ATNF News

Issue No. 46, February 2002

ISSN 1323-6326

FEATURES IN THIS ISSUE

The ATCA captures a "baby" supernova

On the evening of 10 December 2001, the Reverand Robert Evans was conducting his regular supernova patrol from his backyard in the Blue Mountains west of Sydney, when he came across an interloper in the nearby (D=12.5 Mpc) late-type spiral galaxy NGC 7424. In an era when the vast majority of supernova discoveries are made by robotic telescopes, or as part of the high-redshift supernova search programs, Evans' trained eye, photographic memory, and a trusty 0.31-m (12") telescope have allowed him to maintain a proud record of supernova discoveries. Supernova 2001ig was his 39th discovery, and the 241st of 2001.

Since its commissioning, the Australia Telescope Compact Array has played a leading role in the monitoring of several supernovae at radio wavelengths, most notably SN 1987A (Staveley-Smith et al. 1992) and SN 1978K (Ryder et al. 1993; Schlegel et al. 1999). Radio emission from these objects is typically not detected (or even searched for) until weeks, months, or even years after the outburst. A group led by Kurt Weiler at NRL has over the years been very successful at monitoring several historical and newly-discovered supernovae using the VLA *(see http://rsd-www.nrl.navy.mil/7214/weiler/sne-home.html)*.

Shortly after the discovery of SN2001ig, a request came from Kurt Weiler for the ATCA to search for a possible radio counterpart. With the

Continued on page 14

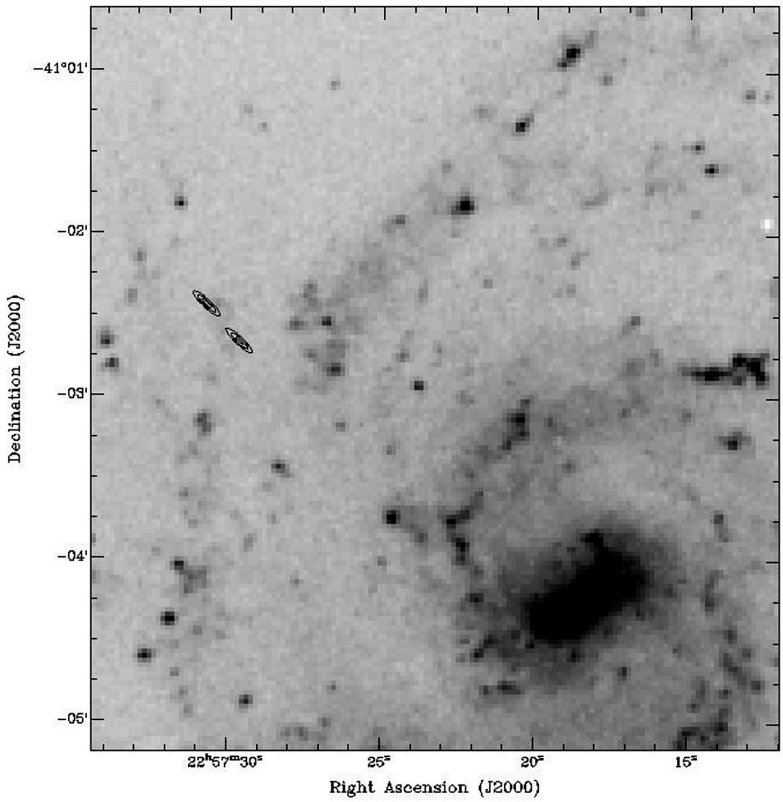


Figure 1: Contours of 6-cm (4.8-GHz) radio emission observed with the ATCA on January 15 2002, overlaid on a blue light image of the outskirts of NGC 7424 from the *Digitised Sky Survey*. SN 2001ig is the upper-left of the two sources detected, and at its peak was comparable in brightness (~15 mJy) to the adjacent source.

Editorial

Welcome to the February 2002 issue of ATNF News. We trust that you have enjoyed the Christmas and New Year festivities and will enjoy catching up with everything that has been happening at the ATNF since our last issue.

The next issue of ATNF News will be distributed in June 2002. As always, contributions to the ATNF News are welcome. Please submit contributions to *newsletter@atnf.csiro.au*.

The ATNF News production team – Steven Tingay, Jo Houldsworth, and Jessica Chapman *(newsletter@atnf.csiro.au)*

Contents

News items

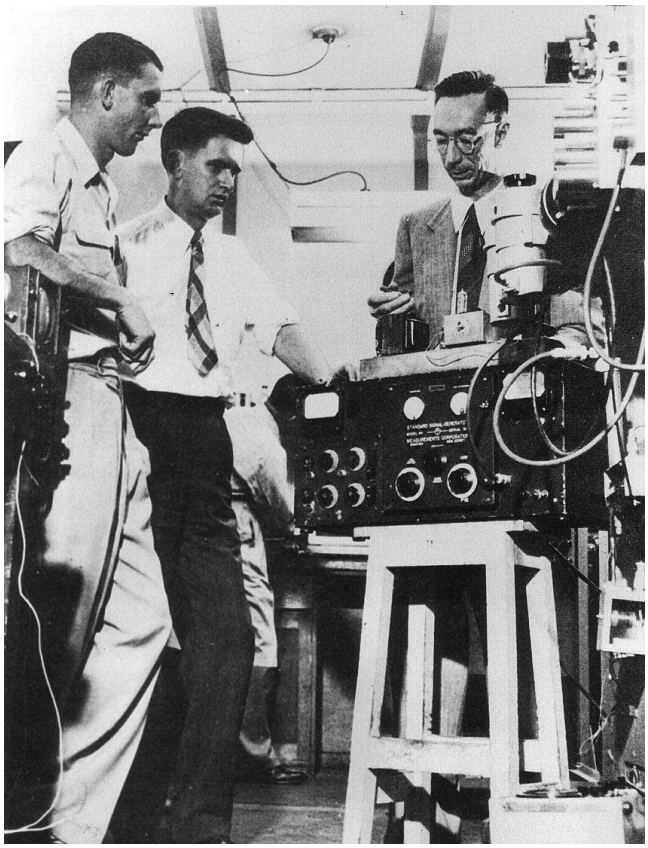
Vale Gordon Stanley

One of the pioneers of radio astronomy died on 17 December 2001. Gordon James Stanley was born in Cambridge, New Zealand, on 1 July 1921, and subsequently trained as an engineer.

Towards the end of WWII he joined the fledgling radio astronomy group at the CSIRO Division of Radiophysics in Sydney, and briefly observed the Sun from North Head in 1945 before developing a 200-MHz receiver for Clay Allen's solar antenna located at Mount Stromlo. He was also involved in the construction of equipment to be taken to Brazil for the 1947 May total solar eclipse.

When plans for this expedition were abandoned, Stanley was assigned to the Dover Heights field station, and he and John Bolton briefly carried out solar observations with the equipment intended for Brazil. With assistance from Bruce Slee they then began a survey of radio sources at a number of different wavelengths using various sea interferometers, a 4.9-m parabolic antenna and the large 'hole-in-the-ground' antenna. As part of this project, he and Bolton spent some months in New Zealand during 1947, using a mobile sea interferometer to obtain rising and setting records of selected sources. Towards the end of the life of Dover Heights as a radio astronomy field station, Stanley teamed with a US Fullbright Fellow, Robert Price, to search for deuterium emission using the 'hole-in-the-ground' antenna. They were not successful.

Late in 1953, John Bolton accepted a position at CALTECH in order to introduce radio astronomy there, arriving in California in January 1954, and he was joined by Gordon Stanley in June of that year. They then began searching for a suitable site for a radio observatory but without initial success. While Bolton was at the 1955 IAU meeting Stanley continued the search and soon settled on Owens Valley. Construction of an interferometer using two 25.9-m parabolic dishes was commenced in mid-1957, and completed two years later. In 1961, a year after Bolton had returned to Australia, Stanley became the first Director of the Owens Valley Radio Observatory, a post that he was to occupy until 1975. As Professor of Radio Astronomy he made important contributions to science over the years.



Gordon Stanley (centre), with John Bolton (left) and Joe Pawsey in early 1954 (ATNF Historic Photo Archives: 4013)

After retiring, Stanley and his wife, Helen, lived in Carmel Valley, California, up until his death. Gordon Stanley will be remembered as one of the pioneers of radio astronomy in Australia, New Zealand and the USA, and Ken Kellermann will join us in preparing a full obituary in due course.

Wayne Orchiston and Bruce Slee (Wayne.Orchiston@csiro.au)

news

Workshop report: millimetre science with the upgraded ATCA

In anticipation of the completion of the ATCA millimetre-wave upgrade in mid-2003, and the availability of a three-element prototype system this coming winter, a workshop on millimetre science was convened at the University of Melbourne on 29-30 November 2001. Participants from the Australian astronomical community, as well as guests from overseas, came to discuss and learn about areas of science that could be addressed with the new ATCA. The speakers have kindly given permission for their viewgraphs to be made available on the web at *http://www.atnf.csiro.au/people/twong/atca/mm_prog.html*.

The workshop began with an overview of the prototype system (three antennas with dual polarisation receivers and limited frequency coverage) by Tony Wong, and a presentation of first 3-mm science results by Bärbel Koribalski. One of the highlights was the absorption spectrum of Centaurus A in the HCO^+ line (Figure 1), where the spatial filtering provided by the interferometer yields a much cleaner spectral baseline than has been possible with single-dish observations. Other ATNF staff members who gave talks were Dick Manchester, who presented the first image of SN 1987A's remnant at 12-mm, Bob Sault, who reviewed progress on water vapour radiometry, and Warwick Wilson, who discussed plans for a wide-bandwidth correlator.

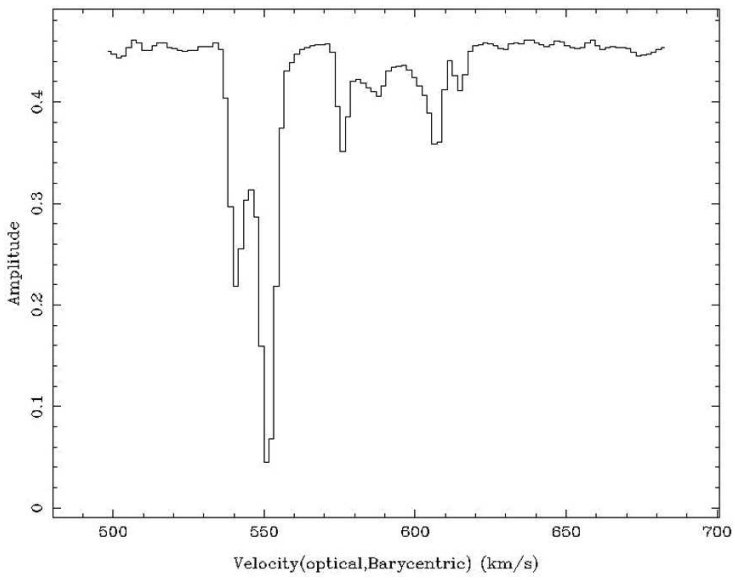


Figure 1: The ATCA absorption spectrum of Centaurus A in the HCO^+ line.

The first two topical sessions focused on the interstellar medium (ISM) and star formation, subjects that by themselves could occupy entire conferences! Although the existing millimetre arrays have made vast strides in these areas, millimetre studies of star-forming regions in the southern skies have lagged far behind infrared studies as a result of the poor angular resolution of millimetre telescopes. The excellent sensitivity and resolution of the ATCA will make it a very competitive instrument for studying protostars and protoplanetary disks, especially once its continuum bandwidth has been upgraded. Two of our invited speakers, Geoff Blake (Caltech) and Tyler Bourke (CfA), outlined several key areas in which ATCA observations can make a significant contribution to our understanding of star formation and young stellar objects. Cornelia Lang (University of Massachusetts) showed us that in the highly energetic Galactic Centre region, molecular gas seems to play multiple roles: forming massive stellar clusters, tracing magnetic field lines, and feeding a massive black hole.

Millimetre spectroscopy is a rich and rapidly growing field, given the large number of molecular lines in this part of the spectrum. Several speakers, including Maria Hunt (UNSW), Robert Smith (UNSW@ADFA), and Mark Wardle (Sydney University), discussed the potential for probing the physical and chemical properties of the ISM using molecular lines. We also heard a great deal about methanol masers from Vincent Minier (UNSW), Andrej Sobolev (Ural State University), and Dinah Cragg (Monash). These masers, which occur at various frequencies throughout the 3-mm and 12-mm bands, appear to trace the early stages of massive star formation, although their excitation mechanisms remain a subject of active research. Indeed, it was clear that much remains to be learnt from millimetre lines other than the ubiquitous CO line, which is a good thing considering that the frequency coverage of the ATCA may not extend up to the CO (1-0) line at 115 GHz.

We rounded out the workshop with a few talks on extragalactic science. Steve Curran (UNSW) presented some of his thesis work on molecular gas in galaxy nuclei as observed with the SEST, emphasising the desirability of higher-resolution data—for example, to confirm the presence of molecular outflows. Tommy Wiklind (Onsala) reviewed searches for molecular gas at high redshift, important for unravelling the star formation history of the universe and obtaining redshifts for submillimetre-detected objects. While CO

emission is difficult to detect except in nearby or lensed sources, absorption in the CO or HCO^+ lines can be observed out to high redshift by ATCA, as long as a suitably bright continuum source exists. Continuing the theme of quasar absorption lines were presentations by Rachel Webster and Michael Drinkwater (Melbourne University) on searching for molecular gas in front of dust-reddened quasars, and Michael Murphy (UNSW) on using CO absorption lines to detect changes in the fine-structure constant with redshift.

As is inevitable with such a small meeting, many areas could not be properly represented, including, among other things, cosmology, solar system science, extragalactic megamasers, and polarimetry. Hopefully these omissions can be rectified at the next millimetre workshop! In the meantime, we encourage ATCA users to learn more about the millimetre systems by following the links to the 3-mm and 12-mm pages at *http://www.atnf.csiro.au/observers/manuals.html*, and to consider applying for observing time this year. Also, look for a (longer) summary of the workshop, as well as several papers by invited speakers, in an upcoming issue of PASA.

The principal organisers (myself and Andrew Melatos of Melbourne University) would like to thank the staff and students of Melbourne University for helping to make the workshop a success. We particularly enjoyed the excellent catered meals and the souvenir mugs. We also appreciate the generosity of the MNRF International Collaboration Committee, which helped to support the travel costs of many of our visitors.

Tony Wong
(Tony.Wong@csiro.au)

Joint ATNF-ANU Professorial appointment

It is with great pleasure that I am able to announce that Frank Briggs from the University of Groningen has accepted a joint ATNF/ANU appointment as an adjunct professor at the ANU. Frank will be based both at Mt Stromlo and the ATNF, and will be involved in Square Kilometre Array research and development, including interference mitigation, and other projects, including of course the neutral hydrogen work for which he is famous. He hopes to arrive in the next few months and I'm sure you will all join me in giving Frank a warm welcome.

Ray Norris
ATNF Deputy Director
(Ray.Norris@csiro.au)

ATNF visitors program

The ATNF has a modest programme to support distinguished visitors who wish to visit for periods that typically range from a few weeks to a few months. Last year, we were delighted to have had visits under this scheme from Mike Disney (University of Wales Cardiff), Barney Rickett (UC San Diego), Frank Briggs (Kapteyn), Carl Gwinn (UC Santa Barbara), and Don Campbell (Cornell). Currently, we have Thijs van der Hulst (Kapteyn) visiting until July 2002 and Jim Cordes (Cornell) through March. In a few months time we are expecting to host Russ Taylor (Calgary) and Rogier Windhorst (Arizona State). Current and future visitors to Epping and the Observatories are listed at: *http://www.atnf.csiro.au/people/current_visitors.html*. Enquiries about the distinguished visitors scheme can be made to the Director, myself or any ATNF staff member.

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

New Officer-in-Charge for Narrabri Observatory

At the beginning of January 2002, Dr David McConnell completed his term as Officer-in-Charge (OiC) of the Narrabri Observatory (Australia Telescope Compact Array). See the later ATCA report for more details. Taking over from Dr McConnell is Dr Bob Sault.

Bob completed a Bachelor of Engineering (First Class Honours) and a PhD in image processing at the University of Sydney, before taking a Research Officer position at the University between 1985 and 1986. He was then a Research Scientist in the Astronomy Department at the University of Illinois from 1986 to 1990. From 1990 to 2001 Bob was a Research Scientist with the ATNF, based in Marsfield. He has also had stints as visiting scientist at the Tata Institute for Fundamental Research (GMRT project) and the Netherlands Foundation for Research in Astronomy (twice). Bob assumed OiC duties at the Observatory in January 2002.

Bob's research interests range across varied software, engineering, and astronomical projects, including the MIRIAD software package, phase correction systems for the Compact Array, microwave background experiments, Jupiter science, interference mitigation, and high-frequency calibrators for the Compact Array.

Steven Tingay
(Steven.Tingay@csiro.au)

news

Progress on Luneburg lens development

The main Australian proposal for the SKA antenna element utilises the multi-beaming capability of the Luneburg lens. This lens is basically a spherically symmetrical ball of graded dielectric such that the incident field is focussed by the lens to a point on its' opposite side. Given the spherical symmetry, any angle of incident field is focused to a point on the focal surface surrounding the lens. Hence, it is naturally a multi-beam scanning antenna by providing one feed per beam and tracking a source by feed movement.

To construct the lenses for the SKA out of conventional dielectric materials is not a viable proposition given weight, loss and cost considerations. From the outset, the CSIRO SKA proposal utilising the Luneburg lens has been dependent on the successful development of artificial dielectrics where weight, loss and cost are reduced considerably compared to currently available materials. Currently, a joint project between four CSIRO divisions (CTIP, ATNF, CMS [CSIRO Molecular Science] and CMST [CSIRO Manufacturing Science and Technology] – the latter two divisions based in Clayton, Melbourne) is underway to develop suitable artificial dielectric materials for constructing the Luneburg lens. While details cannot be given here as there are patents pending on some of the processes involved, in outline, low density low loss foam is being doped with graded small amounts of high dielectric low loss ceramics such a Titania to produce artificial low loss, low permittivity dielectrics. Some sample material has already arrived from Melbourne and over the next few weeks we expect to assess many more samples. Our colleagues in Melbourne are very confident they can produce what we want and are participating in the project with great enthusiasm.

Aside from the work on artificial dielectrics, work is in progress on the electromagnetic and mechanical design of the lens and associated feed system. For the next issue we should be able to report on some tangible results from all of the above investigations.

Graeme James
(Graeme.James@csiro.au)

CSIRO - TRW alliance explores advanced semiconductors

The CSIRO (ATNF and Telecommunications and Industrial Physics [CTIP]), and US telecommunications company TRW have formed a strategic alliance to develop high-performance gallium arsenide and indium phosphide components for radio astronomy, advanced millimetre-wave sensors and telecommunications systems.

Velocium, TRW's telecommunication products company, ATNF and CTIP have already worked together on the high frequency (12 and 3.5-mm wavelength bands) upgrade of the Australia Telescope. Indium phosphide (InP) low-noise amplifiers and digital receiver chips, designed by ATNF and CTIP engineers and fabricated by Velocium, are a key part of the upgrade.

The Australia Telescope is a demanding test bed for the new InP chips, which will help improve the future design of InP components for other commercial sensor and telecommunication systems. CTIP started working with TRW in 1993, and in 1999 CTIP and the ATNF gained early access to TRW's InP technology for exploratory research, which helped expedite the technology's development.

Velocium is part of TRW Space & Electronics, an operating unit of TRW Inc. TRW provides advanced technology products and services for the aerospace, telecommunications, automotive and information technology markets worldwide. TRW's news releases can be found at *http://www.trw.com*.

Steven Tingay
(Steven.Tingay@csiro.au)

CSIRO Summer Vacation Scholarship Program

From December 2001 to February 2002 the CSIRO Summer Vacation Scholarship Program was held with participating divisions including the Australia Telescope National Facility and Telecommunications and Industrial Physics (at both the Marsfield and Lindfield sites). There were 235 applications for the 22 positions, 10 with the ATNF (two of these at the Paul Wild Observatory, Narrabri) and 12 for CTIP. The students worked on projects with a scientist or an engineer for a period of eight to twelve weeks. This year's program included two Summer Legal Clerkship recipients working under the guidance of Anne McManus. We also welcomed Naomi McClure-Griffiths to the organising team.

The program emphasis is on providing the students experience in the working environment of a National Research Facility, as well as catering to group activities. These includes a series of introductory lectures on the work of the ATNF and CTIP, and tours of the CSIRO Marsfield and Lindfield laboratories. The program also includes a weekly afternoon session where a staff member from the either the ATNF or CTIP talks on a topic of their choosing.

The highlight of the program is the Observatory Trip where the students work in small teams and are given the opportunity to tour and work on their own projects at either the Parkes Radio Telescope or at the Australia Telescope Compact Array at Narrabri. The observatory trips were attended by Naomi Mclure-Griffiths at Parkes and Bob Sault at the ATCA.

The program concluded with a Summer Vacation Students Symposium, organised by the students. This was held on Thursday 7 February 2002 at the Radiophysics Laboratory Lecture Theatre in Marsfield.

The next round of Summer Vacation Scholarships will be advertised around mid-June 2002.

Lucia M Bromley-Gambaro
(Lucia.Bromley-Gambaro@csiro.au)

Standing L to R Back row: Naomi McClure-Griffiths (ATNF), Jiufu Lim, Andrea Varsavsky, Richard Dixon, Nicolai Grosse, Edward Taylor, Aidan Hotan, Arron Cleary, Bob Sault (ATNF).
Standing L to R Middle row: Vanee Harichandran, Jessica Chapman (ATNF), Vicky Safouris, Kathleen Anonuevo, Laura Frost, Suzanne Kenyon, Thulasi Karunakaran, Paul Thompson, Jemima Harris, Lucia Bromley-Gambaro (ATNF).
Sitting L to R: Lester Chua, Arvind Vasan, Nicholas Burkett, Mark Cheung, Kristen Feher, Phillip King, Sebastian Corlette.
Absent: Huda Alam, Tammy Humphrey

news

ATNF graduate student program

It is a pleasure to welcome Jess O'Brien and Bradley Warren from the RSAA, Mt Stromlo into the ATNF co-supervision program. Jess' project is "Probing the shape of dark halos of thin edge-on disk galaxies". Her RSAA supervisor is Ken Freeman and her ATNF advisor is Lister Staveley-Smith. Bradley's project is "The Nature of Nearby High HI Mass-to-Light Ratio Field Galaxies". His supervisors are Helmut Jerjen (RSAA) and Baerbel Koribalski (ATNF).

Well done to two students at Swinburne University, Aidan Hotan and Haydon Knight, who have just been awarded a prestigious CSIRO scholarship. These are brand new scholarships. For the year 2002, these scholarships were available for inter-divisional projects, though we expect the scheme will soon be expanded to cover pure astronomy projects. For further details, see *http://www.atnf.csiro.au/education/graduate/csiro_scholars.html*.

It is also a pleasure to congratulate two recently graduated students. Robert Minchin from the University of Wales Cardiff obtained his PhD for a thesis entitled "Properties of Galaxies found in a deep blind neutral hydrogen survey". Maria Hunt obtained her PhD from the University of Western Sydney for a thesis entitled "Molecules in southern molecular clouds: A millimetre-wave study of dense cores".

The 2002 Annual Student Symposium will be held in Marsfield on 1 May. Attendees are asked to register by 17 April. For details, see *http://www.atnf.csiro.au/research/conferences/student_symposia/ASS2002/* or check with the SOC - Erik Muller, Daniel Mitchell and Jess O'Brien.

At the latest ATUC meeting, new publication arrangements were announced for co-supervised students. As has always been the case, ATNF-affiliated students must include their university as their primary affiliation on any paper. However, students may also list the ATNF as a secondary affiliation (note that this may have financial implications for the University). If the ATNF affiliation is given, then the ATNF will contribute 50% of the pro-rata page charges for the student, if based in Australia. It is recommended that ATNF-affiliated students who do NOT list the ATNF as an affiliation in the author list include a footnote on the front page to state that:

"*name* is a graduate student jointly enrolled at the *university name* and the Australia Telescope National Facility."

Co-supervised students who are first authors on publications must have their paper internally refereed by an ATNF staff member (who is not an author on the paper), following standard ATNF publication policy. See *http://www.atnf.csiro.au/research/publications/policy.html.* As always, all authors should include the appropriate acknowledgement for the use of ATNF facilities. See *http://www.atnf.csiro.au/research/publications/*.

Please consult the Graduate Student pages, or contact me, if further clarification is needed. See *http://www.atnf.csiro.au/education/graduate/*.

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

Results of BHAG process

As reported in the last issue of the ATNF News, the ATNF was lead Division on a BHAG (Big Hairy Audacious Goal) proposal, in response to a call from CSIRO's Chief Executive, Dr Geoff Garrett. BHAGs deal with the areas of science and technology in which CSIRO hope to make a national and global impact, over the coming decades. The ATNF-led proposal was titled 'Catalysing the Australian Space Industry' and was one of fifteen proposals submitted across all CSIRO Divisions.

Dr Graham Harris, CSIRO BHAG coordinator, provided the following feedback on the ATNF proposal:

"The space BHAG proposal was not selected for further development by Geoff Garrett and the group. The final decision was based both on the quality of the bids and the cohesion of the bid team, together with the outcomes of wide consultation with Sector Chairs and senior representatives of Government and industry. Each of the BHAGs addresses an issue of national importance where CSIRO can play a timely and critical role. We were looking for areas where key science breakthroughs could be taken right through to the stage of adoption and value generation. At this stage we have seven BHAG

proposals being developed but I stress that we are only taking options on these at this stage. i.e. no final funding decisions have been made and no money will change hands until we have a well developed business and project plan which includes new collaborations and partnerships. The seven BHAG themes are: Light Metals, Energy, Healthy Country, Oceans, Agri-food, eAustralia and preventative Health. Each of these themes is being subjected to a full ex ante financial analysis which will help us to identify the investment opportunities. I expect that some of the better developed BHAGs will begin to get off the ground later this financial year."

Steven Tingay
(Steven.Tingay@csiro.au)

Australia Telescope Users Committee Report

The second meeting of the Australia Telescope Users Committee for 2001 was held on 13-14 November 2001. There were 12 members in attendance and the meeting was chaired by Dr Anne Green. The committee welcomed the following new members: Dr Brad Gibson, Dr Martin Zwaan, Dr Tony Wong, Dr Steven Tingay, Ms Tracy Getts and Mr Daniel Mitchell.

In the Open session on the 13th the meeting received status reports from each facility and the AIPS++ project. Ray Norris announced the move of Warwick Wilson to head the Engineering Services Group, and the resignation of Dave McConnell as Narrabri OiC. He forecast ATNF will be looking to increase staff numbers, as part of the CSIRO-wide "go for growth" strategy.

Graham Moorey outlined the timeline for the mm upgrade project. Currently there are three antennas with prototype 3-mm/12-mm frontends. By 30 December 2002, an additional three antennas should be equipped with "final production" frontends, working at 12 mm. Exactly how to proceed with retrofitting the 3-mm receivers is unclear, but the target date for five final 3-mm frontends and six final 12-mm receivers is 30 April 2003. The longstanding question of improving polarisation purity of the 13-cm receivers was discussed, and ATUC requested a timescale for completing this upgrade, in conjunction with the 20-cm receiver upgrade. Jim Lovell outlined a proposal for a new downconversion system at Tidbinbilla, to work between 18 and 22 GHz. The current downconversion system is greatly reducing sensitivity, and thus the use that can be made of our Host Country time allocation. The committee recommended that a comprehensive dialogue take place between the scientific and engineering communities, with the goal of identifying SKA demonstrator technologies which will yield the best scientific returns in addition to significant engineering advances.

ATUC congratulated the organisers of the very successful Synthesis Workshop and Parkes Open Day. During the meeting Bob Sault gave a rundown of the workshop and outlined plans for the next, in 2003. The members expressed support for the establishment of small groups to test AIPS++ intensively, involving outside institutions and the ATNF.

There was a discussion lead by Tony Wong on the options for weather-dependent scheduling of the ATCA. The next 12 months will be a trial period for capturing statistics on mm observing conditions. ATUC suggested trialling a system of two duty astronomers during scheduled mm time, to ensure full use of good weather. The committee also made some recommendations of how the mm system should be advertised to the user community during the commissioning period.

ATUC also recommended a limited trial of overseas remote observing be conducted, with at least the same conditions and restrictions as for current remote observing.

In response to the issues raised through discussion of the science outcomes expected from the SKA Demonstrators, ATUC organised a session during the University of Sydney Workshop, held 3-4 December, 2001, and titled "Next-Generation Astronomical surveys: Opportunities and Science Drivers". Ideas for science goals with the SKA Demonstrators were discussed.

The next ATUC meeting will be held on11-12 April 2002.

Vince McIntyre
ATUC Secretary
(Vincent.McIntyre@csiro.au)

ATNF open day at Marsfield

The ATNF, in conjuction with CSIRO Telecommunications and Industrial Physics, held an Open Day at the Marsfield site on Saturday, 24 November , 2001. The day was a great success with well over a thousand members of the public wandering the laboratories, admiring our displays and chatting to astronomers and engineers.

Figure 1: Evan Davis answering questions about receivers.

In feedback, visitors revealed that they greatly enjoyed the Open Day and learnt a lot about what the ATNF and CTIP do, and also about the CSIRO in general. In particular, the tours of the ATNF receiver laboratories (Figure 1) and the Square Kilometre Array exhibit (Figure 2) were big hits with the Open Day visitors. In addition there were exhibits featuring remote observing with the ATCA, an "astronomer's corridor", an exhibit explaining aspects of the Parkes radio telescope and celebrating its 40th birthday, and an area where visitors could "ask an astronomer" questions about astronomy (Figure 3).

Thanks go to the many members of staff who contributed to the success of the Open Day, spending time and effort preparing the displays and being there on the day to make the event enjoyable for the visitors.

A set of web pages showing a photographic tour of the Open Day activities is available at: *http://www.atnf.csiro.au/news/openday/index.html*.

Steven Tingay
(Steven.Tingay@csiro.au)

Figure 2: Aaron Chippendale explains a computer simulation of a Luneburg lens.