AAO OBSERVER

THE AUSTRALIAN ASTRONOMICAL OBSERVATORY NEWSLETTER

NUMBER 125 | FEBRUARY 2014

# HERMES Achieves First Light

# Director's message

Warrick Couch

One of the AAO's key functions, as set out in the Australian Astronomical Observatory Act 2010, is "to develop, manufacture and provide instrumentation for use by the Australian optical astronomy community". A conspicuous feature of this issue of the AAO Observer is that over the last semester the AAO has delivered on this in spades, with the successful commissioning of two new instruments on the AAT.

By far the most significant of these is HERMES, the commissioning of which represents the culmination of what has been a mammoth effort by the entire observatory over the last 6 years. Although I feel a complete 'Johnny-come-lately' in being AAO Director for just the last 6 months of this period, I can at least claim to have strong connections to its origins, in having a lot to do with the securing of the NCRIS grant that funded a big chunk of HERMES, and then being party to the AAT Board's decision to give this project the green light. The most prominent memory I have of these early beginnings was the overwhelming support received from the Australian astronomy community for the investment of a significant fraction (~10%) of the NCRIS funds in a major new instrument for the AAT, and the very clear consensus that emerged that it should be a fibre-fed multi-object high esolution optical spectrograph. So it is most gratifying to now be at this point where this capability is now in place on the AAT, ready for our community to reap the scientific rewards.

Of course major instruments do not get to a telescope without a long, complex, and often challenging journey – and HERMES has been a 'crash course' introduction to this world for me as the new AAO Director! Readers of this issue will also appreciate this when they read Keith Shortridge's article on page 8, which so brilliantly captures the ups and downs, highs and lows, moments of despair as well as euphoria of the last 7 months of HERMES' journey. To have successfully dismantled HERMES at the AAO's old

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Credit: Isobelle Teljega (St Margaret's Anglican School), Travis Rector (U. Alaska Anchorage), and the Australian Gemini Office.

The nearby spiral galaxy IC 5332 was captured in the winning image from the 2013 Gemini School Astronomy Contest!

Epping site, shipped it to and reassembled it at the AAT, overcome the serious issues with the imaging performance of HERMES four VPH gratings, achieved first light and fully commissioned the instrument over three runs in close succession in October-December, and demonstrated that HERMES performs close to spec, is an effort of heroic proportions, for which the HERMES team and all the AAO staff should be very proud.

As we head into 2014, the stage is now set for the major flagship survey to be undertaken with HERMES – the GALactic Archaeology with HERMES (GALAH) Survey – to commence, and for HERMES to be made available as a facility instrument to the community starting in semester 2014B. Already, GALAH has made a promising start through an initial pilot survey. With its primary goal being to reconstruct the formation history of the early Milky Way by measuring precise radial velocities and abundances for over a million stars, it has a strong synergy with Gaia space mission that will create a precise 3D map of stars throughout the Milky Way as well as measure their motions. In what has ended up as quite immaculate timing, Gaia was successfully launched on 19 December (2013) – just 4 days after HERMES commissioning was completed – and so far is on track to enter full survey mode in May.

As if commissioning HERMES was not a big enough task, the AAO's new integral field unit KOALA was also successfully commissioned on the AAT the week prior to the first HERMES commissioning run. As described in Simon Ellis' article on page 12, KOALA is a 1,000 element IFU device that provides a bigger field of view and better throughput than its predecessor, SPIRAL. Moreover, it further builds on the AAO's heritage of innovation in fibre optic-based instrumentation, with the use of a 'double lens' microlens array that realizes an almost 100% filling factor and a much more efficient coupling between the focal plane and the fibre array.

With both KOALA and HERMES now commissioned, it is worth highlighting that the AAT is now a very versatile spectroscopic facility indeed in terms of providing multi-object, single fibre and IFU capabilities over a broad range of spectral resolution. The robotically positioned 400-fibre "two degree field" (2dF) system now feeds either the AAOmega or HERMES spectrographs, providing multi-object spectroscopy at low-to-moderate (R = 1300 – 10,000) or high (R = 28,000 – 50,000) spectral resolution, respectively. SAMI and KOALA then provide both multi- (x13) and single-object IFU capability over the same low-to-moderate spectral resolution range, through feeding AAOmega. This represents a powerful suite of capabilities that should keep the AAT scientifically competitive well into the future, noting that further enhancements are planned soon (e.g. upgrade of the AAOmega CCDs in two months time) or are in the pipeline (e.g. expansion of SAMI to a 50-60x multi-IFU system, known as "Hector").

Finally, 2014 will be a very important year for the Australian astronomy community as it undertakes its decadal planning process for the 2016-2025 period. This process (organized by the National Committee for Astronomy) will involve undertaking a stock take of Australian astronomy's capabilities, assessing its impact both nationally and internationally, providing a vision for the future, and determining priorities and strategies for implementing this vision. As such, Australia's national astronomy facilities (AAO and CASS) are certain to figure prominently in these discussions. From an AAO perspective, we are well placed to provide a quantitative assessment of the impact the national and international optical telescopes that the AAO operates/supports (AAT, UKST, Gemini, Magellan) have had over the last decade, particularly as a function of instrumental capability. In looking to the next decade, I think it important to consider the AAO's place within Australian astronomy from two angles: Firstly, what combinations of optical telescope/instrument capabilities, existing or new, does the AAO need to provide to allow the Australian astronomy community to achieve its scientific aspirations? Secondly, what specific roles does the AAO need to have as a national facility if it is to provide the best possible support to its research community and that maximizes its productivity in a decade where the international astronomy landscape is sure to change significantly? Let the decadal planning process commence!

# OzDES and the Dark Energy Survey

Kyler Kuehn[1], Chris Lidman[1], Filipe B. Abdalla[2], Chris D'Andrea[3], Manda Banerji[2], Elizabeth Buckley-Geer[4], Michael Childress[5,14], Tamara Davis[6], Stephen Fine[7], Karl Glazebrook[8], Stephanie Jouvel[9], Alex Kim[10], David Lagattuta[8], Huan Lin[4], Geraint Lewis[7], Paul Martini[11], Jeremy Mould[8], Bob Nichol[3], Ray Norris[12], David Parkinson[6], Eduardo Rozo[13], Eli Rykoff[13], Nick Seymour[12], Rob Sharp[5], Rollin Thomas[10], Syed Uddin[8,14], William Wester[4], Fang Yuan[5,14].

## Ordinary Matter, Dark Matter and Dark Energy

The atoms that make up the things we see every day - us, the air we breathe, the planet we stand on, the sun that warms our skin, and the 6000 stars that we can see when we look up at the night sky - play a relatively minor role in how the universe evolves. Dark matter is 10 times more significant than this ordinary matter. More significant still is dark energy.

What is dark energy? Is it the "cosmological constant" long ago described by Albert Einstein, or does it indicate that our theory of gravity is incomplete? Answering these questions is a key goal of modern physics. In this article, we will describe two new astronomical surveys that will provide the tightest constraints yet on the nature of dark energy, and how the AAT is playing an important role.

## The Dark Energy Survey and OzDES

The Dark Energy Survey (DES) has been allocated 525 nights over the next 5 years to perform two major new surveys of the southern sky: a 5,000 square degree survey around the Southern Celestial Cap, and a new transient search, consisting of 10 fields covering a total of 30 sq. degrees, focused on finding thousands of new type Ia supernovae (SNe Ia) between z=0.2 and z=1.2. The data will be taken with DECam, a new 520 megapixel imaging camera on the 4-m Blanco Telescope at the Cerro Tololo Inter-American Observatory in Chile.

Through its use of multiple probes (galaxy clusters, weak gravitational lensing, large scale structure, and type Ia supernovae), DES will provide the tightest constraints yet on the nature of dark energy. It will also be able to test alternatives to dark energy, such as modifications to Einstein's theory of general relativity.

Over the lifetime of the survey, DES will obtain ten times more SNe Ia than were obtained in the full 5-year data set of the Supernova Legacy Survey (SNLS). Spectroscopically following all these SNe Ia in real time is not practical. Instead, DES will forego the real-time follow-up of the bulk of the SNe Ia and will use a strategy that has been tested in a pilot survey that the OzDES consortium did with the 2dF fibre positioner and the AAOmega spectrograph on the AAT. The central plank of the strategy is to obtain redshifts from the SN host galaxies, from which a large sample of photometrically-classified SNe Ia can be constructed with sufficient purity and completeness for the cosmological analysis. The results of the OzDES pilot survey are described in an earlier edition of the AAO Observer [1].

The success of the pilot survey led the OzDES consortium to apply for a large amount of time with the AAT. Time was awarded for 100 nights over the next five years. Observations started with a 12 night allocation in semester 2013B. Over the next four years, the allocation will increase by 4 nights per semester and will conclude in semester 2017B with 28 nights.

While OzDES will obtain redshifts for thousands of SN host galaxies, OzDES is much more than this. OzDES will measure the growth in the mass of black holes over the past 12 billion years, and will perhaps even discover new kinds of objects. OzDES is also targeting galaxies in rich clusters, hot DA-type white dwarfs, F stars, strong gravitational lenses, radio galaxies, luminous red galaxies and emission line galaxies. The data from OzDES, either directly or indirectly, will be used in all four main probes of the dark energy survey.

## OzDES operations at the AAT

While the coordinates of most of the targets that we observe at the AAT will be known in advance, there will be, at any one time, several dozen transients within the ten DES SN fields that will be bright enough so that their characteristics can be determined directly with the AAT spectra. The coordinates of some of the transients will only be known a few hours in advance of the observations. We have therefore built a system that allows us to download the latest target catalogues and create the configuration files a few hours before each night starts. To simplify things as much as possible, we have developed the web-based tool shown in Figure 1. Each row in this figure represents one of the DES SN fields. The toggles allow the user to lock fibres on selected targets (used only when a field is re-observed during a run), to produce files that can be read by commonly used display tools such as Aladin, and to switch to the backup program if conditions are too poor for the main program. Downloading the latest target catalogue takes a few minutes, and preparing the configuration files even less, so in principle, we could start configuring a field that includes a newly discovered transient with as little as 10 minutes notice.

In addition to transients, we observe other kinds of objects. Each object belongs to a class and each class has a priority and a quota. Naturally, highest priority goes to live transients. Next are the AGN that are used for reverberation mapping, and below that are the SN host galaxies. AGN have higher priority, because the timing of those observations is critical. Strong gravitational lenses, cluster galaxies, radio galaxies, luminous red galaxies, emission line galaxies, white dwarfs, F stars, and galaxies for calibrating photometric redshifts are also part of our target pool.

1 AAO

2 University College London

3 University of Portsmouth

4 Fermi National Accelerator Laboratory

5 Australian National University

6 University of Queensland

7 University of Sydney

8 Swinburne University

9 Institut de Ciencies de l'Espai (IEEC/CSIC)

10 Lawrence Berkeley National Laboratory

11 The Ohio State University

12 CSIRO Astronomy and Space Science

13 SLAC National Accelerator Laboratory

14 ARC Centre of Excellence in All 15 Sky Astrophysics (CAASTRO)


**Fig 1:** The web based tool that we use to create the files that are used to configure 2dF.

Observing requests by groups within DES and OzDES are sent to a centralised repository. An object could be tagged for observation with one or more telescopes. Once an observation is made and the data are made available, the group that submitted the target then decides if the object can be untagged. The criteria for untagging varies from one type of object to another. For example, SN hosts are untagged if a secure redshift is obtained.

## Real-time classification of transients

One of our objectives is to classify all transients as the data are taken and reduced. There are good scientific reasons for examining the spectra of all transients as soon as they have been observed. Foremost among these is the chance to discover news types of objects, which are also probably going to be quite rare. While hard to predict if this would ever happen during the lifetime of the OzDES follow-up, there are examples where this has occurred. Perhaps the most notable recent example was the discovery of super-luminous supernovae, such as SCP06F6 [1]. The discovery of SCP06F6 and its subsequent identification [2] led other groups to search their own data and to discover more of these enigmatic objects.

Another objective is to estimate redshifts for all sources and ingest the results into our database within 36 hours of the data being taken, so that objects are observed only as long as needed. This frees up fibres to observe other targets if a field is targeted multiple times during a run.

Currently, we need a small army to achieve these objectives. Usually, three to four of us are on site at the telescope, while two to three others are offsite determining redshifts. Staffing observing runs with up to seven people for 100 nights of observing represents a significant fraction of the resources available to OzDES, so we are developing ways to increase our efficiency and reduce the number of people needed for a run and to reduce the amount of time we take to process the data, obtain redshifts, classify transients and announce the results.

Significant resources go into computing redshifts. Each field is examined by two people, while a third, the "chief redshift whip," merges the results. Given the generally low signal-to-noise ratio of the spectra, and the wide class of objects we observe (AGN, SNe, galaxies of all types and some stars), it will be a challenge to do compute the redshifts automatically. Progress here will depend on getting better quality reductions from the 2dF data reduction pipeline.

## OzDES science - the progress so far

Our first 12 nights have yielded 4,263 redshifts from the spectra of 6,875 unique objects. Objects with redshifts include live SNe, SN host galaxies, active galactic nuclei, radio galaxies, and much more.

Due to lack of space, we cannot describe all the science that OzDES is working on. Instead, we have chosen to highlight three areas.

### 1. Supernova Science

Dark Energy was originally discovered through observations of distant SNe Ia [4,5]. They continue to be the best standard candles for measuring distances on cosmological scales, with over 500 spectroscopically-confirmed SNe Ia contributing to recent Dark Energy constraints [6].

Wide-field SN searches are now surveying such large volumes that the number of photometrically-identified SN candidates far exceeds the capacity of spectroscopic classification resources. Many of the photometrically discovered SNe Ia have light curves which can be included on the Hubble Diagram [7] to derive tighter constraints on cosmological parameters. This is made possible by a new generation of robust photometric SN classification techniques [8] These techniques provide excellent estimation of SN Ia photometric properties when constrained by the redshift of the SN Ia host galaxy [9].

AAOmega+2dF on the AAT is the ideal instrument for efficiently gathering redshifts of SN Ia host galaxies [10]. This is especially true for the DES SN fields, as DECam and 2dF have a remarkably well-matched field of view [1]. With OzDES we expect to secure redshifts for more than two-thirds of the estimated 4000 SNe Ia expected to be discovered by DES. OzDES will also provide a large sample of spectroscopically confirmed SNe Ia at various phases and redshifts, as well as classification of other SN types (see Figure 2).

In our first season of observing, OzDES has secured redshifts for nearly 900 SN host galaxies, with the expectation that about 200 of these will be cosmologically useful SNe Ia. With 12% of the allocated time used, we are well on track to obtain over 2000 SN Ia host redshifts.

## 2. Active Galactic Nuclei

We aim to regularly monitor AGN as part of OzDES in order to measure the masses of their central, supermassive black holes. The 25 spectroscopic observation epochs from AAOmega, combined with over a hundred photometric epochs from DES, are well suited to accomplish this with the technique of reverberation mapping. This method measures black hole masses through the application of the virial theorem, and the key measurements are the velocity dispersion of the AGN's broad-line region (BLR) and the distance of the BLR from the central black hole. The intensity of the broad emission lines are determined by the intensity of the central continuum source, and as AGN vary in luminosity, the intensity of the broad lines vary in response. Reverberation mapping measures the time lag between variations in continuum and broad line intensity, and thus the light travel time from the central source to the BLR. This time lag ranges from a few light days up to a light year or more for the most luminous AGN, and thus the 5-year DES+OzDES program is well suited to measure even quite luminous AGN.

To date the reverberation mapping technique has been used to measure black hole masses in approximately 50 AGN, nearly all of which are of low luminosity and at low redshift ($z<0.3$). With OzDES, our goal is to measure black hole masses for 500 AGN, and specifically target the luminous AGN at $z>1$ that represent the bulk of black hole mass assembly in the universe. Reverberation mapping is the only technique that can determine black hole masses outside of the nearby universe, as it relies on the time domain, rather than spatial resolution. With these measurements we plan to better calibrate black hole mass scaling relations that will be used to track the evolution of supermassive black hole growth throughout cosmic history. We will also use these scaling relationships to determine distances to individual AGN, and thus use them as a completely independent form of standard candle to probe cosmological parameters.

From the first 12 nights, we have obtained the redshifts for two thousand AGN and have already observed a few hundred of them multiple times.

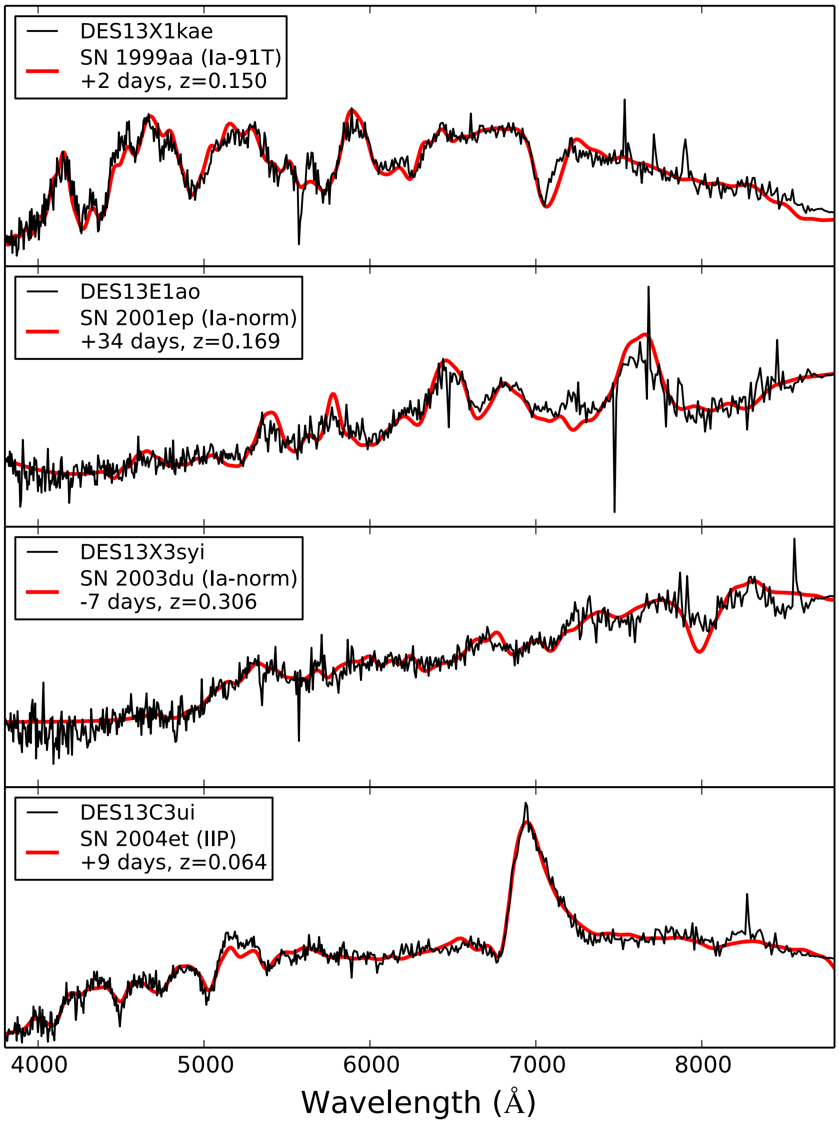


**Fig 2:** Sample spectra of supernova that have been confirmed by OzDES using the AAT. The extracted spectrum is shown in black. The best match is plotted in red. With the improvements to the instrument and in the processing of the data that are expected to occur over the next year, we should be able to spectrscopically confirm Type Ia supernovae up to z~0.5.

### 3) Radio sources from the ATLAS survey

Five of the OzDES fields overlap significantly with the ATLAS 21 cm continuum survey undertaken with Compact Array in Narrabri [11,12]. ATLAS has been undertaking spectroscopic classification of these sources with AAOmega in recent years [13], but adverse weather conditions and incomplete optical photometry have hampered progress. OzDES provides an ideal opportunity to fill in the missing gaps and push identification for star-forming galaxies (the dominant source type at lower radio luminosity) to sensitive limits via optimal stacking of spectra over multiple OzDES visits. Individual targets will have repeat observations until the stacked spectra yield a redshift (or until a predetermined observational limit is reached). To date, OzDES has obtained over 400 new redshifts. These observations will not only allow the completion of our work assessing the evolution of the low luminosity radio-AGN population, but when combined with other DES redshift surveys in these regions, they will provide a powerful statistical sample for clustering analysis, allowing detailed investigation of the role of radio feedback on large-scale structure formation. Our OzDES observations will also provide an invaluable training for the statistical redshift determination which will form an integral part of the EMU survey with the ASKAP facility [14].

### Concluding Remarks

The Dark Energy Survey recently began its first season of operation, and will continue for four more observing seasons. Over that same timeframe, the OzDES consortium will continue to obtain spectra of a wide variety of objects within the 10 DES SN fields. With only a small portion of the nights allocated to OzDES completed, we already have obtained over 4000 redshifts, including the redshifts of 400 radio galaxies and 900 supernova hosts galaxies, and have built a sample of 2000 spectroscopically confirmed AGN. We look forward to reporting the first results of the OzDES survey in future editions of the AAO Observer.

Acknowledgments: TMD and CL acknowledges the support of the Australian Research Council through their Future Fellowship awards, FT100100595 and FT0992259, respectively. Parts of this research were conducted by the Australian Research Council Centre of Excellence for All-sky Astrophysics (CAASTRO), through project number CE110001020.

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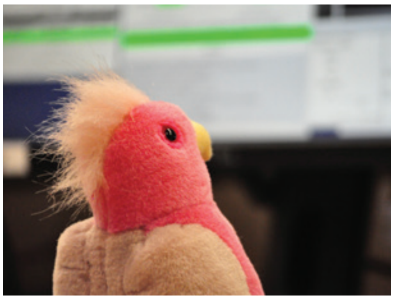
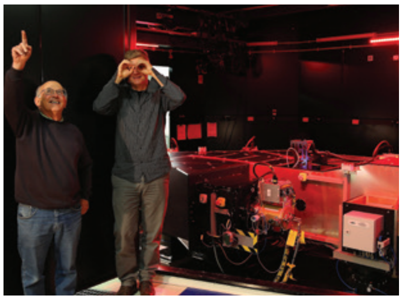
# HERMES Commissioning - as it happened

Keith Shortridge

Those readers who have been following the development of HERMES in the AAO Observer may remember that at the end of last issue's exciting episode, HERMES has been dismantled after testing in Epping and shipped to a fire-ravaged Siding Spring mountain. There it sits, in its component pieces, at the AAT. The astigmatic green and red gratings appear to have been rectified and are awaiting testing in Epping. Can the intrepid AAO commissioning team reassemble HERMES, align the optics, and get the instrument working in the frighteningly short time remaining before commissioning on the telescope? Now read on...





Near the end of May 2013 a complex project plan is issued, revealing 155 separate tasks to be completed by the first commissioning night on the telescope in mid-October. The first is to move the final instrumentation team members over to the new North Ryde office now that HERMES is no longer being tested in Epping. Goodbye to drinking tea under the trees.

Over the months between June and the second HERMES commissioning run in November, a significant subset of the AAO Instrumentation Group make the 900 km round trip between North Ryde and the Warrumbungles. Engineers optical, mechanical, electronic, and software take a mixture of AAO fleet cars, hire cars, and the occasional flight, in a continuous progression to and from the mountain. The AAO 'who's where' web page (not always completely reliable) shows sixteen assorted instrumentalists making about fifty three separate visits totalling about three hundred and twenty eight days away, staying in either Coonabarabran motels or the stopgap "dongas" (think mining camp accommodation) that temporarily take on the role of the much-missed ANU lodge. And of course, they are working with the AAO mountain staff, closely involved with HERMES from its inception, who have carried out the extraordinary task of rebuilding the fibre cables to support both AAOmega and HERMES, who have been getting its new home on the AAT 4th floor ready, and are waiting with some trepidation to see just how well it will work in practice, and how much of a pain (or, just possibly, pleasure) it will be to maintain and operate.

And the cars on the road, the Sydney-based engineers going back and forth, the site technical staff getting to grips with the new beast, all these are just the tip of an AAO (and ANU) mountain of effort; travel organisers making all those bookings, ANU staff managing to provide meals and accommodation with facilities that are still just rising from the ashes, administrative personnel handling the paperwork, IT support keeping the computers and the networks running, managers managing, data reduction programmers itching for some real data to test their code. And project management valiantly tracking progress and trying to control the inevitable conflict between plans and reality.

Slowly, surely, over June and July, the optical and mechanical teams painstakingly re-assemble HERMES in its new home, under the constant eye of the time-delay cameras that watch the whole process, all carried out in clean conditions by people in blue coats with hair-nets and shoe covers - and the occasional beard cover. The room at site has been prepared as planned, painted an uninspiring but practical black, and air-conditioned to provide the required stable thermal conditions. The electronics team install the control electronics, and by August the blue channel is more or less aligned, the blue cryostat is cooled, and the software team are able to try to move the mechanisms and look at some initial data. The red and green gratings are still on their way back from rectification, but are expected soon. The InfraRed grating is also on its way.

The mountain's recovery from the January 2013 bush fires is obvious, but not complete. A prime example is the sleeping quarters at SSO. August is the coldest month, and while the newly installed dongas have reverse cycle air-conditioners to provide heating, these are very noisy. One can be quiet at night, or warm. Pick one. The chemist in Coona sells earplugs, so air-conditioner plus earplugs is a possible option. The ANU facilities people are there to talk to, and a white board starts to get filled with suggestions and requests: "fully stocked beer fridge, please" seems to hit some administrative hurdle, but quieter heaters are promised. Finally, when the HERMES focus motors work and a reasonable looking blue spectrum is acquired, things start to look hopeful.

But reality provides its own surprises, and a potential problem is found when a preliminary test on the 'rectified' red and green gratings seems to suggest that the dreaded astigmatism might still be present. Meetings go over lettered plans starting at 'B' and continue down the alphabet, getting progressively more expensive, and - even worse - delaying things more. The decision is made to install the gratings at site anyway and see how they perform in the actual instrument. Morale may dip slightly, but the show must go on.

Homing in on the focus, it slowly dawns on a delighted team that they really are seeing round images!

By mid-September, the green and red channels are complete, aligned, and ready for testing. If the gratings are astigmatic, focus will not be achieved in the spatial and spectral directions simultaneously and the image will look elongated instead of round. The optics group got the correction right, and these gratings are no longer astigmatic. Morale soars - and the column heaters have arrived for the dongas, so all's well with the world. The project scientist visits ANU to show off the successful images and hand out "Team HERMES" T-shirts.

With only a month to the first commissioning run, the team must get the IR channel up and running. After much hard work, an e-mail goes out to the team one day before the first commissioning night: "we are now running all 4 CCDs simultaneously." The call is close, but the team made it! Yet success is not just getting an instrument working, it is getting it working while pointed at the night sky and taking scientific data. No one wants to waste a moment that could be spent pointing at the sky.

Finally it is the first night of on-sky commissioning for the new HERMES instrument and excitement mounts as the astronomers arrive on the mountain. HERMES has a project scientist and two project astronomers, its driving forces, and all three are either on the mountain or on their way. One project astronomer sets a deadline for the taking of the first twilight flats; a deadline unfortunately missed as the team struggles to achieve an acceptable focus. Despite his palpable disappointment (a new instrument behind schedule!?), most of the team are elated to be on the sky at last. Focussing continues. The other project astronomer, unable to be there for those first twilight minutes, arrives exuding infectious enthusiasm and with a collection of decent Australian reds. And just in time. **First Light**, the first observations of real stellar spectra (47 Tuc), is announced at 10:13 that evening. HERMES is clearly working and working well! Those of the team following progress at home in Sydney, constantly checking their e-mail, sit back in relief.

The night ends with a photograph of most of the team in the control room holding glasses of something that appears to be sparkling almost as much as their collected grins. The next day the AAO director sends out a beaming e-mail announcing a successful first night's commissioning for HERMES, and the congratulatory replies start to arrive.

But does HERMES meet its design specifications? Interest centres on the throughput of the instrument since the arcs already show acceptable focus is being achieved. The project astronomer's calculations look a bit disappointing at first, but early issues surrounding which star is which start to get resolved, and eventually it becomes clear that the stars being measured are much fainter than originally believed. That means HERMES is doing much better than thought, and final calculations show it slightly better than the specifications. AAO's head of instrumentation, who has been holding his breath since that first night - except for the sparkling drink, of course - finally breathes properly again. At a meeting in North Ryde, one of the Galah team says: "**HERMES is performing to spec, except where it's doing better!**"

Only a couple of weeks separate the first and second commissioning runs and, of course, the first run has revealed a large list of things to fix. The mechanical and optical teams painstakingly and completely rework the alignment of the spectrograph and install the thermal insulation for the electronics in the HERMES room.

The second commissioning run starts with less trepidation, as the instrument is known to work, but it needs to be readied for the first actual science observing, scheduled to start the very night after the second commissioning run ends. The control room is now home to a number of stuffed Galahs, mascots of the new survey. A new fire over towards Coonabarabran is taken seriously, but peters out in the end, thankfully. Attention is now starting to focus on the processing of the data through 2dFdr and the Theremin pipeline, and refining the arc line fitting and identification - a reminder of the huge number of people away from the telescope who have a stake in HERMES. One night is clouded out, but 30 seconds during the day produces an impressive solar spectrum, which runs through Theremin and emerges with analysed parameters matching those from UVES on the VLT: another good sign.

As this is being written the third commissioning run is under way. Support is now being provided almost entirely by site staff. Apparent problems with high proper motion stars get the GALAHs all a-flutter at their keyboards, but in the end this seems to be an issue with catalogues, not with HERMES or 2dF. The scientific process at work.

HERMES is now taking scientific data and the GALAH survey has taken its initial steps, but completing an instrument is a big job with a long tail. The high-resolution mask has been reworked for the third commissioning run and is now being tested. The back illumination system for the fibres still needs some work, and of course, keeping the vital 2dF positioner operating efficiently is an ongoing job.

Project plans exist in a wonderland where nothing disturbs the march of success from predecessor task to current task to successor task, and where every task takes the minimum estimated time only. But sometimes, sometimes, we can make that wonderland a reality. In the case of HERMES, a large team of highly competent people worked and planned and organised and managed and built and tested and fixed and tested again very hard for a long time. We brought HERMES to the telescope, operating as planned and on time for its scheduled commissioning.

(The nominal HERMES team is listed on the AAO web site. However, the full list of those who made HERMES a success is far larger, and includes the whole of the AAO staff over the last few years and numerous others from other organisations. Well done, one and all.)

# CYCLOPS2 Catches an Exoplanet in a Polar Orbit

Daniel Bayliss (ANU), Brett Addison (UNSW), Duncan Wright (UNSW), Chris Tinney (UNSW) and George Zhou (ANU).

The planets in our Solar System all orbit the Sun in a relatively orderly way. Their orbits are co-planar to within seven degrees, and all the planets orbit in the same direction as the Sun's rotation - i.e. the planets are all on "prograde" orbits. In recent years, we have learned that this orderly planetary architecture is not universal.

A number of transiting exoplanets have been found to be orbiting their host star in the opposite direction to the stellar spin - i.e. they are in "retrograde" orbits (e.g. see Bayliss et al., 2010). Such orbits are inconsistent with the idea that these planets formed from a disk of dust and gas around the star and then migrated inwards towards the star via planet-disk interactions. Instead, something more dramatic must have occurred in the lifetime of these planets, such as close encounters with other planets or gravitational interactions from a distant stellar companion. By studying the alignment between a planet's orbital axis and its host star's spin axis, we can learn something about the formation and migration history of the planet.

To determine the alignment between a planet's orbital axis and its host star's spin we must take spectra of an exoplanet host star during a transit event, and measure the radial velocity anomaly known as the "Rossiter-McLaughlin" effect. The Rossiter-McLaughlin effect is so named after the work of Rossiter and McLaughlin, who both published work in 1924 explaining that eclipsing binary stars will show anomalies in their apparent radial velocities during eclipses (Rossiter, 1924; McLaughlin, 1924).

The surface of a rotating star presents a range of radial motion to the observer, as some parts of the star rotate away from the observer and some parts rotate towards the observer. Regardless of the viewing angle, these effects are symmetric, resulting in a broadening of the spectral lines but no overall shift in the line centres. However, if another body eclipses or transits the star, that symmetry is broken and the absorption lines from the star will now appear asymmetric, resulting in a measured redshift or blueshift depending on which part of the rotating star is obscured. In the case of eclipsing binary stars the amplitude of this effect can be on the order of km/s and is easy to measure, while in the case of an exoplanet transiting its host star the amplitude is typically much lower and is more difficult to measure - on the order of 1-100m/s. However, such variations can be detected by high precision radial velocity instruments such as CYCLOPS2.

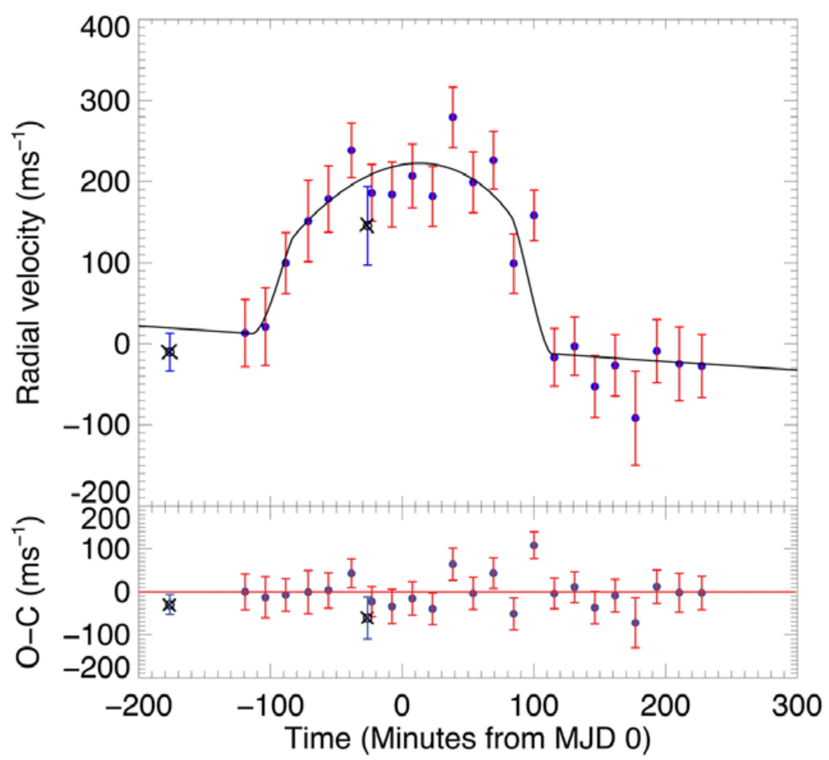



**Figure 1:** Spectroscopic radial velocities of the WASP-79b transit. Velocity are plotted as a function of time along with the best-fitting model and corresponding residuals. The filled blue circles with red error bars are velocities we measured using CYCLOPS2 on the AAT. The two black circles with an "X" and with blue error bars are previously published velocities by Smalley et al. (2012) using their quoted uncertainties. Plot from Addison et al., 2013.

CYCLOPS2 is a fibre-feed system to the UCLES spectrograph on the AAT. The CYCLOPS concept is to use a fibre bundle of 2.5 arc-seconds to collect all the star light under typical Siding Spring seeing conditions (1.5"), and remap it to a pseudo-slit where it is fed into the UCLES spectrograph. CYCLOPS2 was detailed in a previous issue of the AAO Observer (No. 123, page 20). The primary advantage of CYCLOPS2 is that light is not "wasted" on the slit of the spectrograph - particularly important if the FWHM of the seeing is significantly larger than the spectrograph slit. The fibre feed also allows for the light fed into the spectrograph to be scrambled such that the slit is evenly illuminated and radial velocity measurements are not affected by a varying spectrograph Point Spread Function.

CYCLOPS2 has 17 hexagonal fibres, 16 of which are for the target object and one of which is for simultaneous wavelength calibration. This allows simultaneous ThXe arc-lamp observations to be taken to measure small shifts in the spectrograph over time which would otherwise significantly decrease the precision of the radial velocity measurements that could be produced. The fibre bundle is remapped onto a pseudo-slit that is 0.63 arc-seconds wide, allowing for a resolution of R=70000.

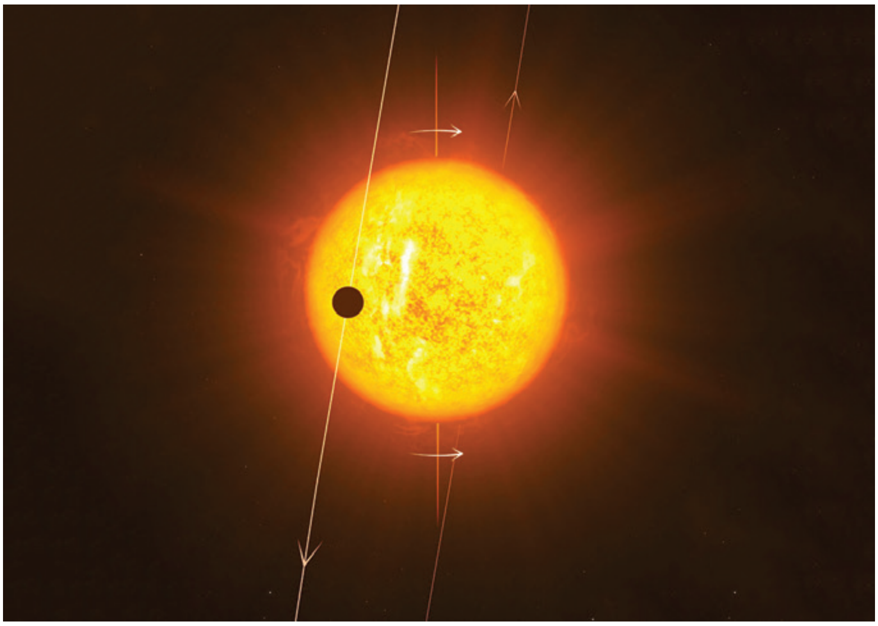


**Figure 2:** A planet in a polar orbit during a transit event. This illustration shows the direction of stellar rotation in relation to the orbit of the planet. The planet can be seen transiting across the portion of the stellar disk that is rotating towards us, hence blocking more of the blue-shifted light and causing a positive radial velocity anomaly as shown in Figure 1.

**Image credit:** Brett Addison (modified version of a retrograde orbit impression by ESO/L. Calçada). http://www.eso.org/public/images/eso1016a Creative commons license

We used CYCLOPS2 on the AAT to measure the spin-orbit alignment of the transiting exoplanet WASP-79b (Smalley et al., 2013). This planet was discovered in 2012, and is a favourable target for observing a large amplitude Rossiter-McLaughlin effect due to the fact that the star is rotating relatively rapidly (vsini=18km/s) and the planetary radius is large ($R_p$=1.7$R_J$). On 23 December 2012, the planet transited its host star, and we were able to monitor the entire event from Siding Spring Observatory under very good observing conditions. We took a total of 23 spectra, each one with an exposure time of 800s. Of these spectra, 14 were "in-transit", meaning the exoplanet was blocking a portion of the stellar disk and therefore producing a Rossiter McLaughlin anomaly on the measured radial velocities.

The velocities obtained over the course of the transit are shown in Figure 1. The anomaly shows a "hump" over the course of the transit, which is indicative of an exoplanet in a polar orbit - i.e. the spin axis of the star being at 90 degrees to the exoplanet's orbital plane (see Figure 2). This surprising result is, to date, the most clear-cut case of an exoplanet being in a polar orbit. Once again we had found a system which points to a non-standard formation and migration history, which may very well have included close encounters with other planets or gravitational interactions from a distant stellar companion.

These results were published in a recent letter to the Astrophysical Journal (Addison et al., 2013).

CYCLOPS on the AAT was also used by our team to confirm and measure the masses of three new transiting exoplanets from the HATSouth project, which were all published in 2013. These were HATS-1b (Penev et al., 2013), HATS-2b (Mohler-Fisher et al., 2013), and HATS-3b (Bayliss et al., 2013).

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# KOALA: a new 1000 element integral field unit for the AAT

Simon Ellis (AAO), on behalf of the KOALA team

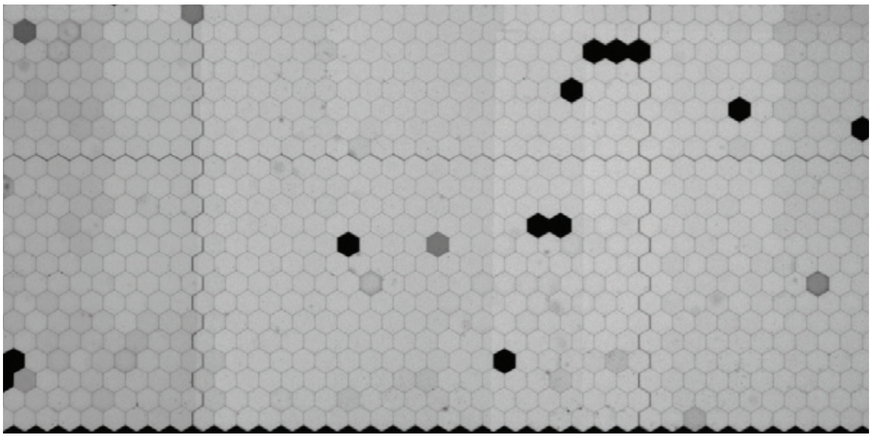

**Figure 1:** The KOALA microlens array, under back-illumination.

KOALA is a new 1000 element integral field unit for the AAT, which was successfully commissioned during October 2013. The goals of KOALA are to replace the current SPIRAL IFU, to provide an optimised feed for AAOmega, at the same time increasing both the field-of-view and the throughput. All these goals have been achieved.

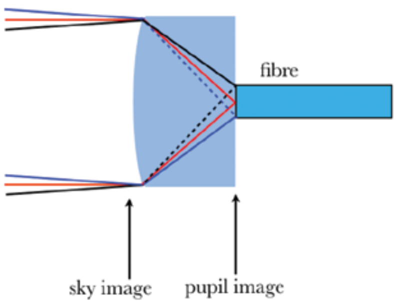


**Figure 2:** Schematic diagram of a single microlens feeding a fibre. The marginal rays shown by dashed lines have a greater angle of incidence than the chief rays shown in red. This is equivalent to feeding the fibre at a faster focal ratio and is known as geometric FRD.

KOALA has 1000 elements arranged in a 40 x 25 hexagonally packed rectangular array, see Figure 1. The spatial sampling can be set to either 0.7 arcsec per microlens or 1.25 arcsec per microlens providing a field of view of 15.3 x 28.3 arcsec or 27.4 x 50.6 arcsec respectively.

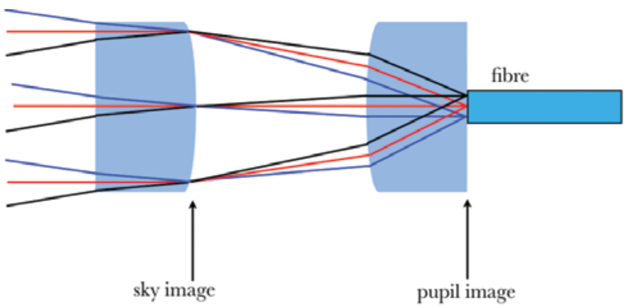


**Figure 3:** A double microlens array can provide a telecentric fibre feed with no cross-talk between lenses and no geometric FRD.

The instrument is comprised of four parts: the fore-optics, the microlens array, the fibre bundle and the slit. The fore-optics accept light from the f/8 Cassegrain focus of the AAT and magnify it onto the microlens array, to provide the correct spatial sampling. There are two sets of fore-optics, one for each plate-scale. These are interchangeable remotely using the KOALA software GUI. The fore-optics are mounted to the CURE interface, enabling illumination from the flat-field and arc lamps with an f/8 beam. A fold-mirror in front of the fore-optics allows illumination of the CURE A&G camera. It is also possible to acquire using the TV direct viewing APOGEE camera, and to guide using the offset guide-probes.

The microlens array uses a novel double lens system. The purpose of the microlens array is to segment the focal plane, and provide a pupil image on the front face of the fibre. Such pupil-imaging systems have two advantages over a bare fibre array. First, a microlens array has close to 100% filling-factor, whereas a fibre array has a limited filling factor due to the fibre cladding and packing. Secondly the coupling into the fibre is more efficient because both the pupil image size and the focal ratio can be matched to those required for efficient coupling into the fibre.

Traditionally, pupil imaging IFUs have used a single lens on the front of the fibre, but this leads to a problem known a geometrical FRD, illustrated in Figure 2. The off-axis light has a larger angle of incidence on the front-face of the fibre, which is equivalent to feeding the fibre at a faster focal ratio. In principle, this can be minimised by using lenses that are significantly larger than the fibre diameter, but such an approach is difficult to manufacture with any guarantee of success for a large number of lenslets, and would be expensive.

KOALA avoids this problem with a novel design using a double microlens system, illustrated in Figure 3. In this design the sky image is formed on the back face of the first lens, and hence the sky image is properly sampled with no cross-talk problems. Furthermore the fibre feed can be made telecentric with correct choice of focal lengths and separation between the two arrays, and thus there is no geometric FRD. The telecentric feed also avoids pupil image shift, and associated FRD due

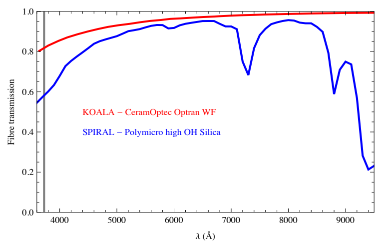


**Figure 4:** Comparison of the fibre throughput between KOALA (red) and SPIRAL (blue). The KOALA fibres have better throughput, but markedly so at λ < 4000 Å.

to the non-telecentric input angle of the beam onto the fibre, both of which can be problematic if there is significant non-telecentricity across the telescope focal plane, although we note that these should be insignificant at the f/8 Cassegrain focus used by KOALA (Wynne, 1989).

The first microlens array consists of hexagonal lenses with a width of 250 mu in a hexagonal packing arrangement to ensure high fill-factor (Figure 1). The second array has identical pitch and arrangement to the first array, but the lenses can be circular since the beam on the front face of the array is circular in cross-section.

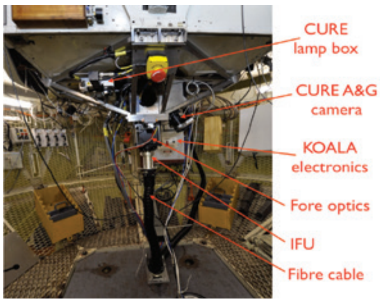


**Figure 5:** KOALA installed at the Cassegrain focus of the AAT.

The fibre run is responsible for a large part of the improved sensitivity of KOALA, especially at blue wavelengths, see Figure 4. The fibre run is 31 m in length and runs from the Cass. cage, down through the telescope horse-shoe structure to the coudé M5 mirror area, and thence into a splice-box mounted on the outside wall of the AAOmega room.

From the splice-box, the fibre run goes into the AAOmega room, and terminates at the slit. The slit contains 40 slitlets each having 25 fibres. The slit is very similar to that of AAOmega, but contains more than twice the number of fibres, which are therefore very closely packed.

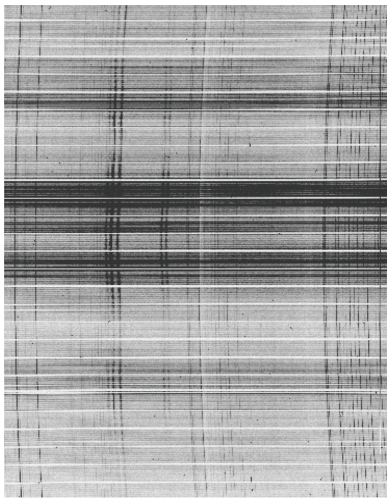

**Figure 6:** Raw KOALA data from a 600s exposure of the central region of NGC 1365 showing Hα, N[II] and S[II] lines.

The commissioning run was very successful, in a large part due to the careful preparation that took place at the North Ryde laboratories prior to shipping the instrument to the telescope. Laboratory tests made at this time measured a throughput of 85% at λ = 6350 Å (excluding AAOmega and the telescope) for KOALA. The installation, alignment and focus of the instrument all went very smoothly, with only minor adjustments having to be made at the telescope. Figure 5 shows an image of KOALA installed in the Cassegrain cage.

We observed a wide-range of science verification targets, using both the wide and narrow fields of view, and using AAOmega in various configurations. The targets observed represent a good sample of the KOALA science case, including merging galaxies, brightest cluster galaxies, AGN, galaxy winds, planetary nebulae, and globular clusters. Modifications to the 2dfdr software are currently being made, to automate the reduction of these data.

An example raw science frame showing the central part of NGC 1365 around the wavelength of Hα is shown in Figure 6. The quick-look image of the same galaxy is shown in Figure 7. This was made using the on-the-fly reconstruction tool written by Michael Ireland, which enables observers to check their data as they arrive. An extracted image showing the bright Hα emission from the AGN, and also knots of star-formation along the bar is shown in Figure 8.

There will be a final commissioning night in February 2014 to check that updates to the CURE lamp box and electronics are correctly working, with the first science nights scheduled immediately after.

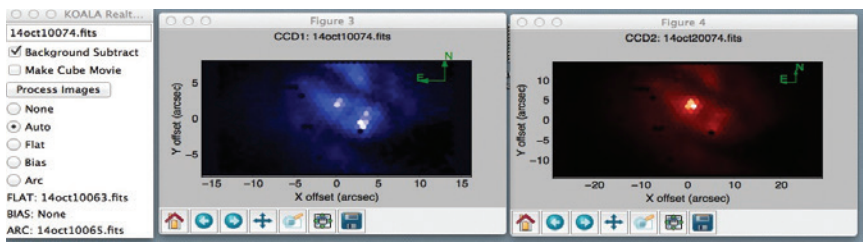


**Figure 7:** The real-time display showing blue and red quick-look images of the core of NGC 1365.

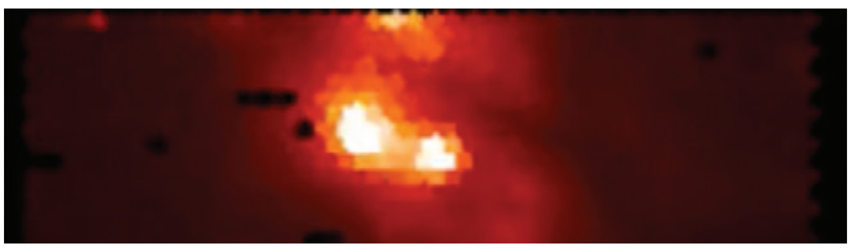

**Figure 8:** Extracted image of the central region of NGC 1365 around the wavelength of Hα showing the AGN and knots of star-formation..

# Resolving the role of environment in galaxy evolution with SPIRAL

S Brough (AAO), S. Croom (University of Sydney), R. Sharp (Australia National University), A. Hopkins (AAO) and GAMA team.

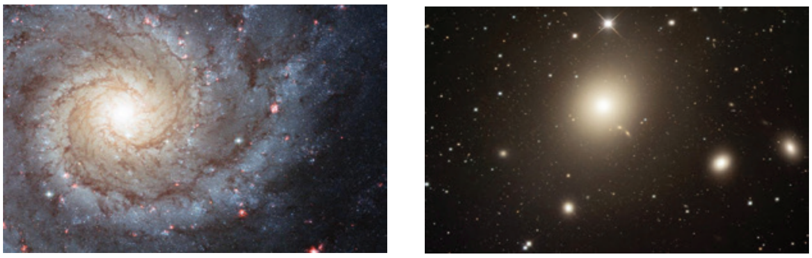

**Figure 1:** Typical 'blue' and 'red' galaxies M74 (blue; left) and M87 (red; right). Image credits: NASA.

We observe many different types of galaxies around us today. Astronomers frequently lump those galaxies into two different boxes: blue galaxies, like our Milky Way, which have 'spiral' morphologies and are still forming stars, and red galaxies which have 'elliptical' morphologies and are red because they are no longer forming stars (Figure 1). When we observe thousands of galaxies, we find that the blue, spiral galaxies are generally less massive and are found in less dense environments (with very few galaxies nearby). In contrast, the red, elliptical galaxies are generally more massive and are found in more dense environments (i.e. closely surrounded by many tens or hundreds of galaxies). We know that the red galaxies have stopped forming stars, but we do not yet know whether this is a result of their higher mass or whether their surrounding environment has slowed and then stopped their star formation.

Observations by, amongst others, the Galaxy And Mass Assembly (GAMA; Driver et al. 2011; Hopkins et al. 2013) survey on the Anglo-Australian Telescope, find that the fraction of blue and red galaxies changes with environment (Wijesinghe et al. 2013).

There are a larger number of blue galaxies and fewer red galaxies in less dense environments and vice versa in high-density environments. However, the amount of star formation in those blue galaxies does not differ with environment, which you would expect to see if environment were slowing or stopping the star formation. However, these previous analyses have generally used single-fibre spectroscopy, which, while providing information on lots of galaxies at once, only samples those galaxies as a single point.

Integral field spectroscopy provides information across galaxies, meaning that it is possible to examine the central as well as the outer regions of galaxies where we might expect to see environment having more of an effect.

We wanted to find out whether the star formation across galaxies is changing as a function of environment. We selected 18 galaxies from the Galaxy And Mass Assembly (GAMA) survey and observed them with the SPIRAL integral field unit (IFU) on the Anglo-Australian Telescope. The galaxies were selected to have a narrow range in mass ($M^*=10^{10}$Msun) in order to focus on the effects of environment.

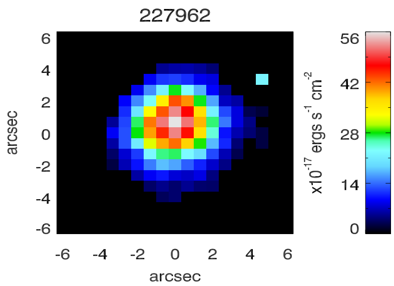


**Figure 2:** SPIRAL image of Hα emission for GAMA galaxy 227962 which is in a low-density environment.

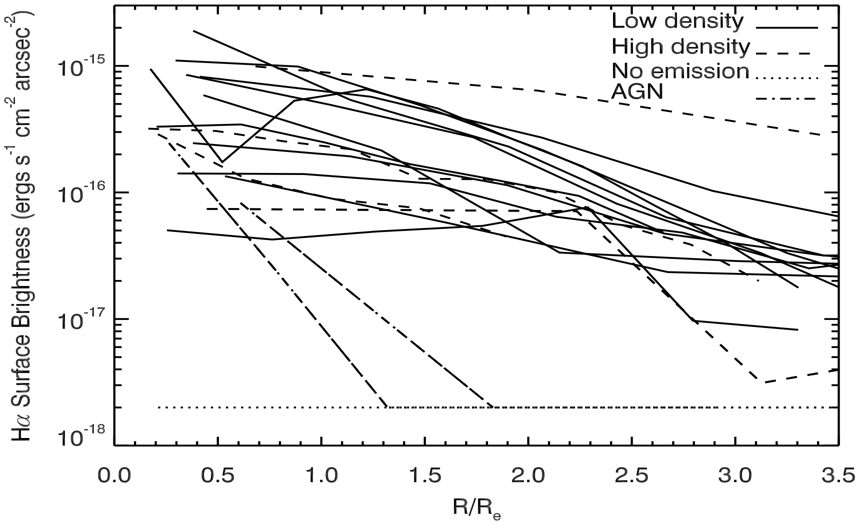


**Figure 3:** Hα surface brightness profiles as a function of the scaled radius of the galaxy. Solid lines show galaxies in low-density environments (surface density $\Sigma_5$<0.77 Mpc$^{-2}$) and dashed lines show galaxies in high-density environments (surface density $\Sigma_5$>0.77 Mpc$^{-2}$), dotted lines indicate regions that do not show emission above the detection limit and dot-dashed lines indicate the emission of the two Active Galactic Nuclei (AGN). The profiles do not show a dependence on environment.

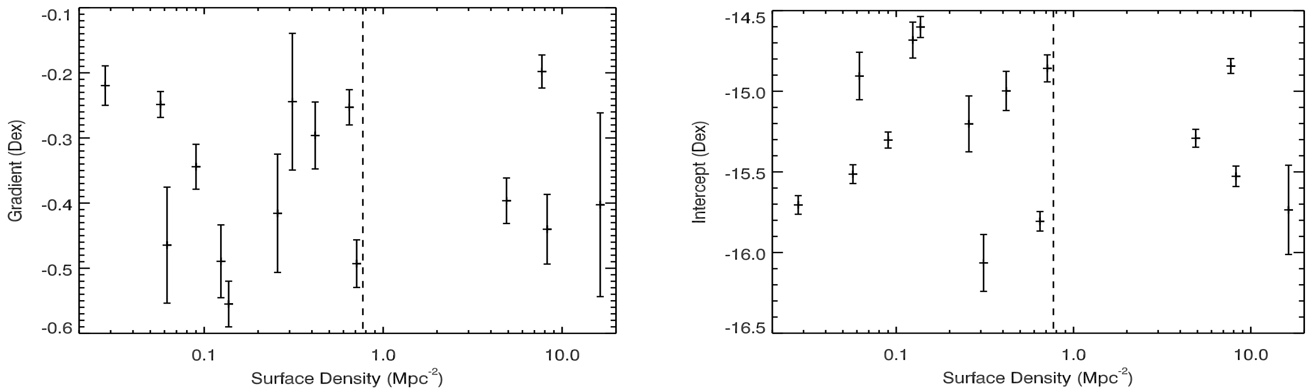


**Figure 4:** Parameters of straight-line fits to Hα surface brightness profiles of the star-forming galaxies as a function of environmental surface density. The eft panel shows the gradient of the fits, the right panel the intercept of the fits. The error bars show the 1σ uncertainties on the line fits. The fits to the surface brightness profiles do not show a dependence on environment.

We use their Hydrogen alpha (Hα) line emission to trace their star formation (Figure 2). This work is published in Brough et al. (2013).

With our observations we checked the aperture correction used to calculate total star formation rates from single fibre observations. We found that the IFU data are consistent with corrected single fibre data for both GAMA and Sloan Digital Sky Survey single-fibre observations.

We found some of the galaxies to have clumpy and off-centre star formation, but that this is not dependent on environment.

Examining the spatial distribution of the star formation, we examined the Hα surface brightness profiles of all observed galaxies, including two AGN and one galaxy with no significant emission (Figure 3). We fitted straight lines to the profiles of the remaining star-forming galaxies and compared the gradient and the amplitude of those fits to the environmental density, finding no relationship (Figure 4).
The spatial distribution of star formation does not depend on environment.
This would infer that any environment-driven star-formation suppression must either act very rapidly (the `infall-and-quench' model) or that galaxies must evolve in a density-dependent manner (an `in-situ evolution' model).

In order to identify more precisely how and when any transition due to environment occurs requires high signal-to-noise, integral-field observations as well as a very large sample that covers a range in stellar mass, environment and star formation stage. The new Sydney Australian Astronomical Observatory (AAO) Multi-object-IFU (SAMI; Croom et al. 2012) instrument will address this with its associated galaxy survey.

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# The Shocking Details: X-Rays, Colliding Galaxies and General Disarray.

Iraklis Konstantopoulos, John Stocker Research Fellow, Australian Astronomical Observatory

New stars form all the time, some times in the unlikeliest places. Collisions between galaxies usually produce spectacular vistas once part of their precious gaseous reservoir, their star-making bank, is shed into intergalactic space and condenses into large clouds of star formation. Some collisions, however, bring about a very different physical process: by driving strong shockwaves through this intergalactic material, they can heat it up to extreme temperatures. Not unlike iron plunged into the blacksmith's firepit and coming out white hot, this matter absorbs so much energy that the radiation it exudes escapes the visible spectrum: it begins to shine in X-rays... pretty much as hot as normal matter can ever be.

From this situation a puzzle arises: since we know that clouds of gas need to be very cool to condense into stars, how does this heating affect the star formation process? In other words, if X-ray shocks and star formation are like rubber and glue, why do we often see both in the same astrophysical playground?

Enter Stephan's Quintet, a group of five galaxies (plus a sixth galaxy photobombing the scene 300 million light years in the foreground) is undergoing a very spectacular event. Having witnessed a multitude of fly-bys between its unruly galaxies over the past 500-or-so million years (astronomers call this 'the recent past'), it has developed a strong intra-group medium, that is, the galaxies have shed a lot of their gas into the space between them. When an intruder (labelled as n7318B in Figure 1, bottom) came crashing not into one of the galaxies, but into this intergalactic junk, the result produced some sensational fireworks, along with some remarkable physics. It sent shockwaves sweeping across the medium, but also appears to have produced a fair bit of star formation.

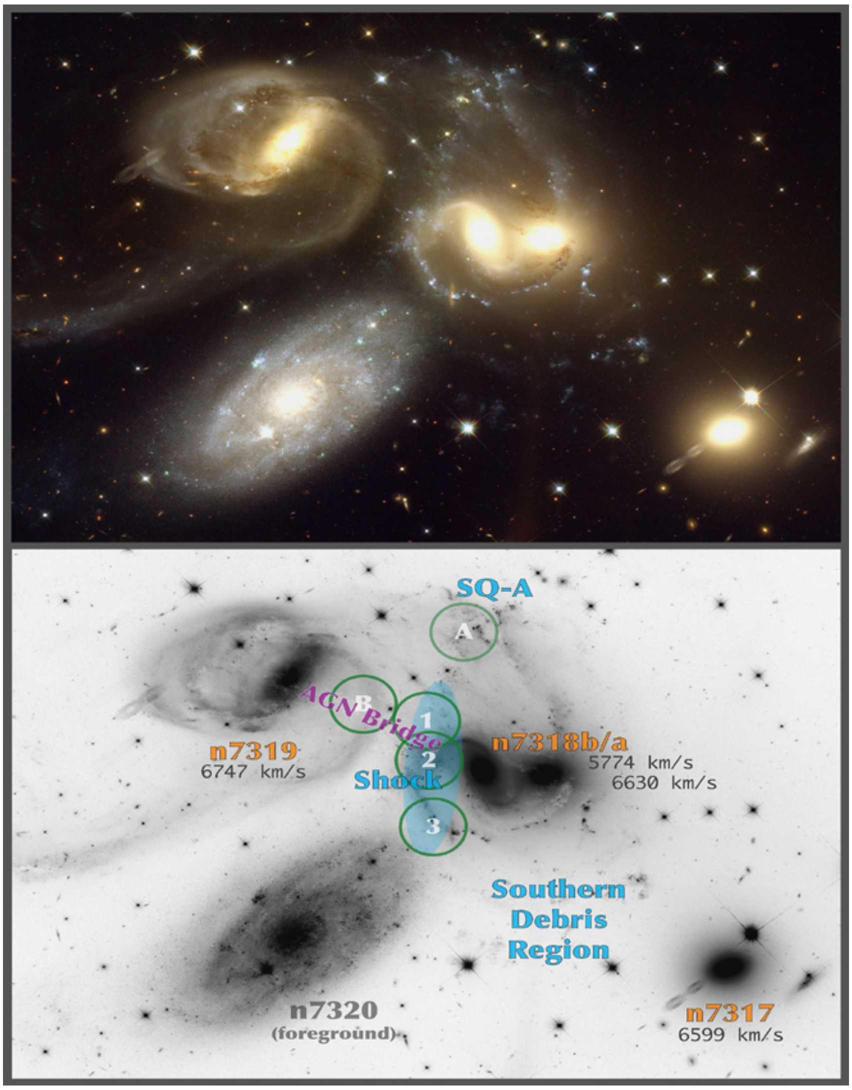


**Figure 1:** Stephan's Quintet in all of its colourful glory, from the Hubble Space Telescope. The bottom panel is a grayscale adaptation of the image above, with annotations marking the four member galaxies (the fifth is outside this image), along with the photobombing squirrel of galaxy-kind, NGC 7320 ('NGC' abbreviated to 'n'). We also indicate the approximate extent of a volume of shock-heated gas, so hot it is emitting X-rays. The marked velocities (in km/s, rather than km/h) correspond to the third spatial dimension, that is, the location of each galaxy into or out of the page. The much different velocity of NGC 7320 places it far, far away from the other four galaxies imaged. The features resembling infinity signs are essentially lens flares on the Hubble Space Telescope camera.

We know that the cool gas off which star formation feeds cannot coexist with the hot gas that the shockwave produced. How, then, can the two be reconciled? In order to get to the bottom of this long-pondered correlation, we decided to seek out, or rule out, causation. We used the collecting power of Gemini Observatory (the northern twin), one of the largest optical/infrared telescopes in the world. From its 5km-high vantage point atop Mauna Kea in the Big Island of Hawai'i, above the clouds, the humidity, and much of the wobbly atmosphere, we collected data of fifty or so bright knots located at the interface between the shock-heated volume of gas and much of the bright star formation. We used spectroscopy in this case, which instead of taking pictures opens up light into all of its constituent wavelengths, just as raindrops split sunlight into a rainbow.

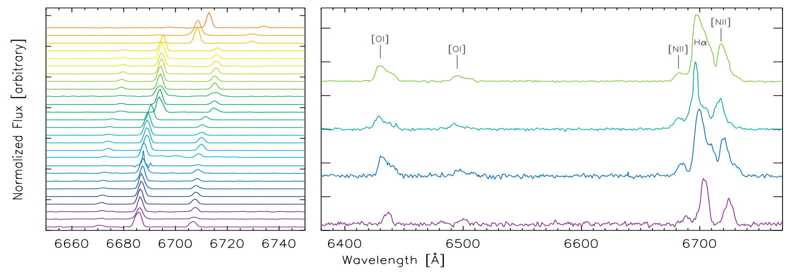


**Figure 2:** Spectra of star-forming regions (left) and clumps of shocked molecular gas (right). The difference in line width is due to the internal motion of the material: hot molecules will jerk around a lot in a fluid, while the stars move around each other more gently. The widths are a direct diagnostic of the nature of the clumps of material to which these spectra correspond, although we also use more sophisticated means to verify this classification.

What this technique affords us is the ability to place these bright knots in three dimensions, instead of guessing the third dimension from a two-dimensional image. Our observations revealed some very interesting structures in 3D space, but also neatly separated the bright knots into two classes: star-forming regions and blobs of shocked molecular gas. Figure 2 shows the difference between the two, with regions of star formation producing spectra with narrow lines and shocked molecular clouds appearing much broader (because particles in fluids move around more when heated). We instantly diagnosed the existence of both sweeping shocks and star formation, "frenemies," projected across the same bit of space. But what about the third dimension?

To understand this we compared the redshifts of the blobs to that of the immense volume of gas in the space between the galaxies, shown in Figure 3. Redshifts can be thought of as velocities, which, in turn, reveal motion into and out of the page onto which we printed Figure 1 (or your computer screen). Matched velocities imply matched location in the third dimension. Figure 3 shows the relation of blob velocities and the gas over which they are superposed in the images. From this we found that none of the star-forming knots are actually embedded within the X-ray-hot material; only the shocked blobs are. All these new stars are instead forming in the intruder galaxy, the one colliding with this intergalactic material. It seems that the intruder is undergoing quite a bit of stress at the moment, with its leading spiral arm being crushed by this 'wall' of hot material. It is in that very narrow interface that all the stars are forming, where the gas in the intruder is piling up—much like the hood of a car is seen to crumple like paper in a crash test video. Everyplace where enough gas is pushed together, some stars form. And the result, while particularly traumatic for galaxies in Stephan's Quintet, produces some stunning imagery, and some pretty neat science on the side.

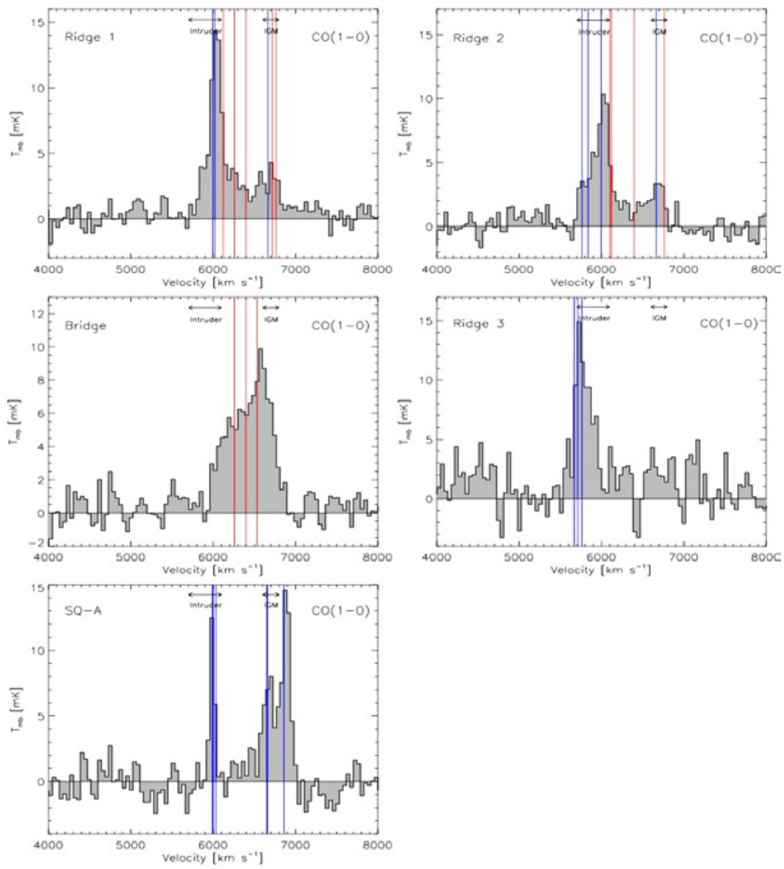


**Figure 3:The** distribution of redshifts (velocities into/out of the page) of all the molecular gas in the Quintet (black lines), along with the knots from Figure 2, whose velocities are marked as blue and red lines for star-forming regions and shocked gas respectively. This plot shows an expected correspondence between shocked clumps and the part of the gas that is very hot. But it also reveals a striking misalliance between star formation and intergalactic space: all the star formation is in the intruder! We interpret this very sharp interface as a region of piling up gaseous material in the colliding galaxy, which is abruptly condensing into new stars.

# A New Chapter for the Australian Gemini Astronomy Contest

Christopher Onken (ANU)

Isobelle Teljega (St Margaret's Anglican School), Travis Rector (U. Alaska Anchorage), and the Australian Gemini Office

The Australian Gemini Office's annual astronomy contest ventured into new ground in 2013, as an independent competition for Australian amateur astronomers was created in parallel to the on-going contest for students. In each division, the entrants were trying to devise the best justification for spending an hour of observing time on the Gemini South telescope to take images of their chosen targets.

The student contest winner for 2013 was Isobelle Teljega from St. Margaret's Anglican Girls School in Ascot, Queensland. The Year 8 student suggested that Gemini image the nearby galaxy IC 5332. The resulting picture is shown above, and reveals pockets of star formation along the galaxy's spiral arms, as well as a loose cluster of background galaxies.

Two runners-up were named in the student competition: Samuel Carbone from Trinity College in East Perth, Western Australia, and the St George Girls High School Astronomy Club from Kogarah, New South Wales. The winner and runners-up each earned a "Live From Gemini" session for their classroom, during which the students connect to staff members at the Gemini Observatory headquarters in Hawaii over a video link and learn all about Gemini's recent discoveries.

The inaugural winner of the amateur astronomer contest was Paul Fitz-Gerald, a physics teacher from Ivanhoe Girls' Grammar School in Ivanhoe, Victoria. Paul selected the nebula Gum 85 for his contest entry, and actively participated in the planning and processing of the Gemini observations that produced the image on the cover of this issue. Gum 85 is the central part of a dense star-forming cloud. This "Nested Egg Nebula" is being ionised by the young, massive stars nearby, giving rise to the extensive H-alpha emission seen in red. In the 1950s, Australian astronomer Colin Gum catalogued the nebula (and 84 others) from Mount Stromlo Observatory, using photographic enhancement techniques that removed the starlight and left only the nebular emission.

With the launch of the amateur division and a new high in terms of student entries, the fifth year of the Australian Gemini Astronomy Contest was an immensely successful one. The Australian Gemini Office is already actively planning for the next iteration, for which the Australian Time Assignment Committee has generously allocated two hours on Gemini South. Further details will be available on the AusGO website:

http://ausgo.aao.gov.au/

# StarFest in the Warrumbungles

by Amanda Bauer (AAO)

This view of Siding Spring Observatory, that shows the UK Schmidt Telescope, the Faulkes Telescope South and the iTelescope facility, was captured by a robotic drone.

Credit: Uwe Steins.

Channel 7 Sunrise reported the weather from Siding Spring Observatory on 3rd October. Correspondent Edwina Bartholomew (yellow shirt) and her crew are seen here with several AAO staff standing in front of the SAMI instrument on the Anglo-Australian Telescope. From bottom left are AAO's Doug Gray, Kristin Feigert and Amanda Bauer.

Credit: Amanda Bauer (AAO).

A Nobel Prize recipient giving a lecture under Australia's largest optical telescope? Clear views of the Magellanic Clouds in a moonless sky? A visit from Channel 7 Sunrise news and singing astrophysicists at the Coonabarabran Bowling Club? Thousands witnessed these phenomena in early October 2013 at the annual StarFest weekend near Coonabarabran and Siding Spring Observatory (SSO)!

This year's events attracted the largest audience ever, as visitors from all over Australia attended "Science in the Pub," the prestigious Bok Lecture, Open Day at SSO, and the inaugural StarFest Star Party.

### Science in the Pub

An enthusiastic crowd of 400 enjoyed the informative and "dark" discussion between ANU's Laureate Brian Schmidt, Prof Matthew Colless (Director, ANU RSAA) and Prof Ken Freeman (ANU) at "Science in the Pub." Professor Freeman described his discovery that the majority of material in galaxies is not the familiar stars, gas and dust, but rather a mysterious, invisible component we call "dark matter." He predicts we should know what dark matter is within 5 years. So exciting!

Matthew Colless, Ken Freeman, Brian Schmidt and Fred Watson (L to R) entertain the crowd with discussion of Dark Matter at "Science in the Pub" in Coonabarabran.

Credit: Amanda Bauer (AAO).

Professor Schmidt talked about his team's surprising find, that our Universe is expanding faster and faster all the time. "Dark energy" is the name of what causes the acceleration in the expansion of our Universe, but nobody knows what it is, yet. The evening's advertised "debate" finally picked up momentum when Professor Colless challenged what can be considered "reality." The panelists concluded that while there is an objective and measurable "reality," our human ability to explain its potential complexity is sadly limited.

The event's compelling compère, Fred Watson, rounded off the entertaining evening by accompanying my musical ode to "Pluto, the Previous Planet" before performing one of his own songs for the appreciative crowd.

## Open Day

The thousands of visitors to Siding Spring Observatory on Open Day experienced the rare treat of exploring inside most telescope domes on the mountain. Open for exploration were the control rooms where astronomers stay up all night controlling the telescopes, the rooms that house the world-class instrumentation, and even the catwalk that surrounds the 4-meter Anglo-Australian Telescope's massive white dome.

Nobel Laureate Professor Brian Schmidt gives his Bok Lecture to an excited crowd on the floor of the Anglo-Australian Telescope dome.

Credit: Kyler Kuehn (AAO).

In addition to Prof Schmidt's Bok Lecture, Questacon activities continuously entertained crowds and ten short talks were given by top astronomers from ANU and AAO throughout the day. A highlight of the day was the ability to thank some of the brave members of the Siding Spring Bush Fire Brigade in person for all their efforts in defending the region against bush fires last January.

## "Meanwhile at the iTelescope end of the Hill"

The iTelescope.net group worked closely with the AAO and RSAA to ensure the weekend remained active for all the crews on the mountain. 'Aussie' Pete Poulos is the Observatory Manager at iTelescope. Net and describes his experience at Open Day as a great success, with hundreds of curious visitors popping into their roll off roof observatory throughout the day.

iTelescope.net provides an avenue for 'Public Astronomy' and Pete says they "had a lot of fun showing bright eyed children how a telescope works up close." Many parents and teachers commented on the potential use of the iTelescope.net systems in the classrooms. iTelescope's Brad Moore gave a public talk about remote controlled telescopes and the important contributions that can be made by amateurs to astronomy.

## Star Party

AAO Technician Robert Patterson explains to the public how the successful Two-Degree Field (2dF) Instrument can simultaneously collect spectra of 400 objects within a two degree area on the sky and has helped uncover large-scale structure in the Universe.

Credit: Amanda Bauer (AAO).

The Warrumbungle Mountain Motel hosted the inaugural Star Party event where an enthusiastic crowd took advantage of a pristine new moon sky over Coonabarabran. As everyone gathered under the twilight sky, they enjoyed a delicious meal catered by the Motel and had the chance to talk with the star party's special guest, eminent astronomer Dr Charlie Lineweaver. The early crowd was also awarded with telescopic views of Saturn and a bright Venus before each planet set below the western tree line. Radio personality David Reneke provided an entertaining presentation while anticipation of dark sky viewing grew.

## Finally, darkness set and the Milky Way appeared.

Spaced around the open field were four telescope and binocular stations where experienced amateur astronomy club members guided guests deep into the night sky. Among the many objects viewed were 47 Tuc, Alpha Centauri, the Magellanic Clouds, the Tarantula Nebula and later in the evening, our biggest neighbour, the Andromeda Galaxy. The site was very well suited for the campers who stayed on to watch the sky roll over head until the wee hours and then retire to their tents.

The StarFest Star Party was a great success and we are looking forward to the exciting events earmarked for next years 50th Anniversary celebrations for Siding Spring Observatory. Mark your calendars now for early October 2014 to experience all the adventures of StarFest!

Amanda Bauer sings her song "Pluto, the Previous Planet" to a guitar accompaniment by Fred Watson.

Credit: Helen Sim (CSIRO/AAO).

# AusGO CORNER

Stuart Ryder (Australian Gemini Office, AAO)

## New AusGO Staff

**Figure 1:** New Joint AusGO / Macquarie University Lecturer in Astronomy Dr Richard McDermid.

Dr Richard McDermid arrived at the start of October to take up the role of Joint AusGO / Macquarie University Lecturer in Astronomy (Fig. 1). This position involves a mix of lecturing, research, student supervision, and AusGO support duties. We are delighted to have someone with Richard's wealth of Gemini knowledge join us, given that he spent the past 6 years at Gemini North in Hawaii. Richard obtained his PhD from Durham University, and was a postdoctoral fellow at Leiden Observatory in the Netherlands before moving to Gemini. His research field is galaxy evolution, and he co-leads the Atlas3D IFU Survey, following on from his work with the SAURON Project. Richard's particular interests are the stellar populations and dynamics of early-type galaxies, and he has also worked on various instrumentation projects such as the MUSE IFU (VLT), and supporting the NIFS IFU and ALTAIR adaptive optics system at Gemini. Richard and his family are enjoying their new life in Sydney, and he's excited to be part of the AAO team!

Welcome Richard!

## Proposal Statistics

For Semester 2014A ATAC received a total of 23 Gemini proposals, well down on the ~33 received in recent semesters. There were 11 proposals for Gemini North, 12 for Gemini South, and no Subaru exchange time requests. The oversubscription for Gemini North dropped from 2.0 in 2013B to 1.3, while demand for Gemini South was also down, from 2.5 to 1.7. The total demand of 201 hours was the smallest since Semester 2011A. Demand for GMOS-N, GMOS-S, NIFS, and NIRI in particular were are all down, possibly due in part to a larger segment of the Australian user community now having institutional access to the Keck telescopes.

Magellan time in 2014A was also down, with oversubscription dropping from 3.4 in 2013B to 2.4 even though the number of proposals was relatively unchanged. In its first semester the Magellan AO system proved the most popular offering with 3 requests, while most other instruments received just one proposal each.

In 2013A, all but two of the 12 Gemini Band 1 programs were completed or had insufficient ToO triggers (one of these has rollover into 2014A); 5 of the 8 Band 2 programs were completed; and just 1 of the 3 Band 3 programs was completed. Most of the incomplete programs relied upon NICI, which has now been withdrawn with the advent of GPI. A further 30 hours of Poor Weather time was also used, but for which Australia is not charged.

## National Collaborative Research Infrastructure Strategy 2013

From 2008–2011 a substantial fraction of AusGO's operations was funded by the Federal government's National Collaborative Research Infrastructure Strategy (NCRIS), under a contract from Astronomy Australia Ltd. NCRIS funding also enabled the purchase of 15 nights per year on the Magellan telescopes. AAL was awarded nearly $3.5M for calendar years 2013 and 2014 from the Collaborative Research Infrastructure Scheme in order to sustain a number of astronomy infrastructure projects previously supported by NCRIS. In August 2013 AAL was awarded a further $12.2M to support operations of critical astronomy infrastructure through to 2015. Among the AusGO-related activities that will be funded by NCRIS 2013 are:

- the purchase of 15 nights per year of Magellan observing time through the end of Semester 2015B, to match the timescale of Australia's current Gemini access;
- funding to cover the costs of Magellan observer travel over that period;
- salaries and travel to Gemini sites for AusGO staff;
- public outreach activities, including the Australian Gemini Astronomy Contests;
- operating the AGUSS program for 2014/15;
- funding to enable PhD student PIs to travel to Gemini to learn about and participate in queue observing;
- seed funding for the 2015 Australian Gemini and Magellan Science Symposium to be held at the AAO in Mar/Apr 2015.

## AGUSS

The Australian Gemini Undergraduate Summer Studentship (AGUSS) program is sponsored by a CRIS grant to AAL. It offers talented undergraduate students enrolled at Australian universities the opportunity to spend 10 weeks over summer working at the Gemini South observatory in La Serena, Chile, on a research project with Gemini staff. They also assist with queue observations at Gemini South itself, and visit the Magellan telescopes at Las Campanas Observatory. There were 22 applications for this year's AGUSS program, the most since the program was launched in 2006. The selection panel of AusGO staff faced the challenge of selecting just two from an incredibly strong field of applicants.


**Figure 2:** AGUSS recipients for 2013/14 Marcus Wong and Rebecca Davies, shortly after their arrival at Gemini South.

The two AGUSS recipients for 2013/14 are Rebecca Davies from ANU, and Marcus Wong from Monash University (Figure 2). Rebecca is working with Mischa Schirmer on a GMOS IFU study of "Green-bean galaxies" (http://www.gemini.edu/node/11904), while Marcus is working with Rodrigo Carrasco on an analysis of the GSAOI data for the "Antennae" galaxies. They started work in Chile on 10 Dec, and will be presenting their results by video in early-February shortly before their return to Australia.

## Instrumentation Update

- **GPI**: Having passed acceptance tests at UCSC in July, the Gemini Planet Imager was shipped to Gemini South in August, reassembled, then tested on the flexure rig in September. GPI had first light on-sky the week of 11 Nov, and is now well into the commissioning phase. A call for Early Science observations may be issued shortly.
- **FLAMINGOS-2**: Following the commissioning of imaging and longslit modes in Semester 2013A, FLAMINGOS-2 has finally become a workhorse instrument in 2013B. However IQ20 performance is currently only possible within the inner 2′ field of view; IQ70 within the inner 5′; and the OIWFS is not yet available. The spectral resolution with narrow slits also varies somewhat with wavelength. MOS commissioning is now anticipated for late in 2014A.
- **GMOS**: The first focal plane array of 3 new red-sensitive Hamamatsu CCDs is scheduled to be installed in GMOS-South in April 2014, to be followed by a similar upgrade in GMOS-North later in the year.
- **GeMS/GSAOI**: Following the winter shutdown, bad weather and technical issues in Sep and Oct prevented any new science data being taken. The first block of GSAOI Guaranteed Time for the RSAA team that built the instrument took place on 18–20 Dec.
- **GHOS**: Following the withdrawal of a key sub-contractor for the Gemini High-resolution Optical Spectrograph, the AAO has now negotiated with NRC Herzberg in Canada as a replacement and the project is now proceeding to the Preliminary Design phase.
- **GRACES**: Issues with shielding and focal ratio degradation in the 280m fibre feed from Gemini North to the CFHT for the GRACES (Gemini Remote Access to the ESPaDOnS Spectrograph) project led by NRC Herzberg have finally been resolved. First light is now expected by mid-2014.

## Student visits to Gemini

Paola Oliva-Altamirano is a PhD student at Swinburne University of Technology, who on her way through South America for a conference in Nov 2013 took the opportunity to stop over in La Serena, Chile, and get a feeling of how Gemini South works. Paola writes:

*"Australia has been a Gemini partner for several years; therefore, astronomy students enrolled in Australian institutions have access to the twin 8 m telescopes located in Hawai'i (Gemini North) and Chile (Gemini South). So, I thought "why not take advantage of this and visit Gemini?"*

*From the beginning the AusGO and Gemini staff were very friendly. I sent an informal email to AusGO, asking if it was possible to visit, and I got the most positive response. They helped me organize accommodation, a trip to the summit, and even gave me useful tourist advice. I could not leave Chile without seeing the beautiful scenery that La Serena has to offer.*

*I spent two days on the summit of Cerro Pachón, where Gemini South is located. I had the chance of talking to the telescope operators and see the telescope in action. The first night the astronomer in charge of the observations explained to me how the queue mode in Gemini works, and how they planned each observation in order to optimise the time. There are different observing plans for each night, and each one is adapted to different weather conditions, resulting in a night spent with the highest efficiency possible.*

*The second night I was lucky enough to see the laser propagation, which generates five artificial guide stars. The laser was undergoing tests, and is an important part of the Gemini Multi-Conjugate Adaptive Optics System (GeMS). It was great to see behind the scenes, and be a spectator of the engineering work that keeps the telescope alive. I absolutely enjoyed my experience at Gemini, therefore I would like to recommend to students in Australia to take advantage of the tools and opportunities that are available to us. It is as simple as asking."*

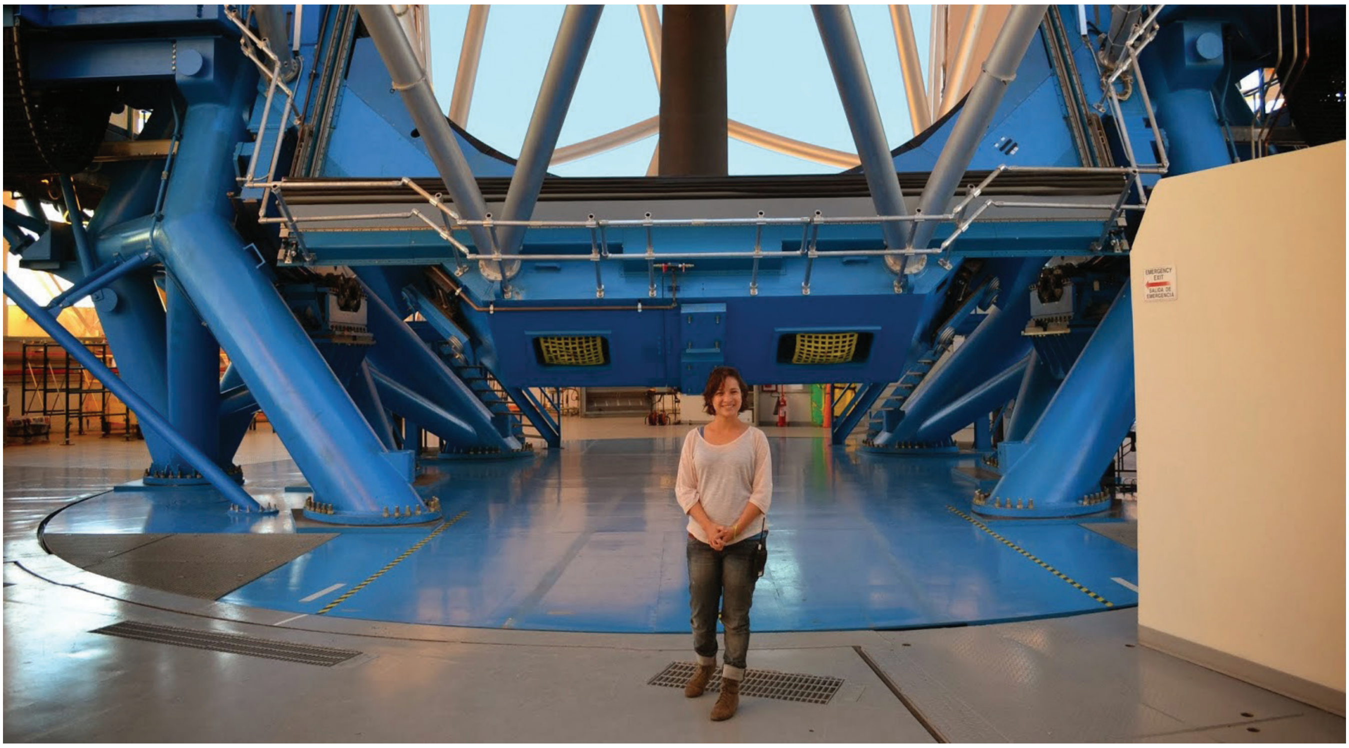

**Figure 3:** Paola Oliva-Altamirano standing in front of the Gemini South telescope prior to the start of a night's observing on Cerro Pachón.

The Gemini Observatory welcomes visits by student and more experienced users at any time, regardless of whether they have been allocated queue or classical time on Gemini. For further details, please see the article on p. 39 of GeminiFocus for June 2012 (http://www.gemini.edu/images/pio/newsletters/pdf/gf_0612.pdf). In Semesters 2014B and 2015A AusGO will be offering funds from the NCRIS 2013 program to enable some student PIs allocated queue or classical time on Gemini to travel to the telescope to participate in the queue observing process, possibly including their own program. Further details will be provided in the next AAO Observer.

## Large and Long-Term Programs

The Gemini Observatory has issued an Announcement of Opportunity for Large and long programs (hereafter "large programs" or LPs). These are Principal Investigator-defined and -driven programs that, as a guideline, either require significantly more time than a partner typically approves for a single program or extend over two to six semesters, or both. Large programs are expected to promote collaborations across the partnership's communities; to have significant scientific impact; and normally to provide a homogeneous data set, potentially for more general use. The participating partners (US, Canada, Australia, and Argentina) will make available for LPs up to 20% of their time at each Gemini telescope over each of the next 6 semesters from the start of LP execution (Australia agrees to participate in the LP process through 2015, and Australian PIs are eligible for programs that will conclude by the end of 2015).

Full details, including an FAQ are at http://www.gemini.edu/node/12096. Letters of Intent to propose a LP must be received by email to largeprograms@gemini.edu by February 3, 2014, while the LP proposals are due by March 31, 2014. AusGO would like to encourage all members of the Australian community to participate in this LP call, both as Principal or Co-Investigators, and stands ready to provide strategic and technical advice as required. Please direct any enquiries to ausgo@aao.gov.au.

## 2014 AusGO/AAO Observational Techniques Workshop

Following the success of the 2011 AusGO/AAO Observational Techniques Workshop, planning has begun for the next workshop to be held at the AAO Headquarters in North Ryde from 1–4 April 2014. Topics to be covered include writing proposals and preparing for observations; "demystifying" the Gemini queue; detectors and the basics of imaging and spectroscopy; multi-object and integral field spectroscopy; and bringing your results to the attention of the world. There will also be hands-on tutorials in using Gemini IRAF within the PyRAF environment, and a set of "data challenges" to enable participants to put their new-found skills to the test. Presentations will be given by AusGO, AAO, and other local astronomers, while Dr Emma Hogan from the Gemini data reduction software group will be available to lend assistance with installing Gemini IRAF from the Ureka release (http://ssb.stsci.edu/ureka/). In lieu of a workshop dinner there will be a stargazing and pizza night at the Sydney Observatory. The workshop is open to anyone, but places are limited and preference will be given to Australian students and early-career researchers. Thanks to funding from the CRIS program there is no registration fee, and lunches and tea breaks will be catered. Registration is now open: follow the links from the AusGO home page at http://ausgo.aao.gov.au/.

# Seventy-Five Years of Schmidtery

Fred Watson (AAO)

**Figure 1:** Malcolm Hartley at the age of seven – already hooked.

When Professor Bengt Strömgren opened the UK Schmidt Telescope as an outstation of the Royal Observatory, Edinburgh, on 17 August 1973, few could have guessed what the telescope's 40th anniversary year would bring. A devastating bushfire that came within a whisker of burning the telescope to the ground. An honourable discharge for a robotic multi-object spectroscopy system that would have seemed like science fiction in 1973. And the completion of a half-million star spectroscopic survey with said robotic system – the Radial Velocity Experiment (RAVE), which Strömgren would have given his right arm to use.

While some of the telescope's 2013 landmarks have already been highlighted in these pages (AAO Observer issues 123 and 124), others have gone unheralded. In particular, a significant event on 31 January was waylaid by the Wambelong fire, passing largely without ceremony as the AAO community came to terms with the aftermath of that terrible inferno. But on that date, the UKST's part-time support staff was officially disbanded, with three former observers going their separate ways. Between them, those three individuals had contributed no less than three-quarter s of a century of service to the UKST, a truly remarkable achievement.

A modest component of that total came from a scientist whose service was limited only by the end of RAVE observations. Milorad (Joe) Stupar joined the observing staff in May 2008 under the so-called 'Macquarie Model' brokered by Quentin Parker. For almost five years, Joe's monthly RAVE slots were a mainstay of the project, and his contribution of some 60,000 spectra places him equal third in the RAVE all-time league table. While no longer directly involved with UKST operations, Joe continues his work as a member of the Macquarie Research Centre in Astronomy, Astrophysics and Astrophotonics.

Although five years' service is a significant achievement in most professions, Joe would be the first to admit that the UKST sets standards of longevity that are in a class of their own. Thus, the other two retiring staff members make up the remaining 70 years of Schmidtery. And these gentlemen have links not only with the Edinburgh days of the UKST, but also its precursor projects.

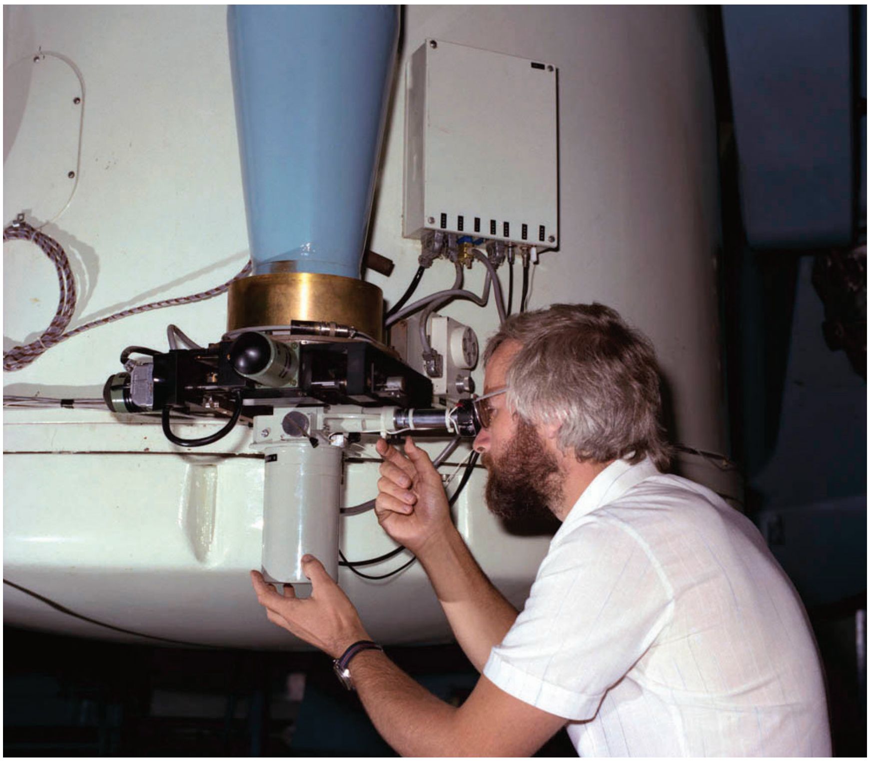

**Figure 2:** Still looking through a telescope, Malcolm Hartley tweaks the UKST autoguider in April 1978. (Brian Hadley via David Malin).

Ken Russell's final job with the UKST was as an IT guru, maintaining the RAVE input catalogues and performance metrics, as well as the telescope's utility software – which he had authored more than a decade before. Although by then based in Albury, Ken made monthly visits to Siding Spring, carrying out his duties remotely in the interim. The fact that he was able to do that successfully highlights his deep knowledge of all aspects of UKST operations. Indeed, it was Ken, who, from his home in Albury on 13 January 2013, gave us hope that perhaps the telescope had survived the passage of the Wambelong fire-front with the news that he was still receiving telemetry from the UKST's external weather sensors.

Ken's career in astronomy began at the Royal Observatory, Edinburgh (ROE) in October 1963 as a youthful member of the recently-formed Satellite Tracking Unit. ROE operated a photographic tracking station on a windswept moor at Earlyburn in Peebleshire, where observers frequently endured temperatures down to -17°C, along with snowdrifts and frozen water supplies. Five years later, however, Ken's fortunes changed dramatically, with a posting to a new ROE outstation at Monte Porzio Catone just south of Rome. Over the ensuing decade, he helped to operate both a Schmidt telescope that was a forerunner of the UKST and a revolutionary Michelson interferometer, with a series of postings to Italy.

It was satellite tracking that brought Ken to Australia in April 1979, in connection with a new initiative of Aston University in Birmingham. But Ken's formal posting was to 'the best Schmidt ever', and, apart

**Figure 3:** The classic portrait of the UKST, with Ken Russell taking his turn at the autoguider in September 1982. (Brian Hadley via David Malin)

from a sojourn in Edinburgh between 1984 and 1986, that is where he spent the remainder of his career. With the incorporation of UKST operations into the Anglo-Australian Observatory in 1988, Ken became an AAO staff member, successfully making the transition from photographic observing to multi-fibre spectroscopy with the FLAIR II instrument during the 1990s. The last decade of his observing career was as a 6dF support astronomer, contributing significantly to both the 6dF Galaxy Survey and RAVE.

No-one associated with the UKST would deny that the most productive observer of all time was one Malcolm Hartley, who also retired on 31 January 2013. Such was Malc's dedication to the telescope that nobody ever bothered to call the dome while he was observing in clear weather – he didn't have time to pick up the phone. Almost one in four RAVE spectra were obtained by Malc, a truly staggering achievement.

That commitment to productivity came from a long career in observational astronomy, which began as a team-leader for ROE's site-testing project in 1970. At the time, the hunt was on for a suitable site for the UK's Next Big Thing in northern-hemisphere astronomy, which eventually materialised as the Isaac Newton Group of Telescopes in La Palma. Three site-testing teams were deployed by ROE in Madeira and the Canary Islands, and the exploits of those intrepid young astronomers on their remote mountain-tops is an adventure story waiting to be told.

It was in 1976 that Malc finally hung up his site-tester's hat, and moved to Australia as a photographic observer at the UKST. Here he quickly made his mark as a survey manager, becoming along the way the world's leading expert in the black art of silver nitrate hypersensitising for near-infrared plates. During the early 1990s, Malc fulfilled the role of Acting Astronomer-in-Charge at the UKST, and, when 6dF was commissioned in 2001, he led the successful deployment of the instrument as a survey machine alongside commissioning astronomers Quentin Parker and Will Saunders.

Both Malcolm and Ken were prolific discoverers of comets and asteroids during the UKST's photographic era. Ken has five periodic comets and numerous non-returning comets to his credit. He also has an asteroid named after him (3714 Kenrussell). But it was a different Solar System object that propelled Malcolm Hartley into the world's media spotlight in November 2010, when NASA's EPOXI spacecraft flew within 700 km of Comet Hartley 2 – one of eight Hartley comet discoveries from the 1980s. Malcolm's trip-of-a-lifetime to be present at Mission Control during the flyby is recounted in AAO Observer issue 119, but his article modestly omits the fact that he, too, has an asteroid named in his honour (4768 Hartley).

The departure of Joe, Ken and Malc from UKST operations marks the end of an era in Schmidtery. It is not the end of the road, however, since work is already underway to prepare the telescope for its next phase. When the revolutionary TAIPAN multi-fibre spectroscopy system is deployed on the UKST in 2015, it will need every bit of sage advice for its successful commissioning. I can think of at least three places where such advice might be enthusiastically given.

**Figure 4:** Joe Stupar (back row, extreme right), Ken Russell (back row, sixth from right) and Malcolm Hartley (second row, third from right) join other UKST observers and supporters for the end-of-RAVE Rave-Up in April 2013. (Laura Hartley).

# News From North Ryde

Amanda Bauer (AAO)

In addition to enjoying an exciting season of commissioning new instruments, the North Ryde AAO offices have welcomed new staff members Vijay Nichani, Millie Maier, Richard McDermid and Jeremy Orr, and celebrated the numerous awards received by staff members.

**Vijay Nichani** joined AAO in August 2013 to help design the next generation electronics for driving the StarBugs micro-robot technology for both TAIPAN and MANIFEST. He has 25 years of experience in designing software and electronic hardware, analogue and digital. Vijay worked at ANSTO before joining AAO where he designed data acquisition software for Dingo, Emu & Bilby Instruments. In the past Vijay worked for the University of Sydney's centre of Field Robotics where he designed 24 GHz radar for Haul trucks that is used for collision avoidance and navigation in open cut mines.

**Millie Maier** is the AAO's newest Super Science Fellow and will be working with the GAMA Survey during the next year. Millie received her Doctorate degree in Astrophysics from the University of Oxford, UK in 2008 and her B.A. in Physics and Astronomy from Pomona College in California, USA in 2005. She was a Gemini Science Fellow at Gemini South in La Serena, Chile where she was secondary instrument scientist for the GMOS instrument. Her research interests revolve around galaxy evolution, particularly nearby early type galaxies. She has expertise in Integral Field Unit science, data reduction, and analysis.

The administrative team welcomes a new casual administrative assistant, **Jeremy Orr**, and **Richard McDermid** arrived at the AAO in October, as described in the AusGo Corner of this newsletter.

Congratulations and recognition are owed to the following award-winning AAO staff members:

- **Wade Sutherland** came second in the Orana Region round of the World Skills Competition.

- **Andrew Hopkins** won an Australian Research Council (ARC) Linkage Grant for "Mapping the dark matter with early type galaxies"

- **Andy Green** received the ASA's Louise Webster Prize for outstanding research as an Early Career Researcher.

- **Andrew Hopkins** and **Jon Lawrence** won an ARC LIEF grant for TAIPAN

- **Fred Watson** won the 2013 Bragg Prize for science writing .

- **the AAO** won the 2013 AHRI Gender Equity Award.

- **Andrew Hopkins** received a Department Leadership Award.

- **Sarah Martell** won an ARC Discovery Early Career Researchers Award (to be taken at the AAO!)

- **Michael Ireland** was awarded an ARC Future Fellowship that he will take at ANU.

- **Amanda Bauer** and **Jeroen Heijmans** were nominated for an Excellence in Innovation award for their "Stories from Siding Spring Observatory" photo exhibition.

- **Cathy Parisi** received special acknowledgement for clocking up 20 years in the APS

# Letter from Coona

by Katrina Harley

16 December 2013

Well it has been a very busy couple of months with me returning to work after my European holiday for 6 weeks, Open Day, Planning day and all the other little, or should I say big, things/ changes occurring during that time.

Open Day weekend was a great success, although a lot of work. It was very rewarding in the end when all went to plan.  The Social Club held a BBQ at the top of the mountain on the day, although been a little over catered for, the Social Club have managed to move most of the excess bread rolls and sausages through many “essential” BBQ’s. Planning is already underway for the 2014 Open Day weekend, so hopefully the weekend will be bigger and better.

Planning Day was great couple of days, and I would like to thank all involved in the Committee who helped organise the event, although I did need a day to recover after returning home.  I won’t talk about Planning Day anymore as Zoe has thoroughly covered the three days in her article.

We welcomed Carl Holmesby who started in December as the Workshop Supervisor- Carl joined us from CSIRO. Heather Meldrum is helping out with the cleaning as Tony is on leave until February 2014.  We said goodbye to Glen Murphy who was in the workshop for a short time helping Wayne and Randal.

So this will be my last “Letter from Coona” for a while as I will be going on maternity leave early January 2014 and returning January 2015.  My expected due date is 29 January 2014, with only 6 weeks to go I’m not organised at all-it’s just coming too quickly.

While I’m on leave Zoe will be filling in for me, so there’s no need to worry. On second thought, maybe you should be worried.

Natural regeneration continues one year after the major bushfire swept over Siding Spring Observatory. Showin in the top image is the view from the catwalk of AAT in January 2013. The bottom image shows the same view almost exactly one year later.

Credit: Zoe Holcombe

**EDITOR: Amanda Bauer**

**DESIGN AND PRODUCTION: Online and Community Engagement, Department of Industry**

**ISSN 0728-5833**

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