allow for future expansion of the Mileura array. The determination of the antenna sites was made using software produced by members of the South African KAT team who are collaborating with our xNTD computing team led by Tim Cornwell. This is one of the first fruits of the collaboration.

NCRIS Proposal

The astronomy proposal to National Collaborative Research Infrastructure Strategy (NCRIS) was submitted in September. It included a request for $19m for the xNTD and LFD projects to be sited at Mileura.

Project management

Dr Dave DeBoer has been appointed as the ATNF's new Assistant Director, and will lead the xNTD and SKA Phase I Theme. Dave's most recent positions have been at the SETI Institute, where he has been Project Manager for the Allen Telescope Array (ATA) since 2003; before that, he was the ATA Project Engineer 2000 – 2003. Dave has also held professorships, scientist and research engineer positions at institutions such as Georgia Tech, Hughes, the University of Mexico, and the Harvard-Smithsonian Center for Astrophysics.

Colin Jacka will retire from CSIRO on 3 November 2006, but intends to remain involved with the xNTD project on a part-time basis to assist with the systems engineering.

Colin Jacka
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Mopra remote observers see the light

Mopra remote observing from Narrabri became a reality at last in August 2006!

With the CSIRO and AARNet lawyers finally "agreeing to agree" in late July, Shaun Amy conducted a northbound tour of the Newell highway to set up the gigabit link connections to the AARNet3 regional network optical-fibre backbone at Parkes, Mopra and the Compact Array – arriving at Narrabri just in time for the Open Day on 29 July.

With the new routers and switches having been tested at Mopra and then Narrabri, even the convivial chaos of Open Day was not enough to prevent the new links from being tried out, and a few lucky public visitors were able to witness the first sanctioned tests of Mopra being remotely operated over the new links. With a suitable benediction ("Let there be light!") the new links were christened, and after a little tweaking were soon working well.

The infant interface was passed on to veteran Mopra observer Annie Hughes, who had graciously agreed to act as "guinea-pig" for the test-phase of remote observing (see the article on molecular gas in Ara OB1 on page 12). After a week of observing with no issues arising, the default operating mode for Mopra observing switched to remote observations from Narrabri.

Remote observing offers the advantages of less travel and increasing the efficiency of telescope use. The prompt move to remote observing for Mopra was made in order to gain as much experience with remote observing as possible before the end of the millimetre season. Ironically, the only disruptions to the link in the first months have been both planned and unplanned outages at Epping, as the gigabit links between observatories all go via Sydney.

However, if the fast links do drop out for whatever reason, observing reverts relatively seamlessly to the old direct link between Narrabri and Mopra. This link restricts bandwidth-hungry tasks but various methods can provide a configuration that is still adequate.

The landscape of the observers' area at the Compact Array now includes the "Mopra corner" occupying the southern alcove. Specifically, *Trachyte* (a name derived from volcanic geology, following the trend for other Mopra machines that are named after local features) is a four-screen display at Narrabri that accesses the Mopra observing computers. The usual online packages remain: TCS, MoniCA, Correlator GUI(s), as well as added monitoring due to MOPra Spectrometer (MOPS) coming on-line this season. The classic Australian birdcalls of TCS are also passed over the link, bringing the sounds of Currawongs, Rufus Owls, and others to the observers' area.

Observers have noted that data transfer, for example, is not possible at anything like the gigabit per second rate that the new links are advertised at, and this arises from the fact that there is a limit on

the data rate for a single TCP/IP connection on some networks, due to factors such as the standard TCP window byte size, network interfaces and switching hardware, and the propagation delay over 400 km. Although it is possible to increase the bit rate, it is only necessary for special projects such as eVLBI, which uses specially tuned hardware, software and protocols. The basic offering (between Mopra and Narrabri, via Sydney) is a little over 2 MB/s for each TCP/IP connection.

In line with an agreement between the ATNF and UNSW (in part in recognition of their contributions to the development of Mopra), UNSW observers have an exemption from the default observing mode and are able to stay at the UNSW cottage at Siding Spring. An exemption may also be granted for any projects which can demonstrate a real scientific need to be based at Mopra for their observations. Albeit, access to support staff is most effective using the default, remote operation.

The experience of observers to-date has been overwhelmingly positive, with the staff support, catered accommodation, and other amenities available at Narrabri all being appreciated. The ability to step outside and get a feel for the weather has naturally been lost, but the on-line monitoring, including the Mopra webcams (with night "IR light") and Siding Spring cloud camera, and indeed, more accurately, the system temperature (T_{sys}) monitoring are generally agreed to provide the required level of information. Aside from weather, the remote station has been met with experienced observers quoted as saying, "It's just like being there." The four-screen *Trachyte* system surpasses the control environment that has existed previously at Mopra, so some may even prefer the new interface, with background images of the Warrumbungles for those with residual separation anxiety.

Remote observing from Narrabri will continue to be the default for 2006. As was the case for remote observing with the Compact Array, remote observing from Epping will be introduced first, with remote observing from other sites likely to be considered further into the future.

Dion Lewis and Phil Edwards
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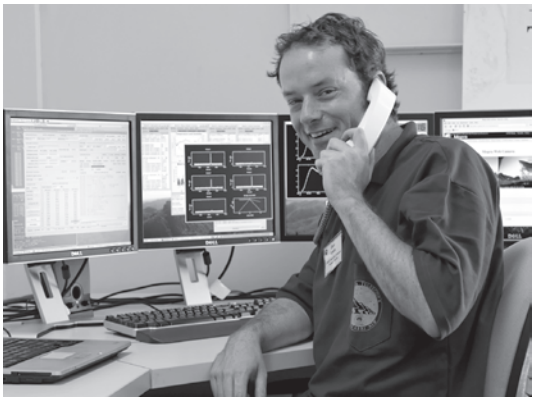


Photo: Shaun Amy

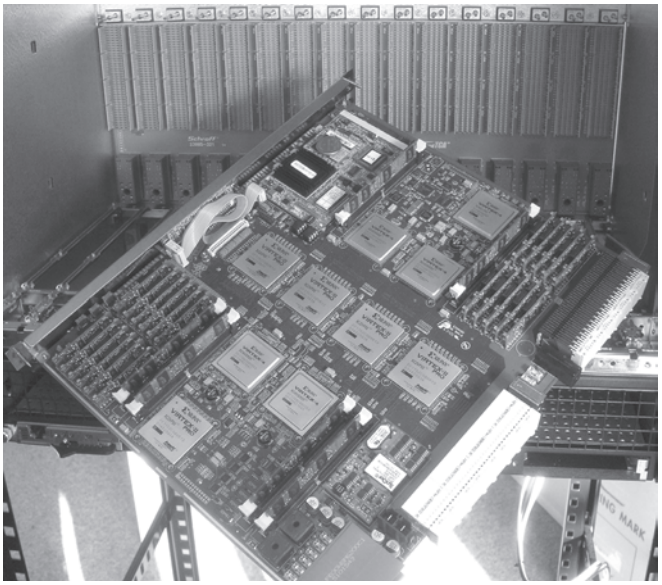
Dion Lewis at the *Trachyte* terminals in the Narrabri control room.

Photo: Jorge Pineda

Annie Hughes on the phone from Mopra

CABB digital signal processing board

The CABB (Compact Array Broadband Backend) upgrade project can be broadly divided into four parts: a wideband conversion system, wideband sampling, wideband optical data transmission and a complementary wideband filterbank/correlator. This article describes recent developments in the filterbank/correlator, or more specifically, the CABB Digital Signal Processing (DSP) board.



Credit: Grant Hampson

Figure 1: The CABB digital signal processing board.

The CABB DSP board is the final stage of a development process which produced the MOPS spectrometer that is now used by Mopra observers (see *ATNF News 59*, June 2006). The new DSP card uses the next generation of Xilinx Field Programmable Gated Arrays (FPGAs; Virtex-4 SX55) to provide all the necessary computing power required for wide bandwidth processing.

The CABB DSP board schematic was developed using the Protel Printed Circuit Board (PCB) design package, which was also used to place all components in the layout (which doesn't sound difficult until one realises that there are 4188 components)! This design was then routed by Siart Design (India) using Cadence tools in ten weeks for a very economical price.

The Advanced Telecom Computing Architecture industry standard card cage and backplane was chosen for the project. In this system each card connects to every other card via the backplane (very good for cross correlating astronomical data). These "connections" are serial in nature and the total bandwidth available across the backplane is in excess of 6 Tbps (at 3.125 Gbps per serial data pair).

Some interesting statistics on the DSP board are: 26 layers (of which 14 are signal and 12 power/ground), dimensions 322x280 mm, track width and spacing of 0.004 inches, minimum hole size 0.012 inches, total number of nets 19217, total number of components 4188, total number of holes 22876, and total trace length 576 metres. The PCB manufacturing was handled by Entech, although it was made in Taiwan by Nan Ya PCB.

The PCBs arrived at the ATNF on 24 August 2006. It has taken one month to assemble the PCB in a piecewise fashion. The first PCB was assembled by hand, however future boards will be assembled using a recently acquired automated pick-and-place machine. A vapour-phase oven is used to reflow the FPGAs and surface mount connectors.

The CABB DSP board will also be used in the Pulsar Digital Filter Bank (PDFB) project. Firmware, including digital filter banks and correlators, has been developed for both projects, although the PDFB firmware will likely process the first pieces of astronomical data at Parkes. This will be an exciting moment for the ATNF Electronics Group!

Grant Hampson and Andrew Brown
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Naomi McClure-Griffiths wins the Malcolm McIntosh Prize

As this issue of ATNF News was being put together, CSIRO and ATNF staff were delighted to hear that Naomi McClure-Griffiths, a senior post-doctoral fellow at the ATNF, has been awarded the 2006 Malcolm McIntosh Prize for Physical Scientist of the Year.

The prize was awarded as part of the 2006 Prime Minister's Prizes for Science. The five Prime Minister's Prizes were presented on Monday 16 October at a ceremony in the Great Hall at Parliament House, Canberra. The 530 attendees at the awards dinner included the Prime Minister, Minister for Education, Science and Technology, other parliamentarians and science dignitaries. Robyn Williams was the Master of Ceremony for the evening's festivities. The Malcolm McIntosh prize includes a tax-free grant of A$50,000 and is awarded for outstanding achievements by a scientist under 35 years of age. In Naomi's speech at the ceremony she thanked the Government for recognising the importance of fundamental research.

Naomi has been awarded this prize in recognition of her outstanding work on the distribution of neutral atomic hydrogen gas in our Galaxy. She uses the Parkes radio telescope and Compact Array for large scale surveys of hydrogen. These involve enormous volumes of data and innovative techniques to extract and understand the results. Her work has led to new insights about the Galaxy, including the discovery of a "new" spiral arm that lies well beyond the visible disk of the Milky Way galaxy. This may be an extension of the Outer Arm, which probably connects to the Norma Arm in the inner part of the galaxy.

Jessica Chapman, Helen Sim
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Credit: © David James

Naomi McClure-Griffiths

ATNF synthesis imaging school

Photo: Michael Dahlem

Participants at the ATNF synthesis imaging school, held at Narrabri.

The 7th ATNF Synthesis Imaging School was held at the Narrabri Observatory during the week of 18 – 22 September 2006. We had a record number of students (47) and 17 speakers/tutors, from a wide range of institutes across Australia and around the world.

The week kicked off with a series of lectures on the principles of interferometry, followed by lectures dedicated to practical synthesis imaging including calibration, sensitivity, imaging, data analysis and error recognition. Lectures later in the week dealt with some of the more specific concepts including polarisation, wide-field imaging, VLBI, and spectral line analysis. The future of radio astronomy was emphasised on Friday, with lectures on the technology and science envisaged for next generation facilities including the xNTD and the international SKA.

Amongst the most popular sessions of the week were the evening Q&A sessions handled mainly by guest speaker Rick Perley (NRAO). In these sessions, all questions posed were answered by a panel, including the days' speakers, only too happy to tackle even the most difficult of questions. The use of anonymous question cards, to encourage even the most bashful of participants to ask a question, proved to be a very useful resource. Thanks go to Ron Ekers for suggesting we use such cards.

As well as lectures, there were practical observing sessions, data reduction and scheduling tutorials and tours of the observatory. The social program was also quite busy and included the traditional camp fire night (Wednesday), a dinner at the Narrabri Golf Club (Monday), and an end of school barbecue (Friday). Many thanks go to Ray Norris and John Storey for providing evening entertainment at the Monday and Wednesday night functions.

We are now in the process of evaluating the feedback forms, which from a first look show that the school was indeed a great success. So a very big thank you is due not just to the speakers, but to the local and scientific organising committees and the many helpers, for making the week the success that it was!

The presentations are now available online and can be downloaded from *www.atnf.csiro.au/synthesis2006*.

Ilana Klamer and Michael Dahlem
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Graduate student program

I would like to officially welcome the following students into the ATNF co-supervision program. Their projects and supervisors are as follows:

- David Brodrick (Swinburne University) – "Astronomical observations using low frequency radio interferometers" with supervisors Dr Steven Tingay (Swinburne), Dr Mark Wieringa & Dr Michael Dahlem (ATNF).

- Albert Teoh (Swinburne University) – "A new-generation baseband recording system for high-precision pulsar observations" with supervisors Prof Mathew Bailes (Swinburne University) and Prof Dick Manchester (ATNF).

- David Jones (University of Adelaide) – "Lunar ultra-high energy neutrino astrophysics using the Square Kilometer Array (LUNASKA) and synchrotron emission from secondary electrons/positrons in Galactic molecular clouds" with supervisors A/Prof Ray Protheroe & Dr Bruce Dawson (Uni of Adelaide) and Prof Ron Ekers (ATNF).

- Paul Hancock (University of Sydney) – "A deep survey of the SCP at 20 GHz, part of the AT20G" with supervisors A/Prof Elaine Sadler (Uni of Sydney) and Prof Ron Ekers (ATNF).

- Nadia Lo (University of NSW) – "The dynamics of molecular gas in the Milky Way Galaxy" with supervisors Dr Maria Cunningham & A/Prof Michael Burton (Uni of NSW) and Dr Erik Muller (ATNF).

- Nicolas Bonne (ANU) – "Investigating the dark and visible matter in the local volume" with supervisors Dr Erwin de Blok & Dr Helmut Jerjen (ANU) & Prof Stacy McGaugh (Advisor) (University of Maryland) and Dr Bärbel Koribalski (ATNF).

- Nino Bukilic (Curtin University) – "Extremely wide bandwidth focal plane array receivers for radioastronomy" with supervisors A/Prof Mervyn Lynch (Curtin University) and Dr John Kot & Dr Stuart Hay (ICT Centre).

- Robert Reinfrank (University of Adelaide) – "High-energy astrophysics using radio telescopes" with supervisors A/Prof Ray Protheroe & Prof Roger Clay (Uni of Adelaide) and Dr Simon Johnston (ATNF).

- Urvashi Rau (New Mexico Institute of Mining & Technology) – "Parameterized deconvolution in radio synthesis imaging" with supervisors Dr Dave Westphal, Dr Jean Eilek, Dr Steven Myers (NRAO), Dr David Raymond (NMT) and Dr Tim Cornwell (ATNF).

It is fantastic to see so many students from a large range of areas join the ATNF co-supervision program. Several of the above students are already well known to ATNF staff.

Congratulations to Meryl Waugh on the successful submission of her University of Melbourne PhD thesis on "Neutral hydrogen in Fornax and Eridanus – blind basketweaving for beginners", and Ilana Klamer on the successful submission of her University of Sydney PhD thesis on "Active galaxies at high redshift: gas, jets and star formation". In May 2006, Ilana started a Bolton Fellowship at the ATNF.

Bärbel Koribalski
ATNF, Graduate Student Convener
(Baerbel.Koribalski@csiro.au)

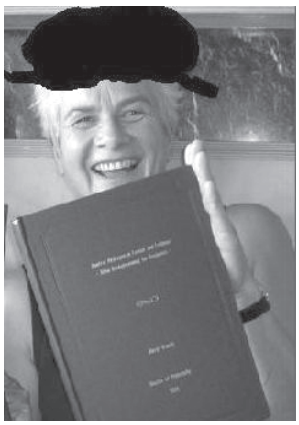

Photo: Courtesy Meryl Waugh

Meryl Waugh

Photo: Diana Londish

Ilana Klamer

Swinburne/PLC mentoring program 2006

In June this year, four students from the Presbyterian Ladies College embarked on an eight-week science mentoring program at Swinburne University, starting with a trip to the Compact Array for a 36-hour observing run. This unique mentoring program provides the opportunity for gifted female secondary school students to undertake an extended research project within the Centre for Astrophysics and Supercomputing. With help from Swinburne PhD student Annie Hughes and PLC teacher Ross Phillips, the students were taught how to run the telescope and the ins-and-outs of radio observing. We observed three interacting galaxy systems in HI, and, impressively, the students learnt how to reduce the data using *miriad*, completing the reduction of the final dataset by themselves. One of the highlights for the girls was climbing onto a dish on the last day. Thanks to Robin Wark for taking the time to explain how the telescope works. The mentoring program continued back at Swinburne for eight weeks following the observing trip, for two hours a week, culminating in a lively presentation session on the last day. Many thanks to the Observatory staff for their support during the observing run, and for helping to make the trip a worthwhile experience for the students.

Photo: Virginia Kilborn

PLC students Iris Chan, Michelle Rassool, Charmaine Choi and Belinda Ng checking out the inner workings of antenna 6.

Virginia Kilborn, Swinburne University (vkilborn@astro.swin.edu.au)

Distinguished Visitors

The ATNF is currently hosting several long-term Distinguished Visitors. Jayaram Chengalur (NCRA, India) arrived last December and will stay until December 2006. Andrea Lommen (Franklin & Marshall College, USA) arrived in late June and will stay at the ATNF until the end of June 2007. Bill Coles (UCSD, USA) arrived in early August for a five-month visit. Ger van Diepen (ASTRON, The Netherlands) also arrived in early August and will stay for a year.

We have had a few shorter-term visitors at the moment and more arriving over the next few months. Uli Klein (Argelander Institut, Germany) and Christian Henkel (MPIfR, Germany) spent most of September at the ATNF. Ettore Carretti (INAF-IRA, Italy) will visit Marsfield from October to December 2006. Emanuela Pompei (ESO, Chile) will visit Marsfield and Narrabri from November to December 2006. Martin Cohen (Berkeley) will visit twice in the coming year, once in March and again next winter.

We have recently farewelled two visitors whom we greatly enjoyed hosting: Ralf-Jürgen Dettmar (Bochum), who left in late July, and Jim Cohen (Jodrell Bank) who left at the end of June.

Details of our DV program can be found at *www.atnf.csiro.au/people/distinguished_visitors.html*. Visits are partially funded by the Distinguished Visitors and the Federation Fellows programs.

Naomi McClure-Griffiths (on behalf of the ATNF Distinguished Visitors Committee) (Naomi.McClure-Griffiths@csiro.au)

Articles

Mopra observations of the molecular gas in Ara OB1

Ara OB1 is a massive star-forming region situated a few degrees below the Galactic plane, at an estimated distance of 1.3 kpc (Arnal et al. 2003). This region contains a variety of star formation phenomena, including early-type stars, molecular clouds with dense cores, embedded clusters, optical HII regions, and compact sources of radio continuum emission. Most remarkable is the bright rim nebula, NGC 6188, which marks the eastern edge of a molecular cloud that is being eroded by the ionising radiation from two O-stars in the young open cluster NGC 6193. Based on high-resolution optical, near-IR and millimetre observations of a 30 arcminute x 30 arcminute region around NGC 6188, Comeron et al. (2005) have proposed that the current star formation in Ara OB1 has been triggered by the progress of a photo-ionisation induced shock front powered by the O-stars in NGC 6193.

To date, however, the neutral interstellar medium surrounding Ara OB1 has not been studied in detail. Low angular resolution (HPBW~2.6 arcminutes) observations of the molecular gas in Ara (Yamaguchi et al. 1999, Arnal et al. 2003) show that there is a thin, clumpy filament of CO emission extending over a degree to the south-west of NGC 6188. The velocity of the gas filament (~20 km/s) is contiguous with the dense molecular cloud adjacent to NGC 6188, but these early studies suggested that the gas in the filament is quiescent and relatively diffuse, and may not be physically associated with the star forming gas in the NGC 6188/NGC 6193 region. Single-dish neutral hydrogen (HI) observations from the Parkes Southern Galactic Plane Survey (SGPS), however, reveal an accumulation of atomic gas that is spatially and kinematically coincident with the molecular filament. McClure-Griffiths et al. (2002)

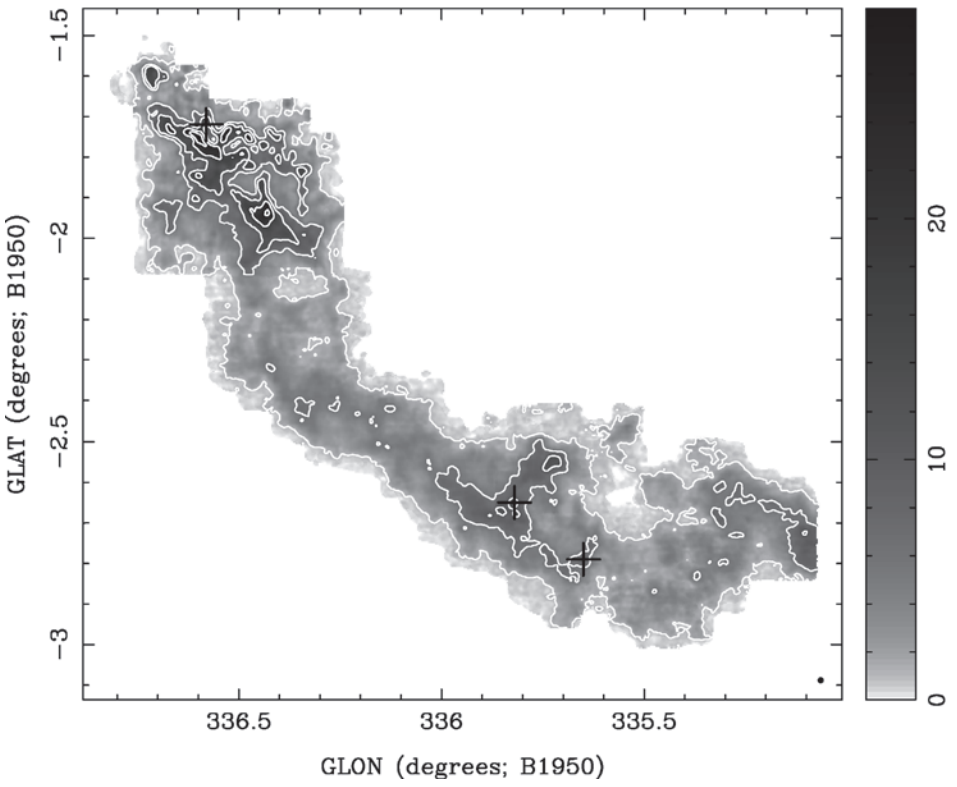

Figure 1: Mopra integrated intensity map of the ^{13}CO (J=1–0) emission from the molecular gas filament in Ara. The data is contoured in steps of 4 K km/s. The 45-arcsecond Mopra beam is shown in the bottom right corner of the map. The crosses indicate the positions of the spectra that are shown in Figure 2.

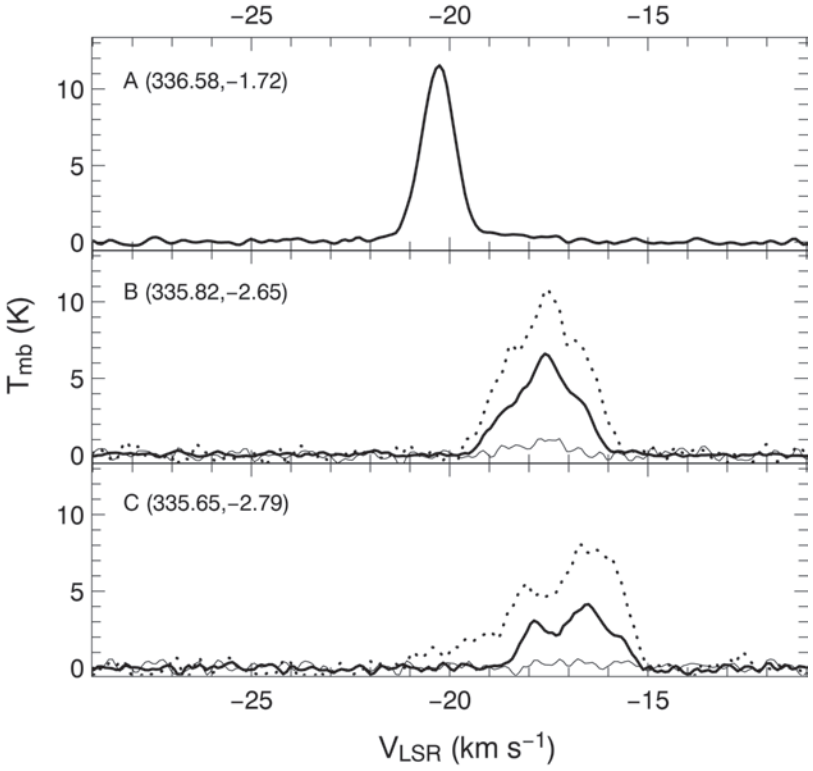

Figure 2: Atomic and molecular lines from three positions along the molecular gas filament: A (336.58, –1.72), B (335.82, –2.65) and C (335.65, –2.79). The positions where the profiles were measured are indicated in Figure 1. ^{12}CO (J=1–0) is shown as a dotted line, ^{13}CO (J=1–0) as a thick solid line, and C^{18}O (J=1–0) as a thin solid line. Position A was observed prior to the installation of MOPS, so only ^{13}CO (J=1–0) data is available for this region.

have tentatively identified this extraplanar HI gas in Ara as the wall of an expanding shell, GSH337+00-05.

This year, we embarked upon a program to obtain high angular resolution maps of the molecular gas in Ara at Mopra, and also conducted complementary Compact Array observations of the HI emission from the atomic gas surrounding the molecular filament. The installation of MOPS in May 2006 (see *ATNF News 59*, June 2006) presented us with the opportunity to observe multiple molecular line transitions simultaneously, and dramatically increased our data acquisition rate! The ^{13}CO (J=1–0) integrated intensity map of the entire molecular filament is shown in Figure 1. The final data cubes consist of 137 5 arcminute x 5 arcminute on-the-fly (OTF) fields, with an angular resolution of 45 arcseconds and a spectral resolution of 0.1 km/s. ^{12}CO (J=1–0), ^{13}CO (J=1–0), C^{18}O (J=1–0) and HI spectra from three positions along the filament are shown in Figure 2. The goal of our study is to investigate the relationship between the atomic and molecular gas in Ara, and to determine whether the scenario proposed by Comeron et al. (2005) provides a complete account of the actual and future star formation in this region.

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Continued from page 3

Transient pulsed radio emission from a magnetar

Subsequent observations with Parkes, the Green Bank Telescope (GBT) and several other telescopes around the world confirmed the detection and established a range of remarkable properties. The discovery and preliminary results were announced in *Nature* (Camilo et al. 2006) and presented during the Prague IAU General Assembly (competing for column space and airtime with the debate about Pluto!).

Magnetars, of which only a dozen are known, are young neutron stars whose very bright and highly variable X-ray emission is thought to be powered by the decay and reconfiguration of their ultra-strong magnetic fields ($B \sim 10^{14}$ Gauss). In this respect they differ fundamentally from the ubiquitous radio pulsars (of which more than 1700 are now known), in which non-thermal radiation, from radio frequencies up to gamma-rays, ultimately derives from the magnetic braking of the neutron star's rotation. This energy source alone cannot power magnetars, whose X-ray luminosities greatly exceed the rotational energy available from spin-down. Despite several searches no radio emission has hitherto been detected from either AXPs or soft-gamma repeaters (SGRs), the two sub-classes of magnetars.

J1810–197 attracted concerted attention in 2003 as the first transient AXP, when its X-ray emission was found to have increased ~100-fold (Ibrahim et al. 2004). This enhanced flux was found to have a strong periodicity at 5.54 seconds, and lengthening by about 1 microsecond per day. The spin-down of isolated neutron stars is caused by magnetic torques, with the rate of slow-down proportional to the magnetic field strength. For XTE J1810–197 this implied a field of $\sim 10^{14}$ Gauss. The X-ray flux has been decreasing exponentially since the outburst with timescales of a few hundred days (Gotthelf & Halpern 2005), and will soon return to the historical quiescent level which, to judge from archival data, it had maintained for at least 24 years.

The magnetar was detected as a continuum radio source, with a flux density at 1.4 GHz of $S_{1.4} = 4.5$ mJy, in the Very Large Array (VLA) MAGPIS survey during early 2004 (Halpern et al. 2005). The origin of this emission remained a mystery until the detection of the remarkable radio pulsations at Parkes. Since late April we have been observing the pulsar using a variety of radio telescopes: with the GBT and Parkes we record pulse profiles and fluxes, as well as scintillation and polarimetric properties; at Nancay we obtain nearly daily timing measurements, supplemented by those from Parkes and GBT; we have investigated the millimetre-wavelength properties of the emission at IRAM; and with the Very Long Baseline Array (VLBA) we are attempting to measure the proper motion and parallax of the star. In addition, we monitor its total flux with the VLA, and are using the Compact Array to investigate whether any of it is unpulsed. We have also used the GBT to obtain hydrogen absorption spectra and are attempting the detection of other species.

The individual pulses that we detect from virtually every rotation of the neutron star at low frequencies (~1 GHz) are composed of sub-pulses of typical width <10 ms that arrive mostly within a 150 ms-wide window. Their peak flux densities can be >>10 Jy—so large that we discovered the pulsar by eye in a pre-search analysis while attempting to identify radio frequency interference (RFI) in the Fourier spectrum! This, and the high degree of linear polarisation do not in themselves make the radio emission from XTE J1810–197 fundamentally different from that of ordinary pulsars. However, at least four characteristics of this radiation make it unusual or unique:

1. The radio spectrum is very flat ($-0.5<\alpha<0$ where $S(\nu) \sim \nu^{\alpha}$) over a range of about 100 in observing frequency (see single pulses detected at 42 GHz with the GBT in Figure 1).

2. At a given frequency there is no stable average pulse profile; different pulse components change in relative intensity and new components sometimes appear.

3. The flux changes at all frequencies. At 8 GHz at least some of this variation is due to interstellar scintillation (we have obtained beautiful dynamic spectra at up to 19 GHz), but at 1.4 GHz the variations by factors of 2.4 on timescales of order a day are likely intrinsic.

4. The radio emission is transient: in 1997 and 1998 the flux was less than 10 percent of the smallest value measured in 2006. Evidently, the radio emission turned on as a result of the magnetospheric changes that occurred in XTE J1810–197 following its 2003 X-ray outburst.

We do not yet understand all the implications of these characteristics. Presumably the observations are telling us something important about the current conditions in the corona of this magnetar. Further radio, infra-red, and X-ray observations may eventually provide a fuller picture. Some of the observed X-ray emission implies the existence of currents in the magnetosphere, and the decay of this emission points to a subsidence of the currents. We thus expect that the radio emission will eventually cease, but we have no idea whether this will take place in six months or 50 years. The discovery of transient (and bright) radio emission from XTE J1810–197 also reminds us that the radio sky is far from static, requiring more frequent monitoring than we can generally obtain with current instrumentation.

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Regular items

ATNF outreach

Wildflowers in the Sky: astronomy for Mid West schools

Photo: Robert Hollow

Two students from Cue Primary School using their new Sunspotter telescope.

The ATNF-led *Wildflowers in the Sky* project is part of the Australian School Innovation in Science, Technology and Mathematics (ASISTM) program. The project involves schools in the Mid West region of Western Australia working with astronomers and educators from the ATNF and partner oganisations, to expand students' understanding of astronomy.

The project commenced in June with a teacher training day held at Cue Primary School. Rob Hollow, the Project Coordinator and ATNF's Education Officer, led the day with support by Pete Wheeler, Manager of the Horizon Planetarium, part of Scitech in Perth.

In August, together with astronomers Naomi McClure-Griffiths and Ilana Klamer, Rob spent a week in the Mid West region visiting each of the five partner schools. Students used their new Sunspotter solar telescopes to observe sunspots safely and modelled the scale of the Earth and Moon. They also had the opportunity to ask the astronomers questions. Viewing nights were held at Meekatharra, with over a hundred people turning up on the sports field at Pia Wadjarri and at John Willcock College in Geraldton. The schools used their new telescopes, funded as part of the project, to view the stunning night skies. Unfortunately a rare thunderstorm at Cue prevented the students there from holding their viewing night, but at least they were able to enjoy the postponed barbecue for lunch the following day.

As the students of Meekatharra School of the Air were out on their stations and not in town Ilana, Naomi and Rob held an "on air" question and answer session for an hour. The students asked many excellent questions and now have their own astronomy club web blog.

The week-long tour was extremely interesting and rewarding for all involved. In particular, responses from the viewing night participants were really encouraging and positive. We travelled over 2,100 km during the week and enjoyed the chance to meet everyone at the schools and the communities.

The project web pages are now online at *outreach.atnf.csiro.au/education/wildflowers/* and new material will be added frequently. An extensive range of project resources, student contributions and teacher professional development material will be made available for project partners and the wider educational community.

The second school tour is planned for March 2007.

Photo: Robert Hollow

Ilana Klamer showing girls from John Willcock College how to observe sunspots safely.

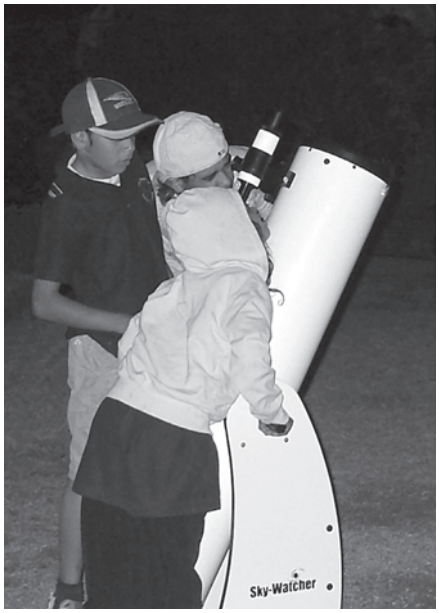

Photo: Robert Hollow

Students from Pia Wadjarri Remote Community School using their new school telescope.

Science teacher workshops in regional NSW

The School of Physics at the University of Sydney runs a science teacher workshop for physics teachers every two years. Rob Hollow ran sessions on spectroscopy and concepts for "The Cosmic Engine" at the Sydney workshop in June. This year the workshop was also taken out to regional NSW with two-day events held in Wagga Wagga and Armidale, and Rob repeated his sessions at each of these. It was a valuable opportunity to discuss the work of ATNF with country teachers and make them aware of the resources and support available.

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ATNF Narrabri Open Day and Visitors Centre ceremony

Photo: Michael Dahlem

A stream of people waiting for antenna tours at the Narrabri Open Day. The solar telescope and amateur radio astronomy displays are set up in the background.

On Saturday 31 July an Open Day was held at the ATNF Narrabri. Several Compact Array antennas were opened to the public for guided tours and visitors were also shown around the Control Building where they saw the correlator room, observing area and control room. Astronomy talks were scheduled throughout the day at the Visitors Centre including: "Radio astronomy in Australia" by Rob Hollow; "Science and results from the Compact Array" by Phil Edwards; "The next generation of radio telescopes in Australia" by Tim Cornwell; and "Seeking the first structure in the Universe" by Aaron Chippendale.

Other attractions were displays on amateur radio astronomy, ask an expert, the xNTD, viewing the sun through a solar filtered telescope, and the new outdoor information panels and sculptures. The Apex club ran a barbecue and a jumping castle for the youngest in the crowd. Due to technical difficulties a helicopter that was to provide joy flights failed to arrive, but although this was disappointing the overwhelming interest was in the activities surrounding the Compact Array.

All of the talks and displays were well attended; the antenna tours were particularly popular with people lining up throughout the day and an extra antenna opened to meet the demand. Approximately 600 people visited and feedback received was very positive, with requests for another Open Day next year. People from Narrabri and the wider surrounding districts of NSW attended, as well as visitors from as far away as Newcastle, Sydney and Brisbane. It was a great opportunity to promote awareness of the telescope within the local community.

Photo: Michael Dahlem

Climbing antenna 4 of the Compact Array at Narrabri.

Photo: Bruce Tough

Narrabri Shire Mayor, Councillor George Sevil, officially opens the new Visitors Centre displays, with assistance from Dr Phil Edwards, ATNF Narrabri Officer-in-Charge.

Earlier in the morning an opening ceremony was held for the new outdoor displays at the Visitors Centre, featured in earlier editions of the ATNF News. The opening ceremony and morning tea afterwards were very enjoyable with Phil Edwards acting as Master of Ceremonies and speeches by Vikram Ravi, who lived on the site with his parents Ravi Subrahmanyan and Lakshmi Saripalli before attending university, and the Narrabri Shire Mayor, Councillor George Sevil, who cut the ribbon. Members of the tourism community, media, education providers, ATNF staff and people involved in the development of the displays were invited. This was an excellent opportunity for networking amongst these groups and the ATNF and for the new displays to be widely promoted.

Many volunteers from across the ATNF gave up their valuable time to assist and provide support ranging from scientific expertise to general preparations and even traffic control!

We thank everyone for their help in making this day a great success.

Photo: Bruce Tough

Vikram Ravi giving a thought provoking speech during the Opening Ceremony.

ATNF Mopra Open Day

On Sunday 22 October the Mopra Observatory was also made available to the public for tours, presenting an Open Day in conjunction with the Coonabarabran Spring Festival. It was held on the same day as the annual Siding Springs Observatory Open Day.

Around 40 – 50 people visited, with Phil Edwards being the astronomer on hand to explain all about radio astronomy and how the telescope works. Observing continued throughout so the visitors were on site while current projects were underway.

Although a smaller event it was well attended and the guests were very interested, with some amateur radio astronomy buffs present. The Mopra Open Day is a good means of keeping in touch with the local Coonabarabran community and astronomical institutions, while at the same time promoting the ATNF.

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Parkes report

Staff

Brett Dawson, who leads the Observatory's receiver group, has recently accepted the role of Deputy Officer-in-Charge. Brett has already taken up the additional duties with gusto, rendering himself even more invaluable to the Observatory's smooth operation.

Gina Spratt left in August to take on 18 weeks of maternity and parental leave. Gina and Todd now have a lovely new addition to the family: baby girl Isla, to keep their firstborn, Jack, company. We wish all the family well.

Operations

Once again we have enjoyed relatively trouble-free operations over the last three months, with one significant exception. A problem was experienced in September with rough driving in the zenith axis of the 64-metre antenna. This caused observing to be suspended for more than 24 hours while the problem was investigated and rectified. This is reflected in the time lost to faults, which has risen to 2.0% for the year-to-date, higher than the typical figure for previous years.

The time lost to high wind is 3.0% year-to-date, typical of recent previous years (although the rainfall year-to-date is only about 20% of the long-term average).

November shutdown

A major shutdown of the 64-metre antenna is scheduled from 28 November to 16 December. The major activity during this three-week period is the refurbishment of the azimuth gearboxes, with essentially all moving parts to be renewed. The other high priority task is the removal of the 20-cm multibeam receiver for the second stage of its refurbishment. Other projects include replacement of the focus cabin hatch, modifications to the focus cabin door (ladder-leg), replacement of studs on centre panels, preparation for installation of mains synchronisation on the main Observatory generator, and numerous minor jobs.

Removal of the 20-cm multibeam receiver

As noted above we plan to remove this receiver from the telescope during the November–December shutdown to undergo its second-stage refurbishment. This work comprises replacing all of the remaining original low noise amplifiers, only about half of which could be replaced during the first phase of the refurbishment in 2003–2004. One new amplifier (in beam 2) has also developed a fault and will be replaced. The CTI 1020 refrigerators will be replaced by new units of the 1050 model to improve the cooling properties of the receiver, and any other necessary minor repairs will also be done. The receiver is expected to return to service early in the April 2007 semester. During its absence the H-OH receiver will be used at 20 cm. This receiver has only a single beam, and its sensitivity at 20 cm is not quite as good as the centre beam of the multibeam system (the system temperature is about 10% higher), but it has better polarisation properties and a much wider bandwidth.

Methanol multibeam receiver

The methanol multibeam receiver is operating to specifications and is now in routine use. The second frequency chain is now fully commissioned with all 28 channels (seven beams x two polarisations x two frequencies) now operational in both the multibeam spectral line correlator and the pulsar analogue filterbank.

One potentially serious problem emerged from the February session of the 6-GHz pulsar survey; a 10-second periodic modulation of the receiver power on all beams, in the form of a sharp negative spike. This problem was identified as originating in the receiver monitoring and has since been eliminated by disabling monitoring of the low noise amplifier bias values, though the fundamental cause is still under investigation.

Another minor problem with the receiver is an uneven height of the calibration signal injection across the seven beams. This is a minor inconvenience, and is unlikely to be addressed until the package is opened up for other major maintenance or repairs.

The main Galactic methanol survey (P502) has been discovering new masers at close to the predicted rate, confirming the performance of the system. The survey is also able to piggy-back on the 6-GHz pulsar survey to obtain deeper integrations over a reduced area of sky, thanks in large measure to a new hybrid multibeam/wideband correlator configuration devised by Warwick Wilson.

It is now possible to switch between the 20-cm multibeam and methanol multibeam receiver (when both are installed) at the flick of a switch in the downstairs control room. This remote control (of all 13 and seven beams on the two respective receivers) is the result of work by Tim Ruckley and Jeffrey Vera.

Upgraded Observatory network access

The installation of a new high-speed fibre link to the Observatory was completed in March and the new connection has been used to great effect during the March and May Long Baseline Array sessions, with continuous near-real-time fringe verification between Parkes, Mopra and Narrabri now almost a routine matter. This has had an enormously beneficial impact on the ease and reliability of VLBI observations.

The faster link is now also available to general users and has greatly facilitated copying of data and web access to/from the other ATNF sites and the wider world.

AARNet3 launch

On 14 September the Observatory participated in the launch of AARNet3, marking the opening of the Australian Academic Research Network's third-generation network. The Minister for Science, the Hon Julie Bishop MB, officially "plugged in" the network at a ceremony at Parliament House before a large invited audience. Broadcast quality images of the 64-metre diameter antenna and a live presentation from the control room by John Reynolds were transmitted to Canberra by the new broadband links as part of the presentation. Professor Deane Terrell AO, Chairman of the AARNet board, used a laptop in Canberra to drive the telescope for a live demonstration of the sound of the Vela pulsar.

The contribution from Parkes made from all accounts a favourable and lasting impression on those present in Parliament House. Many thanks are due to Shaun Amy for providing the technical expertise and management for this highly successful piece of outreach. Shaun was ably assisted by Tim Ruckley, Brett Preisig, John Smith and Jim Lovell.

Backends

Multibeam correlator

As noted above the multibeam correlator now has 28 fully-operational channels to allow dual-frequency operation with the seven-beam methanol multibeam receiver. Tim Ruckley, Brett Preisig and Mark Leach are working to furnish an additional three or four multibeam samplers as spares, as all 28 original units are now in service during the methanol survey.

Wideband correlator

The wideband correlator (WBC) continues to work well but with known limitations of artefacts in pulse profiles, particularly at short pulsar periods.

Pulsar digital filterbank

Construction of the fully-functioned digital filterbank (DFB) at Marsfield is reportedly progressing well, with initial tests at Parkes planned informally for early in 2007, or possibly sooner.

Meanwhile the prototype DFB has become the workhorse instrument for pulsar timing. It is generally working well (bearing in mind its design limitations), although with two niggling problems. On some fraction of starts (variable but of order one in four) the prototype DFB enters a mode where the recorded data are badly corrupted and the observation has to be restarted. This is at present not impacting on data quality but is an inconvenience as it requires careful monitoring of the data in real time. A second problem is the inability to fold reliably at

periods of greater than about four seconds (a problem which also affects the WBC).

A third minor problem, known colloquially as the "NOT KEEPING UP" problem, in which all long observations came to an abrupt and premature halt after about 30 to 60 minutes, has now been solved thanks to the efforts of Warwick Wilson, Mark Calabretta and Steve Ord. The resolution of this problem is most welcome as it has affected both the DFB and wideband correlator since their commissioning.

CPSR2

The CPSR2 baseband recorder continues to work well though with a steady trickle of regular maintenance requirements (as one might expect of a system with 30 parallel nodes). Albert Teoh from Swinburne University has been testing the CPSR2 in 4-bit sampling mode and has had considerable success in removing systematic timing residuals which are believed to be related to the limitations of 2-bit sampling.

VLBI

Progress on upgrading the Mark3A recorder to Mark5b continues slowly but surely. The recorder and formatter units have been ordered and are close to delivery, which is expected for early in 2007.

Radio frequency interference

Significant effort has recently been made at the Observatory to eliminate impulsive RFI from mains contactors on air conditioners and other ancillary equipment. It transpires that the 8-bit (256-level) sampling and correlation of the DFB is very much more sensitive to these impulses than is the 3-level WBC or the one-bit analogue filterbank. Some careful thought may be needed as to how to deal with this interference, both in suppressing it at its source, and flagging it in the DFB data.

RALI

The long-awaited RALI (Radio Assignment Licensing Instruction) scheme for Australian radio astronomy is now in place. Under this scheme, which was originally proposed by the Federal Productivity commission, the ATNF receives advance notice of some applications for radio transmitting licenses that have the potential to cause RFI. The ATNF then has the option of contacting the licensee to negotiate technical changes to remediate potential RFI. The first such notification has arrived and was distributed to a technical group with members at Marsfield, Parkes and Narrabri. Brett Dawson and Michael Dahlem dealt with the response. Steps are underway to procure a propagation modelling package that can be used consistently at all three sites to facilitate quick responses in future.

A second notification has arrived related to a transmitting license application in the Mileura Radio Quiet Zone, and has also been dealt with.

The implementation of the RALI has been in large part due to the tireless efforts of Tasso Tzioumis.

Computing

A new Linux workstation *lagavulin* is up and running in the control room and is being routinely used by observers who are enamoured particularly of its 1900 x 1200 pixel LCD display. It is planned to move the older machine *bourbon* into a different role.

An Apple 5TB XServe raid array is now operational and the first installment of the consolidated archive of the Parkes Galactic pulsar survey (P268) has arrived from Jodrell Bank and will be placed on the array soon.

In Gina Spratt's leave of absence, other significant computing developments are being considered carefully on their merits.

General site works

A second generator, of 100 kVA capacity, is soon to be installed at the northern end of the site primarily to back-up the water pump for fire-fighting. The generator will have sufficient capacity to power the quarters during the not infrequent extended outages of commercial power.

Plans are progressing to install a mains synchroniser on the main Observatory generator (500kVA), taking advantage of the experience gained at Narrabri in similar work. This will render a significant simplification in operations, with outages in the commercial power to the site remaining a common occurrence.

The new kitchen at the quarters, commissioned on 31 March, is continuing to work very well. The servery between the kitchen and the dining area is now complete and the last major step of the works, sanding of the new dining area floor and final painting, are underway and within days of completion at the time of writing. The new facilities have drawn favourable comment from many recent visitors.

Once again many thanks are due to all involved in the Quarters refurbishment, including Barry Turner and his site services team of Ken Reeves, Tom Lees, Jon Crocker, Scott Brady and the late Colin Grover.

Special thanks go to the kitchen staff of Janette Cole, Shirley Ingram and Anne Evans for their energetic cooperation in maintaining the high quality of Quarters service during these works, and their forbearance with the numerous problems along the way.

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Compact Array and Mopra report

Staff

Dion Lewis's term as Mopra Support Scientist finishes at the end of October. Dion will then turn his attentions to completing his PhD. Dion has done a great job easing the way for observers through the introduction of MOPS, changes to TCS, and the introduction of remote observing, readily fielding answers to calls at all hours of the day and night. We wish him all the best for the future. We also thank Tony Wong, Jürgen Ott and Lister Staveley-Smith who have all spent a lot of time at the Compact Array and/or Mopra and have contributed significant efforts to helping characterise and improve the capabilities of both sites. We look forward to welcoming them back as observers in the future!

Noteworthy events

As reported elsewhere in this issue, the Narrabri Observatory Open Day was held on Saturday, 29 July and the 7th ATNF Synthesis Imaging School was held in September, with a record number of students in attendance. Thanks to the efforts of ATNF staff from all sites, both events were great successes. Particular mention should be made of George Graves, who helped out at the Open Day as one of his first activities after retiring from ATNF! The efforts of Tim Wilson and the site services team at Narrabri in converting the Visitors Centre into a conference venue are also noteworthy, as the venue provided a much more comfortable environment than the lodge breeze-way which had been used in the past.

The gigabit links connecting the sites to Epping were finally made available at the end of July, and the introduction of Mopra remote observing is also described elsewhere. The arrival of the links enabled Chris Phillips to make the first eVLBI demonstration in August with the Compact Array, Mopra and Parkes. Chris also used a Compact Array antenna to observe the impact of ESA's SMART-1 satellite into the moon on 3 September, for subsequent correlation at JIVE. Leading up to the impact the weather was particularly poor, with an approaching storm front accompanied by strong winds (which brought to mind the circumstances at Parkes leading up to the more gentle Apollo landing in 1969!), however the front fortuitously passed through in advance, allowing the SMART-1 impact to be observed in relatively calm conditions.

Compact Array systems and developments

Generator/mains power synchronisers are now fitted to all antennas at the Compact Array and Mopra. These allow seamless transfer of power between mains supply and the generator for planned running such as during reconfigurations and maintenance without affecting the cryogenic systems. They cannot protect against an unplanned loss of power, but will synchronise back after the mains returns, preventing unnecessary power interruptions.

The Uninterruptible Power Supply (UPS) on CA01 was recently replaced as part of an on-going program to replace units which are no longer supported by the manufacturer with newer models. The next UPS replacement will probably take place during the array shutdown in late March/early April 2007 for the 7-mm receiver installations.

The prototype trial 7-mm receiver was installed on CA06 in August during the split array period and found to perform in line with expectations. CA06 still has perforated panels in the outer two rings of the dish, and it is planned to perform holography of the surface in November in order to tweak its performance. Also related to the NASA contract is the no-blank modification to the phase and sampler rotators. These boards are now in production and will be installed across the array.

Moisture in the feed horns on the 12-mm systems has been an issue in the past, with some antennas affected more than others. A bottled dry air system was fitted to CA01 to test required flow rates and the effectiveness of such a system and, following encouraging results, installation of full dry air systems on all antennas is now underway.

The degraded 3-mm performance of CA05 earlier in the winter season was ultimately traced to subsidence and cracking of the foam plug at the top of the feed horn. Replacement of the plug restored the performance of the receiver to its previous level, and a new material has been sourced for fabricating these plugs in the future.

The main observing computer, *ellen*, has been replaced by a new pair of linux machines named *skull* and *xbones*. All scheduling files and tasks were moved to *xbones* in October and the VAX machines *noel* and *leon* will no longer be relied upon. For information on how to prepare schedule files, see the time assignment report on page 25.

Mopra developments

MOPS, the wideband Mopra spectrometer, was installed in May and has undergone several upgrades in subsequent months. Observers have been greatly impressed with the capabilities of the new system (see article by Annie Hughes on page 12). As described elsewhere in this issue, remote observing from Narrabri is now the default for Mopra, with observers reporting that the experience is “just like being there”.

The launch of the CloudSat satellite in April has introduced a potentially powerful source of radio frequency interference in the 3-mm band. An automated warning system has been set up to alert observers to impending passes of CloudSat over Mopra and the Compact Array.

A problem with quantised, but random in time, phase jumps seen in VLBI data from Mopra has been isolated to a sampler inside the data acquisition system, and the faulty unit has been replaced.

A number of observing proposals were submitted for Mopra in the 2006OCTS semester and, as a result, Mopra observing will continue into early December this year.

Site infrastructure

With corporate financial restrictions resulting in the new control building being postponed for at least one year and probably two, funding has been allocated to address urgent issues, such as the air-conditioning and fire alarm system in the screened room. With summer just around the corner, routine clearing of the perimeter of the Observatory site, and burning off areas around the buildings, has been undertaken.

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Time assignment information

Schedule files

October has seen the final move at the Compact Array away from the two VAXes, *noel* & *leon*. Schedule files should now be made using the linux version of the scheduling program on the new computer *xbones*. From within ATNF, use secure shell (ssh) to log on to the atcaobs account on *xbones*. From outside ATNF, first log in to your own account on *nelle*, then use ssh to connect to the atcaobs account on *xbones*. You can also download the scheduling program to your own machine, see *www.narrabri.atnf.csiro.au/observing/sched/* for details. The linux version of the scheduling program is called *atcasched*, but in all other respects it is exactly the same as the VAX version (previously called *sched*). When naming schedule files, remember that linux is case-sensitive! Also, as linux does not give each revision of a schedule file a new version number, observers are advised to back-up all important schedule files to their own computers.

Remote observing

With the 2006OCTS semester we are trialing a relaxation of the requirements for Compact Array remote observing. Remote observing will still only be granted to astronomers who have observed with the Compact Array in person at Narrabri within the previous 12 months, however other restrictions on the amount of remote observing per week, etc, will be relaxed for the duration of this semester. The conditions for remote observing are given at *www.narrabri.atnf.csiro.au/observing/remote.html*.

ATCA Users Guide

A new version of the ATCA Users Guide has recently been completed to reflect the recent changes to systems. The guide is available, in html and postscript versions, from *www.narrabri.atnf.csiro.au/observing/*.

Tidbinbilla antennas

The radio telescopes at Tidbinbilla are operated by the Canberra Deep Space Communication Complex, part of NASA's Deep Space Network (DSN). As well as continuing to offer service observing on the 70-m antenna (DSS43), in the 2007APRS semester time will also be offered on the 34-m beam-waveguide antenna (DSS34). The DSS34 antenna is equipped with a 31.8 – 32.3 GHz (Ka-band) receiver with a system temperature of about 160 Jy, comparable with that expected of the Compact Array following the 7-mm upgrade. While this is a narrow band, it contains a HC_5N transition which may be of interest to some users. Time on this antenna will be offered under the same conditions as the 70-m antenna but will be operated on a best efforts basis as resources allow. Priority will be given to time on the 70-m antenna. Details on the DSS34 antenna will be made available on the ATNF Tidbinbilla pages.

Users requesting single-dish Tidbinbilla time or LBA time involving Tidbinbilla should be aware of the following JPL requirement:

> *It is a basic requirement for all proposals to use the DSN to do radio astronomy that the research require some unique capability of the DSN.*

Proposers are therefore encouraged to state clearly in their scientific and technical justification why this facility is needed. Such a statement helps in obtaining the requested time.

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ATNF publications list

Publication lists for papers which include ATNF data or ATNF authors are available on the web at *www.atnf.csiro.au/research/publications*. Please email any updates or corrections to this list to *Christine van der Leeuw*.

This list includes published refereed papers compiled since the June 2006 newsletter. Papers which include ATNF staff are indicated by an asterisk.

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