A new redshift record for the AAT

This quasar is one of the most distant objects yet found, at redshift 5.03, and the most distant found using the AAT. The spectrum was taken on 2dF as part of a program headed by Karl Glazebrook (JHU) to combine Sloan photometry and 2dF spectroscopy in a search for QSOs missed by other surveys based on photographic photometry. For the full story see page 4.
The recent announcement by the Australian Government that it is to invest $23.5M in the strategic opportunities represented by Gemini and the Square Kilometre Array is excellent news for the Australian astronomical community. On a per capita basis, it represents a similar level of new investment in astronomy as the UK’s decision to join ESO announced last December. These decisions reflect true vision on the part of the UK and Australian Governments. Both Governments have recognised the key role that astronomy has to play in helping to underpin the scientific, engineering and technological base in each country.

The Australian and UK successes share many common features. First, both were based on a united community being able to communicate a coherent strategic vision for the future of the discipline coupled with a clear set of scientific priorities. Secondly, the UK and Australian communities have both been able to demonstrate successfully the very real scientific and technological benefits to be gained from investment in astronomy. Indeed, these benefits are nowhere more apparent than the AAO. As a case study, we need look no further than the A$8M investment in 2dF – an investment which has not only yielded fundamental science via the redshift surveys but also generated A$10M to date in external instrumentation projects brought to the AAO through the development of the AAO’s capability in instrumentation.

Given this capability, the AAO is well positioned to play a major role in helping to facilitate Australia’s and the UK’s enhanced position in world astronomy via the provision of new instrumentation including the potential opportunity for the AAO to engage in the development of instrument concepts for the next generation of 30–50m optical/infrared telescopes.

With the prospect of enhanced access to 8m-class telescopes for both the UK and Australian communities, we also need to position the AAT to fulfil its support/complementary role for these facilities. The focus on AAT infrastructure over the coming 2–3 years and the associated need to move towards longer runs recognises the changing role of the AAT over the next few years. With this changing role come new opportunities, further enhanced by the increased availability of dark/grey time for new programs in semester 02A as the redshift surveys draw to a close at the end of the year. The success of the SDSS follow-up program on 2dF (see the article by Karl Glazebrook in this Newsletter) demonstrates that 2dF is still a uniquely powerful facility.

The success of the Major National Research Facilities bid therefore caps off what has been an outstanding year for astronomy in both the UK and Australia. Of course, this only really marks the start of a very challenging yet exciting period for astronomy in both Australia and the UK. I look forward to the AAO playing a central role in this new era.

Brian Boyle
In line with the strategies identified in the *AAO of the Future* and the implementation plan supported by the AATB at their March 2001 meeting, the AAO needs to reduce the cost of operating the telescopes by a factor of two by 2006.

Although the major reduction in operational support will be phased in over the period 2004–06, there will be an impact on AAO operations before then as the AAO diverts resources into essential telescope infrastructure upgrade programs.

Beginning in semester 2002A, the AAO will therefore need to start making the changes to operations that will ensure the AAT can evolve into its new mode with no loss of, or disruption to, its scientific productivity. The changes outlined below are designed to provide users with new opportunities to embark on longer scientific programs well suited to the AAT’s instrumentation suite and the Siding Spring site.

Following advice received from the ATAC, PATT and AAO Users’ committee, the following scheduling arrangements will apply with effect from the beginning of semester 2002A:

- **All facility-class instruments will be scheduled in minimum one-week blocks.**

  The AAO facility-class instruments are currently 2dF, IRIS2, WFI, UCLES/UHRF, Taurus/TTF and the RGO spectrograph. The AAO will make every effort to schedule all successful 3- or 4-night programs within these instrument blocks (including service time).

- **A maximum of 2 major changes to an instrument set-up per week.**

  Short programs (less than 3 nights) will only be supported if they can be scheduled with other programs requesting similar instrument set-up. Major changes to an instrument set-up include detector changes and 2dF grating changes.

- **All expert or visitor instruments will be scheduled in minimum 3–4 night blocks.**

  This includes SPIRAL, LDSS++, MES, SemelPol, UNSWIRF and MAPPIT. All applicants proposing to use any of these instruments are asked to discuss their proposed program with the Director prior to the submission deadline each semester.

With the move toward longer runs, all applicants should now also explicitly include an allowance for weather (33% overhead) in their estimate of the total time required to complete their program. This will give applicants the best chance to achieve their programme’s scientific goals and enhance further the science outcomes from scheduled AAT runs.
PROBING THE PEAK OF QSO ACTIVITY IN THE UNIVERSE

Karl Glazebrook, Zlatan Tsvetanov, Wei Zheng, Erik Hoversten, Kuenley Chiu, (JHU, Baltimore), Terry Bridges, Brian Boyle (AAO)

Introduction

The completion of the first large swathes of the sky by the Sloan Digital Sky Survey (SDSS) promises to revolutionise large scale survey astronomy. To date most large surveys (such as the 2dFGRS and 2QZ) have been based on photographic data simply due to sky coverage. SDSS is the first optical survey to cover a significant chunk of the sky (1/4) DIGITALLY using CCD technology. The photometric precision of this survey will be unprecedented and moreover the survey is in 5 colours (ugriz), covering the ultraviolet to the near-infrared. At the time of writing, some 1000 deg^2 has been surveyed.

Of course such surveys will result in extensive spectroscopic followup; in particular, SDSS itself will follow up about 1 million galaxies and 100,000 QSO candidates using a dedicated 2.5m telescope and a fibre spectrograph, one of the two largest in the world. However, this only touches on the potential.

The other large fibre spectrograph is of course the AAT’s own 2dF facility, and the potential to do 2dF surveys based on SDSS imaging data has long been recognised on both sides of the Pacific. After all, the AAT is a 4m telescope and has the flexibility to go considerably deeper. We have recently obtained early data on one of the first of these collaborative ventures, which promises to answer one of the outstanding problems in QSO evolution: just when were QSOs at their most active in the Universe?

The problem is illustrated in Figure 1 which shows the measured QSO luminosity density as a function of redshift from the 2dF QSO survey (Croom et al. 2001) and SDSS high-z QSOs (Fan et al. 2001) which has probed QSOs to z=6. It climbs from z=0 to z=2.5 (very well constrained by the 2QZ) and at z>3 there is a sharp decline. However there is NO DATA at 2.5<z<3 where the QSOs peak (about 11 billion years ago for the currently fashionable cosmology).

Why is this? The answer is simple, all QSO surveys are colour selected, to weed out these objects from the vast numbers of Galactic stars. For z<2.5 the colour selection is simple – just look for blue U–B or u–g colours as exemplified by the 2QZ. For z>3.5 QSOs become redder than stars in u–g while still being bluer in the other colours, and can be picked out easily. Application of this method consistently over large tracts of sky has led to the discovery of many z>4 QSOs in the SDSS.

However at z=3, there is a problematic area in colour space where the locus of QSO colour vs redshift cuts very close to the stellar locus. Even with full ugriz colours it is impossible to select QSOs without introducing an overwhelming contamination from galactic stars. In fact, standard SDSS targeting explicitly avoids this redshift range for exactly this reason.

The QSO track also crosses the stellar locus in another place – at z=5.7 the optical colours become indistinguishable from late M-stars. The success of the z>5 SDSS survey for QSOs has come about because the observations were supplemented with targeted JHK infrared photometry which allows the QSOs to be split from stars before spectroscopy. This has led to the discovery of z>6 QSOs such as the recently famous z=6.28 QSO which possibly demonstrates the Ly-Alpha
Gunn-Peterson trough.

The 2dF-SDSS QSO survey

Our concept with 2dF was to tackle these ‘problem spots’ for QSO surveys directly with a dedicated 2dF survey taking advantage of the large number of 2dF fibres available. The concept is simple – we select ALL objects with QSO colours in the regions 2.5<z<3.5 and z>4.9 and target them with 2dF. This of course will result in a huge stellar contamination. But looked at in a different light, the candidate density is comparable to 2dF’s fibre density – about 100–150 objects per square degree. Thus with one 2dF pointing we can survey all QSOs in these redshift ranges over 3 square degrees.

Extrapolations from SDSS indicated that to our i<21 limit, we might expect to find 4–5 QSOs in our redshift range per 2dF pointing – the other ~300 objects being stars. To some this may seem inefficient but to us it is exciting – we are using the huge multiplex of 2dF to do surveys which were never possible before. This ‘brute force’ approach is the only way to find these difficult objects.

As well as QSOs we are also targeting ~10 extended objects per field with unusual colours – candidate high-z galaxies. At z>3 the presence of the Lyman absorption produces a characteristic colour signature in galaxies just as it does for QSOs. Why are we doing this given we know that the mean redshift for i<21 galaxies is ~0.3 and z>3 objects are typically i>23? Well, we are looking for rare and unusual objects which deviate far from the mean – for example it is possible for a background galaxy to be highly magnified by gravitational lensing – one example of such rare objects is MS1512–cB58 (Pettini et al. 2001). It is difficult to calculate the expected number of such objects, but an upper limit of perhaps 1 per deg² is reasonable. Discovery of serendipitous BRIGHT high-z galaxies would be a boon – because they are bright, high-resolution spectra could be obtained on 8m telescopes and their astrophysics studied in depth. They would also be probes of z=1 lensing objects (probably galaxy clusters) along the line of sight.

Games with CONFIGURE

We were given 3 Director’s nights in July 2001 to try out this idea. (We had time in July 2000 but it was clouded out). Our first task was to tackle the problem of configuration. It turns out that with our colour cuts we typically had 150–200 blue z~3 candidates and 150–200 red z~5 candidates per 2dF pointing. Ideally we would want to set up the field configuration so all blue objects go to one 2dF spectrograph with the 300B grating, and all red objects go to the other spectrograph with the 316R grating. However the ability to target objects to spectrographs is not built into CONFIGURE.

We found a way to do this using multiple CONFIGURE runs on the same field. The essence of the approach is to first CONFIGURE a field with only the blue objects listed and one spectrograph disabled in the fibre tables. Then CONFIGURE is run again with a file containing both blue AND red objects and the previous allocation imported (a little documented feature!). Then CONFIGURE is run again to allocate extra fibres; as long as the red objects have higher priority than the blue objects, they get allocated first and the result is most of the fibres go to the correct spectrograph (typically 80–90%). As we feel this ability to target per spectrograph is generally useful, we have made available detailed notes on how to do this and a simple shell script to semi-automate the process at: http://mrhanky.pha.jhu.edu/~kgb/2dfmisc/configure-tricks.html

Our final configurations typically hit 70% of blue targets and 50% of red targets per 2dF pointing in a 2dF field.

Spectroscopic Results from July

Our July 2001 run was very successful. Out of our initial allocation of 3 nights we had 2.5 clear. While at these redshifts QSOs are very hard to distinguish from stars PHOTOMETRICALLY, it turns out that they are very EASY to distinguish SPECTROSCOPICALLY! This is because at z~3 we have strong Lyα and C IV broad lines, and at z~5 strong Lyα plus Lyβ forest trough. Thus we only need continuum S/N ~ 3 to reliably pick out all the QSOs. 2dF reaches this S/N at i=21 in a 1 hour exposure, even if the seeing goes slightly off (2°). So we are able to churn through a large number of fields very quickly and cover large areas of sky – critical to building up reliable statistics and finding z=5 objects.

Our standard observing procedure was to take 6 x 15 minute exposures – 4 on the source and 2 on a neighbouring sky position (in a O S O O S O P pattern). Having sky frames means going 50% slower but improves the typical 2dF sky-subtraction residual from ~5% to ~1%. While not as good as Nod & Shuffle (e.g. Glazebrook et al. 1999, AAO Newsletter #90, August 1999), there is far less overhead. (Future upgrades such as AAOmega will allow Nod & Shuffle with fewer overheads). For the benefit of 2dF users who may also be interested in trying this technique we have made the gory details about our modified 2dfdr data reduction sequence using this method available at: http://mrhanky.pha.jhu.edu/~kgb/2dfmisc/2dfdr-sky.html

So how well did we do? We observed a total of 13 fields...
and found 50 $z \approx 3$ QSOs and 3 $z > 4.5$ QSOs (out of 3750 total objects observed) including one beautiful object at $z=5.03$. This is a redshift record for the AAT.

Figure 2 shows the number-redshift distribution of these QSOs, compared with the expected selection efficiency of the normal SDSS targetting scheme. It can be seen that indeed we have succeeded in our goal of picking out objects where normal methods do not work. We show a selection of our QSOs in Figure 3, and in Figure 4 show the location of our QSOs in ugriz colour space. It can be seen very clearly that we are targetting objects very close to the stellar locus!

This gives a QSO number density of $\sim 2$ per deg$^2$ (after taking into account our 70% fibre allocation efficiency), which is approximately a 10 fold increase relative to both the SDSS and 2dF results in this redshift bin! We have converted the number of bright QSOs into a space density; so far this is just a lower limit, and is overlaid on the plot from Fan et al. in Figure 1.

We also got three $z \approx 5$ QSO. This is also a high number given the small area covered, and it is possible that the space density of high-$z$ QSOs has been underestimated. One advantage of our ‘brute force’ approach is that we have very low systematics; as we employ no IR blue-continuum selection, we are not biased against obscured objects at $z=5$. The locations of our QSOs in ugriz colour space are shown in Figure 4: it can be seen that all are indeed very close to the stellar locus.

Our high-redshift galaxy search has revealed a couple of tantalising spectra, however at S/N=3 we need to follow up our best candidates with longer spectra elsewhere before we can be sure.

**Future plans**

Our primary goals are to define and map the QSO luminosity and clustering at the epoch of the maximum, for which we will need a sample of 500 objects. This redshift range is also useful, since bright $z \approx 3$ quasars are especially critical for the HeII Gunn-Peterson study. At this redshift range, the HeII Lyman-alpha feature (at 1/4 of the HI wavelength) falls around 1200Å, and may be observed by HST and other UV telescopes. In the last decade, extensive searches have been carried out to find candidates that are UV bright. Our new quasars, if they are bright, can be further studied in the UV. According to the current cosmology models, the reionization of intergalactic helium took place later than the hydrogen, probably around $z = 3-4$. Therefore our study of the $z \approx 3$ quasars adds new values toward the study of the early universe.

Based on the outstanding success of this initial run we are applying for a long-term project to use 5-6 2dF nights per semester for the next 2 years to achieve this. We plan on doing a set of tiled fields in order to study 3D clustering as well as evolution. As well as 500 $z \approx 3$ QSOs we would obtain 30 $z=5$ QSOs and about 3 $z > 6$ QSOs. Perhaps the AAT will regain its old redshift record!

**References**

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Figure 3. QSO spectra from our survey. (a), (b) and (c) showing 2.5<z<3 targets from the blue spectrograph including one BAL QSO. Note how easy it is to identify the QSOs in this redshift range, right down to the i* = 21 magnitude limit! (d) is a z=5 QSO found from one of our red spectrograph observations, this adds to the 11 z>5 QSOs known (all found by SDSS).

Figure 4. Location of our QSOs in u-g, g-r, r-i and i-z colour space. It can be seen that they all lie very close to the stellar locus.
RADIAL VELOCITIES FOR THE PULSATING SUBDWARF B STAR PG 1605+072
Vincent Woolf, C. S. Jeffery (Armagh Obs.), Don Pollacco (Queens U. Belfast)

It is now several years since the discovery that some subdwarf B stars pulsate (Kilkenny et al. 1997). Their variations, based on photometry, generally have periods of 100–200 s and appear to be due to low-order stellar pulsations.

PG 1605+072 has the largest photometric pulsations amplitudes and the richest frequency spectrum of all sdBVs studied. As such it is ideal for study to determine whether asteroseismology can be used to determine the physical properties of sdBVs.

We obtained high-speed spectroscopy of PG 1605+072 using 4-m class telescopes: the AAT and WHT. At the AAT we used the 82cm camera of the RGO spectrograph and the special Time-series mode of the OBSERVER system. Our data covered 16.3 hours of a 32.1 hour period. It included the Hβ and Hγ Balmer lines. The spectra were obtained every 13 s (WHT) or every 22 s (AAT), a faster repetition rate than that used in earlier spectroscopic studies of the star (O’Toole et al. 2000).

The periodogram for our data is compared with the frequencies and relative strengths of peaks found in the photometry periodogram by Kilkenny et al. (1999) in Figure 1. Peaks occur in similar positions in both periodograms. The differences in peak amplitudes indicate a shift of power between modes over a ~ 3 year period between the measurements. The frequencies of some peaks also differ slightly from those found using photometry. For example, the strong peaks in our velocity periodogram at 2.731 and 2.753 mHz do not correspond well with the peaks in that frequency region in the photometry periodogram, where there is one strong peak at 2.743 mHz and several much weaker peaks, none of which are at the velocity peak frequencies.

A possible method to identify pulsation modes as needed for use in asteroseismology is the moment method (Balona 1986). To test whether variability of the moments can be measured in PG 1605+072, we used the cross-correlation function to approximate the average line profile and measured its moments. Peaks are present in the moment’s periodograms, as seen in Figure 2.

A multi-site campaign of simultaneous high-speed spectroscopy and photometry will provide the best chance of mode identification for PG 1605+072.

References

Figure 1. Periodogram of velocity data (top panel). Kilkenny et al. (1999) peak frequencies and strengths from photometric data (bottom panel).
GIANT AND DWARF GALAXIES IN THE COMA CLUSTER
Scott Edwards & Matthew Colless, RSAA

The motions of the galaxies in a rich cluster can potentially provide information on the mass distribution within the cluster and the dynamical history of the cluster’s formation. Many such studies have been performed using the easily observed bright giant galaxies, but few have included a significant number of dwarf galaxies.

This is an important omission, since the kinematics of the dwarfs may provide some important clues about the dynamics and formation of the cluster. For example, clusters approach full dynamical relaxation in two stages: first through violent relaxation, which leaves all galaxies with the same dispersion of velocities regardless of mass, and subsequently through dynamical friction, which results in equipartition of energy and leaves the massive giants with a lower velocity dispersion than the dwarfs. The kinematics of the dwarfs might also indicate something about their origins. For example, some subset of the dwarfs may be preferentially accreted at late times from the field, so that they are falling onto the cluster rather than in virial equilibrium; alternatively some of them may in fact belong to satellite populations bound to the cD and D galaxies in the clusters. In all these cases the kinematics of the dwarfs provide a tell-tale signature.

However, dwarf galaxies in clusters are not only faint, they are also hidden amongst a larger number of background galaxies of similar apparent brightness than their giant siblings. It therefore requires much more observational effort to measure the velocities for a complete sample of dwarfs than for the giant galaxies in a cluster. This problem is made tractable by the large number of spectra that can be obtained simultaneously over a wide field of view using 2dF.

We have now obtained redshifts for a sample of 1174 galaxies within 1.5 degrees (2.5 Mpc for $H_0=70$ km/s/Mpc) of the centre of the Coma cluster, 272 of these with 2dF (in less than half a night!). Of these 793 are cluster members:

![Figure 2. Moments of the cross correlation function.](image)
452 are giants (with \( b < 18 \), corresponding approximately to \( M_B < -17 \)) and 293 are dwarfs (with \( b \geq 18 \)). We have compared the distributions of these samples of giants and dwarfs in both position and velocity. Figure 1 shows the velocity distributions for the giants and dwarfs. Although the velocity distribution of the giants is clearly non-Gaussian (as found by Colless & Dunn 1996), the gaps in their velocity distribution are not apparent for the dwarfs. Although the dwarfs have a slightly larger velocity dispersion (1100 km/s) than the giants (980 km/s), the difference is only significant at the 2.2-sigma level.

We have attempted to determine whether these differences in the velocity distributions are localised in the distributions of giants and dwarfs on the sky or in joint position-velocity space (see Figure 2). However a battery of tests shows no significant differences at all – the dwarf to giant ratio does not appear to vary across the substructures in the central parts of Coma. Monte Carlo simulations indicate that with samples of this size it would clearly be possible to detect mass segregation across the cluster as a whole due to dynamical friction. On the other hand, the simulations indicate that we would need more redshifts to detect evidence of equipartitioned subclusters which are conjectured to have merged with the main body of Coma, although our results don’t rule out this scenario. We conclude that the only kinematic difference between the giants and dwarfs detectable with a sample of this size is that the dwarfs have a Gaussian velocity distribution while the giants have a non-Gaussian distribution, appearing to avoid velocities close to the velocities of the cD galaxy NGC4874 and the D galaxy NGC4889.

Figure 1. Histograms of the line-of-sight velocity distribution for galaxies in the Coma cluster: (a) Giants \((b < 18)\); (b) Dwarfs \((b \geq 18)\).

Figure 2. Smoothed density of galaxies as a function of line-of-sight velocity \( c_z \) and distance \( D \) along the NE-SW axis of the cluster (where NE is positive and the cluster centre is at \( D = 0 \)). (a) is the distribution of giants, and (b) is the distribution of dwarfs. In each case the density is smoothed using an adaptive 2D Gaussian kernel with base dispersions \( \sigma_z = 5' \) and \( \sigma_D = 200 \) km/sec. The small crosses mark the positions of the galaxies; the three large crosses represent the three dominant galaxies: from left to right, NGC 4889, NGC 4874 and NGC 4839.
A CLOSE LOOK AT MARS
Stuart Ryder

Every 2 years or so, Mars reaches opposition and attains its largest angular size as seen from Earth. The most recent opposition on June 21 2001 was the best since 1988, with the planet just 67 million kilometres away, allowing a wealth of detail to be seen by amateur and professional astronomers alike.

Halfway through the night of June 18, the scheduled AAT observers Stuart Ryder (AAO) and Yeshe Fenner (Swinburne University) found themselves with a dearth of suitable extragalactic targets for their program using the Taurus Tunable Filter and the new EEV 2K x 2K CCD. With only a slight amount of coaxing from the night assistant, Steve Lee, they decided to take advantage of the exquisite seeing that night (0.7 arcseconds!) and the ability to do direct imaging to take time out to observe Mars. Normally, the brightness of the planet (apparent mag -2.3) makes this impractical even with the shortest exposure times, but the narrow bandwidth of the TTF (12 Angstroms), coupled with some judicious adjustment of the mirror covers, made it possible to avoid saturating the detector in 0.5 second exposures. The results through 4 different blocking filters are shown in the figure below, which has north at the top, and celestial east to the left.

The image at top left is taken through the TTF’s B1 blocking filter, with a central wavelength of 3900 Angstroms. In blue light, Mars’ polar caps of frozen carbon dioxide, and any clouds or hazes (particularly near the planet’s limb) are prominent. In this image, the south polar cap of Mars is seen at lower right, while a bright “hood” cloud is all that remains of the north polar cap as autumn begins in the northern hemisphere. A bright limb cloud can also be seen on Mars’ western (evening) terminator, which is almost certainly the recurrent “Syrtis Blue Cloud” as it lies atop Mars’ most famous dark surface feature.

Going to redder wavelengths emphasises these darker surface markings, the so-called “maria” and “terrae” recorded by Schiaparelli (of Martian canal fame) and others. The image at top right is taken through the B4 filter centered on 5000 Angstroms, the one at lower left through the R0 filter (6680 Angstroms), and the one at lower right through the R1 filter (7070 Angstroms). The prominent fork-like feature running from the centre of the planet towards the west is made up of Sinus Sabaeus and Sinus Meridiani. The bright patch to the north is the Moab/Arabia basin. The darkest region to the northeast is Niliacus Lacus, while that in the southeast is made up of Aurorae Sinus and Erythraeum Mare.

Using the images shown here, Steve Lee has attempted to produce a “true colour” view of the planet, and the result can be viewed at http://www.aao.gov.au/local/www/sdr/mars.html. As it happens, we were extremely lucky to get these images when we did. A week or so afterwards, a huge dust storm swept out of the Hellas basin (see the Hubble Heritage image at http://oposite.stsci.edu/pubinfo/PR/2001/24/index.html), and has since engulfed half the planet!
ASTROBIOLOGY WORKSHOP
Jeremy Bailey (AAO)

The first Australian Astrobiology Workshop was held at Macquarie University on July 12th – 13th, jointly sponsored by the Anglo-Australian Observatory and by the newly formed Australian Centre for Astrobiology at Macquarie University.

Astrobiology has been described as the study of the origin, evolution, distribution and future of life in the universe. An important feature of astrobiology is its interdisciplinary nature. It involves cooperation between scientists from a range of fields including astronomy, biology, chemistry, geology, paleontology, planetary science and others. The Macquarie workshop had the aim of bringing together, for the first time, such a cross-disciplinary group of scientists from Australia and New Zealand.

The workshop also marked the establishment of the Australian Centre for Astrobiology, and its affiliate membership of the NASA Astrobiology Institute (one of only three members outside the USA). The centre was formally opened by Macquarie University vice chancellor, Professor Di Yerbury, at a reception on the evening before the workshop, and was welcomed as a member of the NASA Astrobiology Institute by NAI associate director, Rose Grymes. The reception followed a public lecture given by Professor Paul Davies on the subject “Did Life Come from Mars?”.

The scientific program of the workshop covered a wide range of topics including the search for extrasolar planets, the origin of life, the early history of life on Earth, life in extreme environments, life on Mars, and the search for extraterrestrial intelligence (SETI). The full program and abstracts of the papers are on the web at:


While there isn't room here to give a full account of the discussions at the workshop, the following descriptions will give an idea of some of the main themes that were covered.

**Extraterrestrial Terrestrial Planets**

Despite the detection of more than 60 extrasolar planets by the radial velocity method, we are still some way from being able to detect earth-like planets, or even solar systems that resemble our own. John Greenhill (University of Tasmania) described how studies of microlensing events should be able to either detect solar-system-like planets (i.e. Jupiters in Jupiter-like orbits) or set limits on their occurrence. Ross Taylor (ANU) outlined the many factors that went into the formation of the Earth and made it suitable for the emergence of complex life. He concludes that this sequence of events is unlikely to be repeated in detail elsewhere.

Charles Lineweaver (UNSW) described the use of observations of the metallicities of extrasolar planet host stars together with the star formation rate and metallicity evolution of the Universe, to obtain an age distribution for terrestrial planets in the Universe. He finds that three-quarters of the earth-like planets will be older than the Earth and their average age is 1.8 billion years older than Earth. If these planets have life it could have had much longer to evolve than life on Earth.

When we eventually detect extrasolar terrestrial planets it is hoped that spectral analysis will enable us to determine whether they show evidence of life. This is the aim of space interferometer missions such as NASA’s Terrestrial Planet Finder (TPF) and ESA’s Darwin. Victoria Meadows (JPL) described a new program which has recently been funded by the NASA Astrobiology Institute which aims to construct detailed computer models to predict the spectra of terrestrial planets with and without life. The project aims to determine the best spectral features to use as “biosignatures”, and thus to help the design of future instruments which might be used to search for signs of life.

**LUCA — The Last Universal Common Ancestor**

From studies of the differences in gene sequences of living organisms it is possible to reconstruct the “family tree” of evolutionary descent. The most complete such analysis has been made using the gene for small unitribosomal RNA, a gene that is present in all living organisms and so can be used to construct the so-called “universal tree of life”, showing the evolutionary relationships of all groups of living organisms. At the root of the tree lies the organism known as LUCA, the Last Universal Common Ancestor of all organisms living today. From LUCA, modern organisms inherit the basic chemical mechanisms of the living cell, such as the use of a DNA genome which describes proteins using a universal genetic code, and the protein synthesis machinery which reads the messages on the DNA and builds the corresponding protein. From LUCA the tree branches into the three domains of life, the eucarya (or eukaryotes, which includes all the complex forms of life such as plants and animals), the bacteria and the archaea.

Studies of the tree have shown that many of the deepest branches closest to the root of the tree lead to microorganisms which live at very high temperatures...
(hyperthermophiles, which grow at temperatures above 80°C and sometimes above 100°C). This leads to the suggestion that LUCA was itself a hyperthermophile, and that life might have originated in high temperature water such as that around hydrothermal vents.

Hugh Morgan of the University of Waikato has studied many of these hyperthermophiles to investigate the energy source for their metabolic processes. Living organisms normally use a molecule called ATP (Adenosinetriphosphate) as the carrier of energy to drive the cell’s metabolic processes, but Morgan finds a number of hyperthermophiles can use pyrophosphate in place of ATP for one important metabolic reaction. Unlike ATP, pyrophosphate can occur naturally in geothermal waters. Morgan suggests that pyrophosphate could be the original energy source for life if it developed in a high temperature environment.

Such a high temperature start for life is challenged by the work of Anthony Poole and collaborators at Massey University in New Zealand. Poole’s work focuses on what is called the RNA world, an early stage in the development of life which is widely considered to have preceded the current DNA/protein basis for life. In the RNA world RNA provided both the genome (the job currently done by DNA) and the catalysts (which are currently mostly protein enzymes). Poole’s team have studied the use of RNA in modern cells and identified RNA molecules which they believe are “relics” from the RNA world. They find most of these relics among the eukaryotes, suggesting that this is the most ancient branch of the tree of life. They argue that the prokaryotes (bacteria and archaea) are a subsequent, more efficient, form of life which evolved to cope with the demands of living at high temperatures. Thus the hyperthermophiles represent a subsequent adaptation, with LUCA living at more moderate temperatures.

To resolve the issue of the temperature at which LUCA lived, David Saul of the University of Auckland outlined an ambitious program to recreate genes from long extinct organisms. In this technique, analysis of the DNA sequences of a gene in several organisms which share a common ancestor, is used to determine the most likely sequence of the ancestral gene. The ancestral gene can then be synthesized and inserted into a host microorganism which will express the corresponding protein. Saul plans to use a gene for an enzyme which is highly temperature sensitive, and thus deduce the temperature at which the ancestral organism lived. Such techniques for recreating past genes have already been used successfully (see New Scientist, 21 July 2001, p31), but Saul hopes to push the method back billions of years to study the environment of the earliest life on Earth.

Life on Mars

Everett Gibson of NASA Johnson Space Center gave an account of the latest work on evidence for past Martian life from Martian meteorites. Gibson was a member of the team that made the original, highly publicised, announcement in August 1996, of evidence of relic Martian life in the meteorite ALH84001. The team have continued to gather evidence and now claim to have found similar evidence in two other Martian meteorites, Nakhla and Shergotty. However, the most convincing evidence of life, according to Gibson, is the presence of truncated hexa-octahedral magnetite crystals in ALH84001. These are identical to magnetites produced by magnetotactic bacteria, and according to Gibson cannot be explained by any inorganic processes, and constitute evidence of the oldest life yet found.

One objection that has been raised to the suggested microfossils in ALH84001 is that they are much smaller than terrestrial bacteria and possibly too small to contain the necessary chemical machinery of a living organism. Philippa Uwins, of the Centre for Microscopy and Microanalysis at the University of Queensland, has found what she calls nanobes, which she claims are living organisms in the same size range as the ALH840001 “microfossils”. The nanobes come from sandstones collected from petroleum boreholes off the shore of Western Australia. Uwins presented preliminary results of DNA extraction and sequencing from nanobes which suggested that they are related to bacteria.

A note of caution was added by the work described by Stephen Hyde and Andrew Christy (ANU) who showed how inorganic carbonate precipitates could mimic many features of biological structures. They warn that biotic materials cannot be identified on the basis of form.

Nick Hoffman (La Trobe University) raised doubts about the possibility of any life on Mars, by questioning the evidence for liquid water on Mars. Mars is a cold and dry planet today, and in the past it should have been even colder as the Sun was 30% less luminous billions of years ago. However, Mars seems to show clear evidence for channels on its surface which appear to have been the result of flowing water. Hoffman argues that all such features can be explained by flows involving gaseous carbon dioxide and proposes the model he calls “White Mars” in which Mars has always been cold and dry. On this model life could only have ever existed deep below the planet’s surface.
ASTRO EVENTS

Richard Stancliffe: I have been working with Chris Tinney on using spectroastrometry to detect binary brown dwarf systems. The technique involves measuring the centroid position of the target image formed on the detector by the spectrograph, and seeing how this changes with wavelength. The plot of the centroid position against wavelength is known as a position spectrum, and the shape of the spectrum can be used to detect companion objects, as changes in the centroid position indicate changes in the relative flux between the primary and any companion.

As part of the project, I have developed models of what the position spectra of hypothetical brown dwarf binary systems should look like. The models were used to develop specific measurements that could be made on the actual data, as a simple way of determining the separation and spectral type of any companion that may be present. These tests were applied to data taken from the three late M-dwarfs BR10021, DENIS 0021 (both M9.5s) and LP944-20 (an M9), to set limits on the presence of any companion these objects may have. My time here at the AAO has been a fantastic experience, and I feel I have learned an incredible amount whilst I have been here. Thanks to everyone for the great time I’ve had, and to Chris in particular – for all the help and advice he gave. Cheers, and hope to see you all again someday!

Parimal Patel: Whilst at the AAO, I have been working with Terry Bridges, Russell Cannon and Scott Croom on the feasibility of using the Nod & Shuffle observing technique for the new AAOmega instrument. Nod & Shuffle should be an effective way to reduce sky contamination in object frames because the same optical paths are used for taking both sky and object spectra. The main aim of my project was to see how data taken and reduced in Nod & Shuffle mode compared with the same data reduced by conventional sky subtraction methods. This should allow a decision to be made on whether to optimise AAOmega for Nod & Shuffle or not. Unfortunately, the results weren’t quite what we expected… however, I’m hoping that more data taken using Nod & Shuffle will give a much clearer view on the use of this technique for AAOmega. Working at the AAO has been an excellent experience — the only problem is that my final year at university is now going to seem very mundane. Being part of a real research environment is a real eye opener, partly because it involves hearing the researchers telling you that most of what you’ve learnt at university is probably in doubt!

UK Vacation Students 2001

This winter we had five astronomy students from the U.K. at the AAO. Below we have their thoughts on their stay with us.

From left to right: Chris, Parimal, David, Vivienne & Richard
**Vivienne Wild:** During my stay at the AAO, I have been working with Scott Croom using spectra from the 2dF QSO Redshift Survey (2QZ). The aim of the project was to locate and study any quasars in the catalogue with host galaxies which show signs of a starburst. The possible connection between starburst galaxies and active galactic nuclei (AGN) is an important topic of research, which will hopefully lead to a fuller understanding of the formation of both types of objects. Individual QSOs have already been discovered with hosts showing characteristic starburst features. Not only within QSO surveys, but also radio galaxy and ultraluminous infrared galaxy (ULIRG) surveys, samples of these objects have been found. The advantage of 2QZ is the huge number of quasar spectra observed, around 20000 at present, the largest sample ever taken.

My project was to develop a fully automated method for finding signs of starburst host galaxies in the spectra, and then measure the relative flux of the starburst, together with its age. QSO spectra come in many “shapes and sizes”, with often large emission lines, making it quite a difficult task to find the usually weak signatures of the underlying hosts. Developing an automated method is a little challenging, and I learnt that persuading a computer to “see” what the eye can, can be an interesting problem. Various methods have been investigated so far, such as comparing the whole spectrum with model spectra, looking for the characteristic 4000 Å break, and calculating the strength of individual absorption lines. Each of these methods has found objects with strong starburst components, although these probably account for less than 1% of the total number of quasars in the catalogue. The last method has proved a robust way to locate prospective candidates by measuring the strength of the Balmer series and Calcium H and K absorption lines: signatures of starburst galaxies. Over the next few weeks I will be looking at measuring their age and relative luminosity. Before I leave it is planned to submit an HST proposal in order to further investigate the objects with the largest starburst components.

**David Wilman:** It always seems to me that research projects don’t accelerate smoothly towards a peak in activity halfway through and then make a calm and relaxed deceleration through to a perfectly executed parallel park of a conclusion. No, none of that — that would be boring. Instead, as with this project, the accelerator hits the floor just as you should be hitting the brake. Then just as time is running out, you realise that the project you had at the beginning has transformed out of all recognition. And as you screech to a sliding stop in the final seconds, you are left with many more questions than answers.

Such is science and as I enter the last 2 weeks of my project with Joss Bland-Hawthorn, we seem to be coming across all sorts of interesting phenomena, all of which need investigating further and with some potentially exciting results awaiting. It is not really such a surprise that the 2dFGRS data I have been investigating is producing good science: with such a large sample of galaxies such good statistics have never previously been available. I have a sample of over 150k objects taken from the 2dFGRS, with redshifts and line fits calculated for the data, all in a single database provided by Ian Lewis. Over 15k of these objects have been matched to 2Mass objects by Shaun Cole at Durham, providing B and J colour data.

The next step was to include the spectral classifications from the Cambridge group (Lahav, Madgwick) since we want to establish how nuclear activity varies with galaxy Hubble type. We first demonstrated that the spectral classifications showed a clear trend in bulge to disk ratio. This is evident from the galaxy colour (B – J), and from the trend in emission and absorption lines. Just in the nick of time we achieved our goal to form a definitive list of active galaxies. We picked out about 2000 narrow emission line galaxies (NELGs) most of which are probably Seyfert 2 galaxies. These are identified from emission line diagnostics. We also found about 500 broad emission line galaxies (BELGs) which are referred to as Seyfert 1 galaxies. These were found by eyeballing a reduced sample of objects where the automatic line fitting provided evidence of broad Hβ emission. We are now embarking on understanding the luminosity function of NELGs and BELGs for our low redshift sample. Hopefully, we can achieve this before my time is up. Whatever happens, I have thoroughly enjoyed my time spent upside-down and I’m sure I’ll be back soon to meet some more kangaroos, sharks, crocs & koalas and of course to observe this most incredible Southern sky which puts our hemisphere to shame, during my PhD at Durham.
UK Vacation Students 2001

Chris Arridge: My time at the AAO has been spent in the care of the FMOS team, working on the Echidna multi-fibre positioner for the Japanese 8.2m Subaru telescope. I have been working mainly on the dynamics of the spines which has involved both experimentation and supporting theoretical analyses.

As a side project, I also investigated a possible alternative to the prototypes which already existed. Earlier spine concepts demanded very light, stiff spines that show little sag under gravity. A concept was developed whereby nickel would be electroplated onto aluminium tubes and the aluminium could be etched away leaving nickel cylinders with walls a few tens of microns thick. My part in this was to take already plated tubes, etch the aluminium away with hydrochloric acid, and determine how strong they were — basically a short feasibility study. Unfortunately, the nickel tubes had an unpleasant tendency to fall apart during etching and several ideas have been formulated to explain this mechanical failure, including corrosion due to hydrogen gas or hydrochloric acid, and mechanical failure due to vigorous shaking, or some combination of these factors.

However, my main work has been trying to determine how the spines behave, both qualitatively and quantitatively, and hence identify the best way to drive the spines. This work has required an application of a range of techniques from data analysis and processing of sensor data, a theoretical analysis of piezoelectric tube bending, to construction and testing of spines. A substantial amount of my work has been done using an inductive sensor to measure very small displacements of Echidna spines and piezoelectric tubes. Some of these displacements have been less than a tenth of the diameter of a human hair and have been difficult measurements to make accurately due, in part, to the not-very-static Massey building.

I would like to extend my thanks to the FMOS group and the staff at the AAO, AAT and CSIRO who have made me very welcome during my time here. My selection for the vacation student program was a pleasant surprise and I’m glad I made it (eventually). Thank you all for the opportunity and a very enjoyable summer (winter).
NEW EEV 2K X 4K CCD COMMISSIONED ON UCLES
Stuart Ryder

The EEV2 device was commissioned with UCLES in early July 2001. It should be the detector of choice for most programs when working blueward of H-alpha (6563 Å). At longer wavelengths, fringing can be a problem (see below), and the MITLL3 has greater quantum efficiency than the EEV2 anyway. More information about the characteristics of the EEV2 CCD (readout rates, cosmetics, etc.) are available from http://www.aao.gov.au/local/www/cgt/ccdimguide/eev.html. The same readout windows used for the MITLL2A/3 detectors can also be used with the EEV2, as the array dimensions are the same. The smaller pixels give improved spatial and spectral resolution cf. the MITLL devices, at the expense of 10% less coverage of the echellogram. The EEV2 device shows no sign of the charge diffusion between pixels that limits the resolution attainable with the MITLL2A device to R<70000; indeed, by closing the slit down to 0.3", a resolving power R=115000 at 5500 Å is attainable. More realistically, a 0.5" slit will yield R=85000, but slit losses due to seeing will still be significant. When viewed on the XMEM display, EEV2 images have red (lower number) orders on the left, and wavelength increases going up each order. When saved to disk and viewed with figdisp/Ximtool, the images are flipped vertically, so that wavelength increases from top to bottom along each order. This is the same orientation as the Tek, and the exact reverse of the MITLL2A/3 orientation. Just 36 hours after being installed, the dark current stabilises to a level of 0.9 e^-/pix/hr. This is rather better than the MITLL2A an reach in the same time, but still higher than the lowest values reached in the lab. The difference is due to a faint glow from the coude room walls, which we hope soon to reduce by repainting the walls. Just as with the RGO spectrograph, fringing is apparent with the EEV2 at wavelengths beyond 6000 Å, and becomes worse as one goes further into the red. At 6000 Å, the fringing is at a level of <2% p-p; it is still <3% p-p at 6500 Å, but rises to 6% p-p at 7000 Å, and 36% at 8000 Å. However, careful flat-fielding can reduce this to tolerable levels; for instance, dividing the spectrum of a standard star by a flatfield image taken immediately afterward (see figure) reduces the fringe amplitude at 7500 Å from 20% p-p, to 4% or less. Thus, unless the wavelengths of primary interest are redder than 6500 Å (in which case the MITLL3 should be favoured due to its superior quantum efficiency), the fringing should not be a serious hindrance to most UCLES programs. The UCLES signal-to-noise calculator (http://www.aao.gov.au/cgi-bin/uclsnr.pl) has also recently been updated. The EEV has now replaced the Tek, and predicted count rates are now available down to 3500 Angstroms (subject to atmospheric throughput). In addition, the results are now output in Analog-to-Digital Units (ADUs), rather than electrons, depending on the readout speed selected.

Figure Plot showing the level of fringing before (dashed line), and after (solid line) flatfielding with the new EEV CCD on UCLES, near a wavelength of 7500 Angstroms. The amplitude of the fringing has been considerably reduced.
The AAO/ANU/U. Melbourne Wide Field Imager has seen continued action on the AAT since its first commissioning run in August 2000. Integration issues between the ANU’s CICADA observing system and the AAT’s Telescope Control System (TCS) and Prime Focus Unit control (the shutter and filter controller) have been significantly improved. All WFI images now contain header information derived directly from the barcode name encoded onto every filter holder.

Control of the AAT from the WFI CICADA system is now possible. This control includes the ability to prepare observing sequences for multiple exposures with telescope dithering, and filter changes (including focus adjustment and support for random dithering). Though the file formats for defining these sequences are somewhat complicated, they do work. So it is no longer necessary to “hand start” every single exposure.

Auto-guiding has been used to obtain long U-band exposures. The overheads associated with acquiring guide stars into one of the eight WFI guide CCDs are non-negligible (2–3 minutes per new position). Given the AAT’s excellent tracking over 5–10 minute periods, there is little advantage to guiding in passbands which are sky-limited in times less than 10 minutes. In other words guiding is only recommended at U.

We look forward to seeing an increased number of WFI applications in future semesters, with its improved ease of use and reliability.

The Fibre Positioner OzPoz, which the AAO is building for the ESO VLT at Paranal, Chile, had a lucky Friday the 13th in July when it successfully positioned its first button – a real breakthrough in the development of the positioner control software. Since then, OzPoz has configured multiple fields containing a number of test fibres, including fibre cross-overs. Also, it is now operating under control of ESO high-level control software, as it will be run at the telescope. The input data for the Positioner are prepared using ESO P2PP software and a specially adapted version of the original 2dF Configure program, developed by Keith Shortridge. A number of ESO astronomers have already used a version of Configure program, which has been highly regarded.

The EEV has had a successful run on UHRF in slit mode. The dark current level was found to be comparable to the Tek, thus avoiding the problems experienced with the MITLL2A. The EEV was not used in the red with UHRF, so the effect, if any, of fringing has not yet been determined. A single observation at 4554 Å of a comparison star with AB = 4.2 mag. gave a countrate of 900 Hz/0.01 Å. This is consistent within the uncertainties with laboratory predictions of an increase of 40% in efficiency. Thanks to observer Sean Ryan for trying out the detector and supplying calibration data. A more detailed analysis will be posted on the UHRF web page shortly. This is the first large format CCD which appears to have no usage limitations with UHRF, and the increased wavelength coverage will be particularly beneficial for R=300,000 observations, where almost 20 Å coverage is obtained! Note that until the effect of fringing is determined, it is still recommended to use the Tektronix CCD for programs requiring both red and blue wavelength settings.

The 1200J and 600H diffraction gratings are now unavailable, as they are on an indefinite loan. The 600H has been unmounted for some years. The functions of the 1200J are covered almost entirely by the 1200I grating, especially since high dispersion work in the far red is not recommended for 2dF.

Both UCLES and UHRF are offered in service mode for projects up to three hours total integration. Recent successful service nights for both instruments have almost emptied the service queue, so send in those requests! In particular, the availability of the new EEV CCD (see articles above), with its superb blue response, makes possible a whole range of projects not previously feasible in service time.

The RGO manual and accompanying tools will be undergoing an update during the next couple of months, so, as for all instrumentation documentation, ensure you are using the most recent version when preparing observing proposals. And don’t forget to consider SPIRAL as an alternative instrument for your program.
IRIS2 ROLLS TOWARDS OCTOBER COMMISSIONING
C. Tinney for the IRIS2 Team

As we write, IRIS2 is entering its sixth thermal cycle in pre-telescope testing and commissioning at Epping. With two more thermal cycles of the dewar expected in Epping, things are looking good for on-telescope commissioning starting in October 2001. A number of critical phases have been passed by IRIS2 in recent weeks – its wheels are now moving reliably when cold, optics have been installed, and the engineering-grade HAWAII detector is being read by the new AAO2 controllers. The image below shows the very first images obtained with the engineering detector and the IRIS2 optics – a warm “aperture target”. As usual the “first light” image was out of focus. But an in-focus image was acquired soon after. Testing of the performance of the IRIS2 optics in Cycle 5 (in their “firstcut” unoptimised positions inside the dewar) has revealed the optics designed by Damien Jones, and manufactured by Graseby Specac in the UK, do deliver excellent images. The graphic to the right shows on-axis focus sequences at J and H of a 10\(\mu\)m pinhole at the nominal telescope focal plane (focus of the instrument is achieved by axial motion of the detector on a stepper motor driven array translator). The best images reveal on-axis intrinsic image quality of better than one pixel for IRIS2. Off axis images are currently elongated to 1x2 pixels, but this should be due to the lack of a field lens in these tests, and sub-optimal axial location of the camera elements. In Cycle 6 (see the image of IRIS2 cooling down for Cycle 6) we hope to rectify these issues and deliver one pixel imaging over the entire field!

Figures 1 and 2. “First light” images for the HAWAII Engineering device in IRIS2 - the image to the left is the usual out-of-focus first light image, while that to the right is in focus.
Figure 3. Focus sequences for the IRIS2 camera viewing a 10μm pinhole (equivalent to a 0.07" source at the AAT f/8 focus) in the J and H passbands. At the very first go, we get 1 pixel images!

Figure 4. IRIS2 being pumped and cooled in preparation for Cycle 6 testing in the AAO Epping labs.
LETTER FROM COONABARABRAN
Rhonda Martin

We are a compassionate lot on the mountain, well, mostly anyway. Just take the great swallow hunt in the AAT, or the brown snake found in the Schmidt a couple of years ago. Did the denizens of the UKST immediately look for a heavy object to drop on the unsuspecting reptile? Did they use their big boots to crush out its life? Of course not — they asked Len Francis, the cleaner, to return it to its natural habitat, which, they pointed out cogently, was NOT the office floor of the Schmidt! With great kindness and an infinite amount of respect Len donned the thickest of gloves and picked up the slim, brown length and took it outside, much to the relief of all and sundry. Sad to say, said snake tried very hard to bite Len through his glove which was a little ungrateful but after all, it WAS just a baby and evidently had not yet been taught its manners. Eventually it took quite happily to being returned to the bush below the Schmidt where, no doubt, it has grown into a great big snake and is just waiting for someone — probably Will Saunders — to venture within nibbling distance.

During the 6dF commissioning Will camped in a rather nice tent in pretty much the same area (although we did not tell him that!) and he enjoyed himself hugely by all accounts. Now that Will has gone, the hillside overlooking the tip is strangely empty and we miss his windblown countenance but we are sure he will return, one day — probably at the start of the next snake season.

I remember a long time ago when Brian Plummer found a snake skin in an air conditioning duct at the Schmidt. We never did find out what happened to its one-time occupant……

Welcome Swallows are delightful little birds and we have many of them at Siding Spring, usually talking excitedly to each other as they groom their trim suits of feathers. They do, of course, fly in and out of the ground floor and recently, when the hatch to the second floor was open, they invaded the upper reaches of the AAT. The hatch then being closed, they could not escape and they were spotted by Allan Lankshear sitting forlornly on a piece of equipment. We called upon the well-known kindness of that other great softie, Frank Freeman. Most birds will fly upwards when frightened so on this assumption, the hatch to the main floor and the dome’s wind shield were opened to permit their escape, preferably before they made messes everywhere, something at which they excel. One immediately took the opportunity and shot outside like a small rocket but the other, of course, wanted to return the way he came in, that is, down. It took quite a bit of time and a bit of fiddling before this avian visitor was also evicted. Frank accepted my congratulations with aplomb but I am quite certain I heard an under-the-breath comment as he departed my office, something like…… ‘would’ve shot the bloody things but didn’t want to get blood and feathers on the mirror…..’, but surely, he wouldn’t have said anything like that, would he?

It is with sadness that we announce the death of Peter McCartney. Peter retired a few years ago from his job as Storeman at the AAT and had not been well for quite some time.

We have lost Ed Penny to Epping and wish him well. We’ll miss you Ed – don’t forget to come back and see us some time.

On a decidedly foggy, cold day in July the Site people farewelled David and Phillipa Malin at a Christmas-in-July lunch on the mountain. It was very pleasant in the inside warmth munching turkey and plum pudding whilst ignoring a totally opaque world outside the windows, listening all the while to anecdotes about David, some of them embarrassing, from Fred Watson. David, of course, got his own back in his own inimitable style — somebody else we will miss. Good luck to you David in your new venture.

What is it about this time of year? Another regretted departure is Ian Lewis, our 2dF expert. Ian, Alison and toddler Hannah have become part of the Site family and we reckon that Oxford is darn lucky to get them. We will miss them and that small, blond baby very much indeed — Hannah had the innate ability to send all the grandfathers in the place (and they are legion) into an attack of the cluckies.

Yet another departure? Yes indeed! Len and Ann Francis, contract cleaners since 1988, have left us. They were farewelled at a morning tea and presented with mementos of their time here. Len, of brown snake fame, and Ann were always to be found working hard at Social Club functions and at that mountain of washing up after a Board lunch. Our sincere thanks go to them and we wish them well in their future endeavours.
EVENTS IN EPPING
Helen Woods

Aside from the lively company of five students, mentioned elsewhere in this newsletter, the AAO has enjoyed a visit from Penny Sackett and Eduard Westra, from Groningen. Here they worked with Terry Bridges for a few weeks on their WFI data, where they are hoping to find planetary transits in 47 Tuc.

Jason Griesbach, one of Epping's electronics engineers has become a father for the second time. The last few months have been a very mixed emotional journey for Jason and his wife Petrina who was pregnant with twins, one of whom was diagnosed with severe defects which would not allow him to live after birth. On 26 July Petrina was rushed to hospital for a caesarean section. Nathan, the baby with the difficulties, was born first and died peacefully about half an hour later. Jonathan, was delivered second, and despite his premature birth, has now joined his older sister and parents at home and is doing very well.

On 21 August the Epping part of the Observatory held a farewell lunch for John Straede. Aside from one or two members of staff who have left and rejoined the AAO, John is the Observatory's longest serving staff member, beginning his career at the AAT project office in Canberra in March 1973.

John moved to Siding Spring early in 1974 with Pat Wallace to install and complete the AAT control system. Pat says he found John to be a brilliant lateral thinker and a writer of mind-blowing assembler code. Hindsight has demonstrated that to be true, as it was a very long time before the AAT control system was bettered, and it is still operating today.

John was made a permanent member of the staff in February 1975 and moved to the demountable buildings that were then the Epping headquarters in about July that year. Since then, he has had a hand in most of the significant AAT instrumentation projects – CCD systems, IRIS 1 and 2dF to name just a few. He has just recently completed software that allows us to integrate the old interdata telescope control computers with the new IRIS 2 software – so his software will run for a long time at the AAT.

It’s been great working with John. His brilliant mind and robust laughter will be missed throughout the Observatory; but he will still be around in code for many years to come!

POETRY CORNER*

Ode to the R.G.O. Medium Dispersion Spectrograph

Oh venerable R.G.O.
You are now scratched and battered
But be proud that you've done your job
And been there when it’s mattered.

You collected redshifts by the dozen
And mapped the L.M.C.
You measured eclipses, pulses, flares
And all kinds of polarimetry.

You almost stood upon your head
To watch '87A fade.
And countless other tasks were yours
In the decades since you were made.

Now and then retirement looms
“Too old, give us something new.”
But R.G.O., you do so much
Breaking up is hard to do.

UCLES gave us high resolution –
“One camera can go!” we said.
But Jeremy thinks spectroastrometry
Is the best thing since sliced bread.

2dF collects redshifts
By the thousand, not the score –
Autofib and FOCAP
are finally out the door.

And now we have the new SPIRAL
And Nod and Shuffle too
And R.G.O., I think we might
Have found a replacement for you.**

* This is a new column for the AAO Newsletter. Contributions are welcome. (Or you will have to suffer more of my poetry!) ………….The Editor.

** Don’t worry - the RGO spectrograph is still being offered at the AAT. But do consider SPIRAL as an alternative for future observing programs.
Reproduced with permission from the front page story in “The Australian”, photographer Ray Strange. And before you say “that’s not the AAT”, Brian is perched in front of the 74 inch at Mount Stromlo as he was in Canberra at the time of the announcement.

Why is AAO Director Brian Boyle so happy? Because when Senator Nick Minchin, Australian Minister for Industry, Science and Resources, announced the “winners” of the A$155 million Major National Research Facilities (MNRF) Program, the astronomy proposal was allocated A$23.50 million – the largest of the 15 successful grants.

The proposal, entitled “Gemini and SKA: Australia’s Astronomy Future”, will concentrate on attracting the Square Kilometre Array (SKA) to outback Australia, and on boosting the growing optical/IR astronomical instrumentation industry in Australia. See the Director’s Message for Brian’s comments.