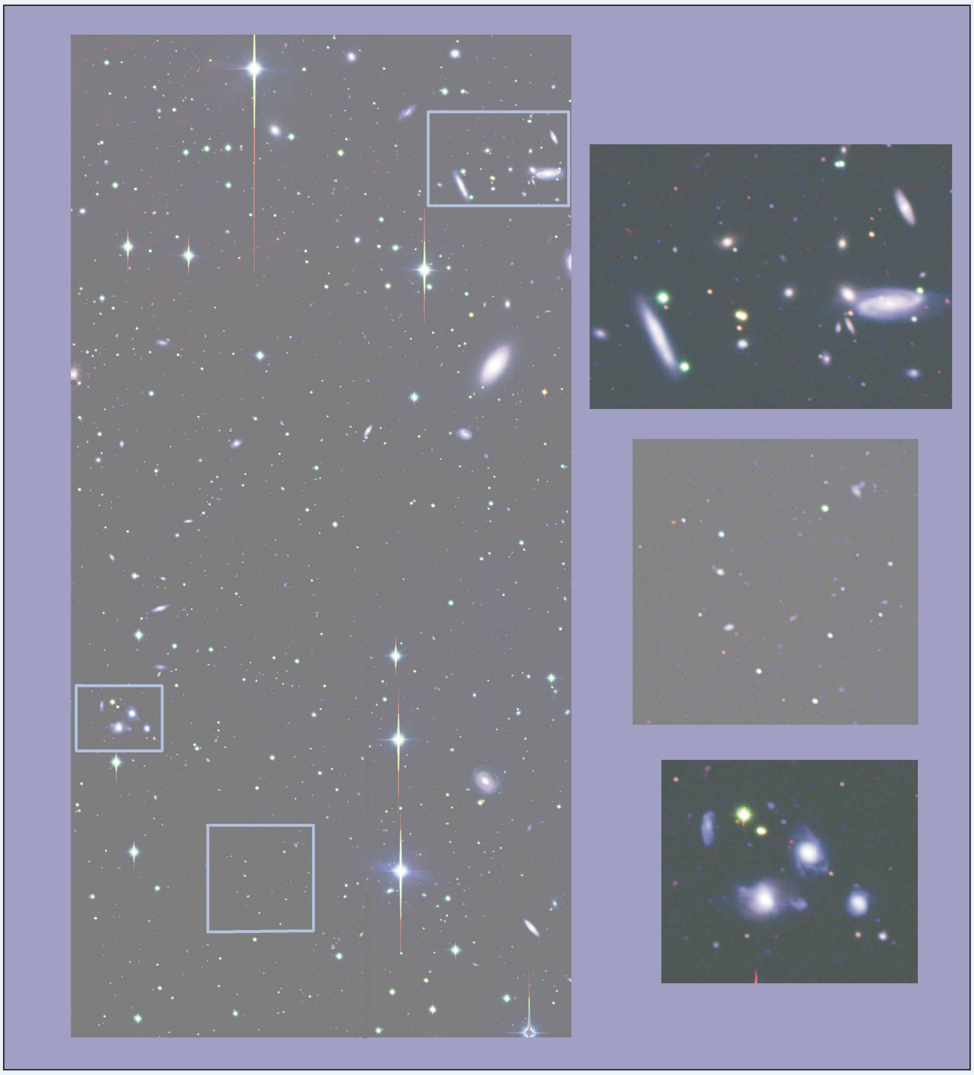
No. 1, September 1999

# The Isaac Newton Group of Telescopes

# NEWSLETTER



*These images, courtesy of Dr. Steve Howell, represent one of the fields observed in the Faint Star Variability Survey which is one of the Wide Field Survey programmes being carried out at the INT (see article by Nic Walton on page 3).*

## Message from the Director

*Dear Reader,*

First there was the Gemini newsletter of the Royal Greenwich Observatory, then there was Spectrum, produced by the Royal Observatories... But now there is ING's own magazine: the ING Newsletter!

The ING Newsletter is the third incarnation of the information bulletin for the Isaac Newton Group of Telescopes on La Palma. The changes in name over the years reflect the managerial changes that have passed the scene. The name of this newsletter may not be as poetic as the previous two incarnations, but at least it describes its purpose well.

The main purpose of the ING Newsletter is to keep users of the telescopes informed on the actual state of the facilities. It will report on telescope and instrument enhancements, on progress in improving the infrastructure, and to keep the community up to date with new instrument developments and policy issues. The ING Newsletter will also be a source of factual information that astronomers may need when applying for telescope time.

## THE ISAAC NEWTON GROUP OF TELESCOPES

The Isaac Newton Group of Telescopes (ING) consists of the 4.2 m William Herschel Telescope (WHT), the 2.5 m Isaac Newton Telescope (INT) and the 1.0 m Jacobus Kapteyn Telescope (JKT), and is located 2,350 m above sea level at the Roque de Los Muchachos Observatory (ORM) on the island of La Palma, Canary Islands, Spain. The WHT is the largest telescope in Western Europe.

The construction, operation, and development of the ING telescopes is the result of a collaboration between the United Kingdom, the Netherlands and Eire. The site is provided by Spain, and in return Spanish astronomers receive 20 per cent of the observing time on the telescopes. The operation of the site is overseen by an International Scientific Committee, or Comité Científico Internacional (CCI).

A further 75 per cent of the observing time is shared by the United Kingdom and the Netherlands. The University of Porto (Portugal) has 28 nights of observing time on the JKT and access to the INT and WHT under open competition with other astronomers. The allocation of telescope time is determined by scientific merit. The remaining 5 per cent is reserved for large scientific projects to promote international collaborations between institutions of the CCI member countries.

The ING operates the telescopes on behalf of the Particle Physics and Astronomy Research Council (PPARC) of the United Kingdom and the Nederlandse Organisatie voor Wetenschappelijk Onderzoek (NWO) of the Netherlands.

The Roque de Los Muchachos Observatory, which is the principal European northern hemisphere observatory, is operated on behalf of Spain by the Spanish Instituto de Astrofísica de Canarias (IAC), as the Teide Observatory on Tenerife is.

*(Continued from front cover)*

Of course we will also report on scientific highlights that have come out of the telescopes. You, as a user of the ING telescopes may wish to write a short article on your most recent scientific result from the telescopes. Our editor is eagerly awaiting your submissions and ideas!

The Newsletter will be issued twice per year, before the deadline for telescope applications so that everyone is made aware of the latest plans for the instruments and telescopes. Distribution will primarily be through the World Wide Web because that is the fastest and most reliable distribution route. We will inform you on the availability of new issues of the Newsletter through our email distribution list. A small number of copies will be printed and distributed to libraries of astronomical research centres where most of ING's users work.

In this first issue you will encounter various interesting articles, such as a progress report on the INT Wide Field Survey observations, about the programme to improve the computing infrastructure at ING, and on progress on ING's two main development projects INGRID and NAOMI. You will also find useful practical information such as contact points at ING and which instruments will be available for semester 2000A.

I hope you will enjoy reading this first issue of the ING Newsletter, and if you have any comments or suggestions regarding its content then don't hesitate let us know.

*Dr René Rutten. Director, ING.*

## The ING Board

The ING Board oversees the operation, maintenance and development of the Isaac Newton Group of Telescopes, and fosters collaboration between the international partners. It approves annual budgets and determines the arrangements for the allocation of observing time on the telescopes. ING Board members are:

Prof. T de Zeeuw, *Chairman* - Leiden
Dr. W Boland - NWO
Dr. A Collier-Cameron - St Andrews
Dr. A Mampaso - IAC, Tenerife
Prof. M Merrifield - Nottingham
Dr. P Murdin - PPARC
Dr. C Vincent, *Secretary* - PPARC

## The Instrumentation Working Group

The Instrumentation Working Group for ING was recently re-constituted primarily to provide scientifically informed advice on the instrumentation programme for the ING telescopes. The IWG fulfils an important function as intermediate between ING and the user community. IWG members are:

Dr. R G McMahon, *Chairman* - Cambridge
Dr. S Arribas - IAC, Tenerife
Dr. G B Dalton - Oxford
Dr. V S Dhillon - Sheffield
Dr. S F Green - Kent
Dr. K Kuijken - Groningen
Dr. N A Walton, *Secretary* - ING, La Palma

## The ING Newsletter

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Apartado 321; 38700 Santa Cruz de La Palma; Canary Islands; Spain.
Telephone: +34 922 425400
Fax: +34 922 425401
URL: http://www.ing.iac.es/

**Editoral team:** J Méndez, R Rutten, S Sánchez, D Lennon.
**Designer:** J Méndez
**Preprinting:** Gráficas El Time.
Tel.: +34 922 416651
**Printing:** Gráficas Sabater.
Tel.: +34 922 623555

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SCIENCE

# The Isaac Newton Group's Wide Field Survey. Status of the Survey and Associated Data Pipeline

Nicholas A. Walton (ING), Mike Irwin, Richard McMahon, James R. Lewis (IoA)

The Isaac Newton Group's Wide Field Survey (optical) (WFS) is using the Wide Field Camera (~0.3 $deg^2$) on the 2.5 m Isaac Newton Telescope (INT). The project was initiated in August 1998 and is expected to have a duration of up to five years.

The WFS is an umbrella for competitively judged science programmes which were assessed on the usual criteria plus the wider worth of the data set and the management competence of the proposing teams.

Multicolour data will be obtained over 200+ square degrees to a typical depth of ~25 mag (u' through z'). Importantly, the data is publically accessible by the UK and NL communities from day one, with access to the rest of the world after one year.

The preliminary processing and calibration (up to object catalogue generation) is the responsibility of the WFS project.

Full information can be obtained at http://www.ing.iac.es/WFS/. These pages also provide links to in press and forthcoming publications describing various aspects of the WFS.

## Introduction

In recent years a number of major survey programmes covering a variety of wavelengths have been initiated. The 2Mass project is covering the entire sky at a resolution of 4 arcsec in the JHK bands (http://www.ipac.caltech.edu/2mass/) The Sloan Sky Survey (SDSS) (http://www.sdss.org/) will cover significant areas of the Northern Hemisphere. These wide area surveys are having a significant impact, both as target selectors for 8 m class telescopes and for inherent survey science programmes.

This article briefly describes the Isaac Newton Group's Wide Field Survey (WFS). This aims to provide deeper data than the SDSS, but still cover significant targeted coverage, typically of fields being observed by facilities at other frequencies.

## The Isaac Newton Telescope and the Wide Field Camera

The WFC is an array camera of four 4k×2k thinned EEV CCDs (with excellent QE, read noise, full well, cosmetics, etc). It has 0.33 arcsec/pixel, this matches to the Roque de Los Muchachos Observatory median seeing of 0.7 arcsec. The WFC has a 0.29 square degree field. This is large for a 'thinned CCD' mosaic, and is approximately equal to the coverage of ESO's WFI@2.2m. The WFC currently takes some three minutes to readout, although this will be reduced to one minute in September 1999, and to 30 s in 2000 Q1.

The CCD broadband zero points (mag for 1 photon/s) and 5σ detection limits, assuming a dark sky and 1.2 arcsec seeing, are:

| Filter | Zero Point | 5σ detection (in) | Time (sec) |
|---|---|---|---|
| U | 23.8 | 24.00 | 600 |
| B | 25.6 | 25.25 | 600 |
| V | 25.7 | 25.00 | 800 |
| R | 25.6 | 24.50 | 800 |
| I | 24.9 | 23.50 | 600 |
| Z | 23.5 | 21.75 | 800 |

## The ING Wide Field Survey

The concept of the survey was originally proposed to the ING's Joint Steering Committee (JSC) (now the ING Board) by Walton and Irwin. The primary goal was to exploit the excellent capabilities of the WFC in a timely fashion over a period of 4–5 years and allow instant access to the processed data to facilitate its rapid scientific exploitation.

The Survey proposal was approved by the JSC in October 1997 with a subsequent 'Announcement of Opportunity' closing in March 1998. The WFS International Review Panel approved three main programmes in the first year, allocating five–six 'dark/grey' weeks per semester to the WFS. In June 1999 a first year review was carried out by PATT and the International Review Panel, this confirmed the continuation of the first year WFS programmes into 2000.

The Survey data is available to all UK and NL based observers in near real-time. Raw data is typically available as taken, whilst the pipeline reduced data is available after one month. The data is available to the rest of the astronomical community after one year.

## The WFS Programmes

The main science programmes were chosen to provide a 'wide' programme, a more focused smaller area programme, and a programme to address time variability.

*INT Wide Angle Survey (WAS).* PIs: McMahon, Irwin (IoA), Walton (ING) (see http://www.ast.cam.ac.uk/~rgm/int_sur)

This is the largest approved programme and includes sub-projects ranging from determination of cosmological parameters (e.g. via SN Type Ia studies) to searches for Solar System objects. It is the umbrella programme for the WFS project and leads coordination with the other programmes on, for instance, field, filter selection, to maximise scientific leverage of project.

The WAS additionally incorporates two distinct science programmes in the summer semesters centred on Virgo and the North Galactic Pole:

- *A multicoloured large area survey.* PI: Davies (Cardiff)

This aims to obtain the luminosity function (LF) of Virgo (using the u', g', z' filters) as a function of colour and position in the cluster down to L star of local dwarf spheroidals.

- *The Millennium Galaxy Catalogue (MGC).* PI: Driver (St Andrews) (see http://star-www.st-and.ac.uk/~spd3/mgc/mgc.html)

The MGC will provide a complete and local galaxy catalogue to faint limiting magnitudes ($m_B$<27 mags/arcsec$^2$) for low luminosity systems. It will contain ~5 million objects and be an important target generator for 8-m+ telescope science.

*A Deep UBVRI Imaging Survey with the WFC.* PI: Dalton (Oxford)

This programme is carrying out deep imaging of four contiguous regions of 10 deg$^2$ to a limiting magnitude of B=26 and I=24.5. It will enable the study of the evolution of galaxy clustering as a function of colour at faint magnitudes and provide a catalogue of rich galaxy clusters at intermediate red-shifts. Further, quasars will be detected at z>5.

In good seeing, observations of two 5 deg$^2$ fields to U=26 are being observed to investigate clustering of Lyman-break galaxies at z>3.

*Faint Sky Variability Survey (FSVS).* PI: van Paradijs (Amsterdam)

This programme is searching an area of >20 deg$^2$, studying photometric and astrometric variability on scales of one hour to a year to a magnitude of V=25. Example areas of investigation include: the evolution of specific galactic populations (e.g. CVs, RR Lyraes, halo AGB stars, brown and white dwarfs, Kuiper belt objects, sdB stars), the structure of the galactic halo, statistics of optical transients related to γ-ray bursts, and deep proper motion studies.

The first data run in November 1998 provided over 1600 new variable objects discovered in the first six nights.

## Field Coverage to Date

Survey data is being obtained on a weekly basis and thus a summary of the data obtained will soon be out of date. A complete summary of observations obtained is kept on-line at http://www.ing.iac.es/WFS/.

The situation at the end of May 1999 was that ~60 deg$^2$ had been observed in the first ten months of survey.

## Survey Progress: The Processing Pipeline

The WFS data is fully processed by the Project. After acquisition at the INT the data is transferred to the Cambridge Astronomical Survey Unit (CASU) at the IoA.

The data is then run through the WFS pipeline:

- de-biased and trimmed.
- bad pixel replaced.
- non-linearity corrected.
- flat fielded.
- de-fringed (i' and z' data only).
- gain corrected.
- astrometric solution applied.
- photometrically calibrated.
- object catalogues generated.

An example of a single data frame and the object catalogue image is shown in Figure 1.

The images are archived, the headers are available via Sybase database and WWW front end. The raw data is available soon after acquisition.

Calibration libraries of master biases, flat fields, fringe maps, photometric calibrations are maintained and are available for download.

The astrometric calibrations are currently based on the GSC-I (and

### WFS OBSERVATION STATUS AS OF END OF MAY 1999

| Field | Comments | Colours | Area (deg$^2$) |
|---|---|---|---|
| 0219-0500 | XMM region, NVSS & FIRST data | UBRIZ | 3 |
| 0354+0010 | SA95, NVSS & FIRST data | UBVRI(Z) | 4 |
| 0801+4019 | NVSS, FIRST, WENSS data | UBVRZ | 3 |
| Equatorial | Strip 10h<RA<15h, Dec 0d | Br' | 10 |
| Virgo | 12h39m, +12d27m | B | 9 |
| 1610+5430 | ELIAS-N1 region, NVSS, FIRST, WENSS | Z | 3 |
| 2240+0000 | 2dF region, SA114, NVSS & FIRST data | UBVRIZ | 5 |
| Pleiades | 03h47m, +24d00m | IZ | 8 |
| Dalton | 00h20m, +35d10m & 16h30m, +46d25m | BVRi'Z | 5 |
| FSVS | some CHANDRA fields | BVIZ | 10 |

*Notes:*
- *field patches will be 3 x 3 deg$^2$ for all except the Dalton and van Paradijs fields.*
- *exposure times ~600 to 800s per filter (1200s for U), and 2400 to 3600s for the Dalton fields.*
- *the initial runs used the Harris UBVRIZ filter set due to delays in obtaining the Sloan Gunn filters. By July 1999 the g', r' and i' filters had been acquired and are now being used. The U and Z filters are similar to the u' and z' filters. See http://www.ing.iac.es/~quality/filter/filt.html for details.*

soon APM scans of Schmidt plates where available). Internal accuracies are better than 0.1 arcsec with external errors to ~0.25 arcsec.

The catalogue generator produces seeing estimates, sky brightness/arcsec$^2$, limiting magnitudes, etc. These are stored in the FITS headers. Flux calibration will typically be good to 0.05 mag.

## Survey Progress: Data Products

The data products available for access include:

- Observing logs built from the FITS headers.
- A 'sybase' user interface to access. the raw and processed data.
- Library bias frames, flat-field frames, defringing frames and non-linearity corrections.
- Colour equations for all filters.
- Processed 2D image maps, with a full record of processing steps in the FITS headers.
- Astrometric calibration, with the World Coordinate System in the FITS headers.
- Photometric calibration – zero points and extinction.
- Data quality control plots.

In the coming months the data products provided will be expanded to include:

- Object catalogues, generated using APM based routines (Irwin, 1985) and possibly SExtractor (Bertin and Arnouts, 1996) to give positions, magnitudes, image quality, etc. These will be stored as FITS binary tables with original 2-D image frame headers.
- Multicolour object catalogues, with cross-referencing of colour data to provide sub-sample selections based on colour-colour diagrams.
- An improved user interface to the WFS archive via the WWW front end, giving, for instance, the ability to extract arbitrary regions etc.
- Improved cross referencing to other survey data (e.g. FIRST, 2dF, AXAF) available for WFS fields.
- Association with reddening maps and HI maps. ¤

Nic Walton (naw@ing.iac.es)

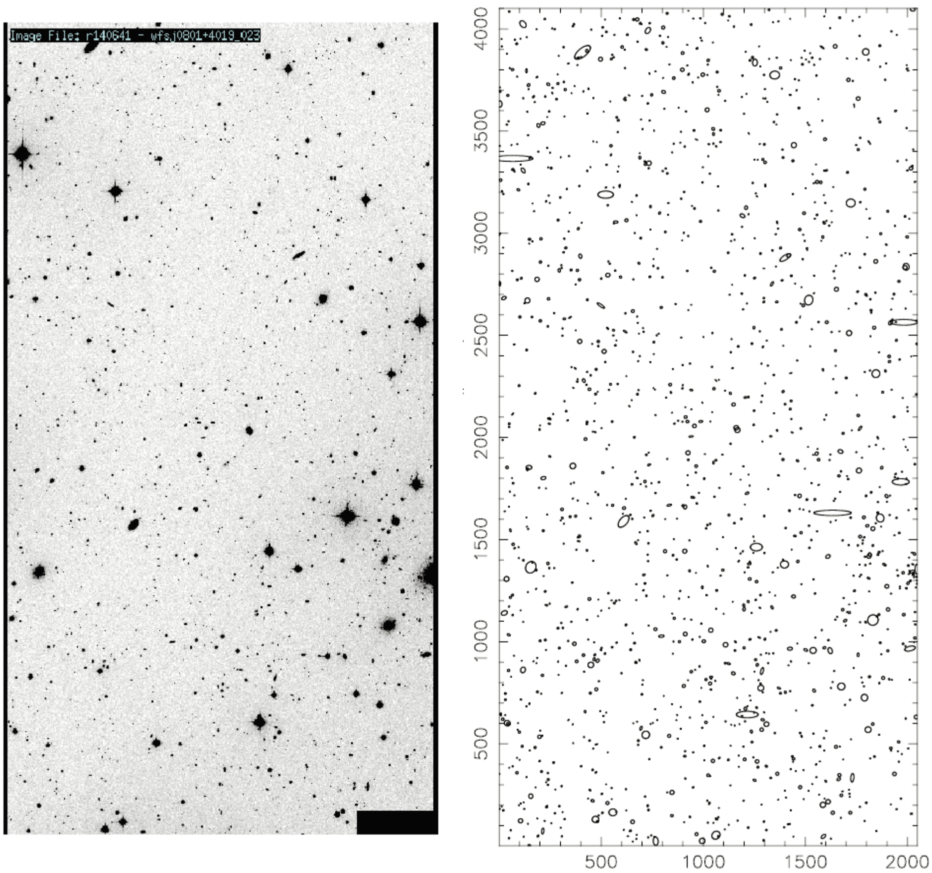


*Figure 1. A processed 600 s R band image (1.0 arcsec image quality, ~11 x 22 arcmins, this being one of the four images obtained in each exposure) is shown in the left panel, with the APM object catalogue representation on the right (~1600 objects are identified in this at the 5 sigma detection level).*

# Extragalactic Stellar Spectroscopy

D.J. Lennon (ING), S.J. Smartt (ING), P.L. Dufton (QUB), A. Herrero (IAC), R.-P. Kudritzki (Uni-Sternwarte, Munich), K. Venn (Macalaster College), J. McCarthy (CalTech)

The advent of large 8–10 m telescopes heralds a new age in stellar astronomy. It is now possible to carry out detailed spectroscopic observations at high resolution of the brightest stars of galaxies in the Local Group, and it is envisaged that intermediate resolution observations will be extended to stars in the nearest galaxy clusters such as Virgo and Fornax. For some years the authors have been carrying out the groundwork involved in identifying young massive supergiant stars in nearby resolved galaxies, with a view to performing follow-up detailed studies of selected samples. In this article we summarize the contribution that the William Herschel Telescope has made to this project, and further, show that even a 4.2 m telescope with a blue sensitive, large format CCD at a good site with dependable sub-arcsecond seeing can make an important contribution to the detailed study of our nearest spiral neighbours M31 and M33.

We have two primary objectives in the study of massive stars in nearby galaxies; one is to use these objects as probes of the present day chemical composition and the second, which will not be discussed in detail here, is their use as standard candles. Blue supergiant stars have absolute visual magnitudes in the range –7 to –10, and may be conveniently split into B-type and A-type stars. The B-type objects typically have broader lines (with widths corresponding to Doppler velocities of 50–100 km/s) and have many strong isolated lines of light elements such as C, N, O, Si, and Mg. A-type supergiants on the other hand have somewhat narrower line-widths and many weak lines of Fe-group, s- and r-process elements. Hence a detailed analysis of a sample of these objects can provide very powerful constraints on models of a galaxy's evolution. However as AB-type supergiants are relatively young stars, we are restricted to galaxies with active star formation, typically spirals and dwarf irregular galaxies. In the rest of this article we will concentrate on some work which has been performed on M31, the largest and most luminous galaxy in the Local Group.

The brightest stars in M31 were originally studied spectroscopically by Humphreys (1979), from a sample selected from photographic photometry. The selection was performed on the basis of magnitude and colour, and we have essentially repeated this selection using the CCD photometric catalogue of Magnier (Magnier et al., 1992 and Haiman et al., 1994). Our colour magnitude diagrams covered $16.0 < V < 18.5$, and colour range $B-V < 0.4$, within which single O, B, A and F-type supergiants members of M31 should lie. These criteria resulted in a sample of several hundred blue supergiant candidates. At the distance of M31, 1 arcsec corresponds to 3.4 pc and hence some of our chosen objects turn out to be composites, with spectral signatures of two (or more) stars of differing spectral types.

Additionally the highly variable reddening across M31 requires that the red cut-off is relatively high, which then encroaches on the colour-magnitude region occupied by Galactic foreground late types and subdwarfs. Hence low-resolution spectroscopy is an essential filter for target identification.

The combination of AutoFib2 and WYFFOS on the WHT is ideal for this kind of project – approximately 90 science fibres can be placed within the 1 degree un-vignetted field of view at Prime. We match the Magnier CCD colours of our selected objects to the astrometric coordinates from APM plate scans to provide the necessary accuracy (0.2 arcsec) for AF2 fibre placement and consistency with fiducial guide star positions. We have already had a successful observing run in December 1997 when we obtained spectra of approximately 100 supergiants in M31, with another

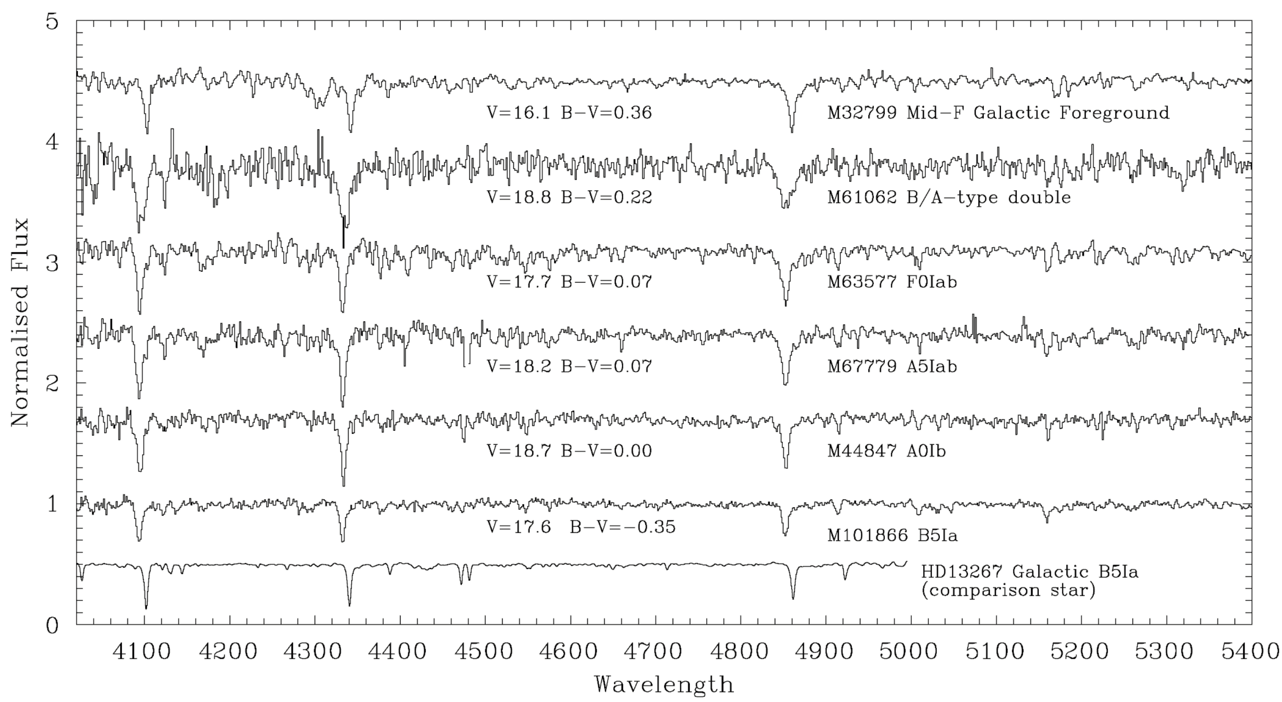


*Figure 1. Four massive supergiants spanning the spectral range mid-B to mid-F are shown from the AF2/WYFFOS run in December 1997. Their spectra are velocity shifted by approximately –550 km/s, consistent with membership in the SW spiral arms of the galaxy, and the visible lines are consistent with them being single evolved massive stars with the given spectral types. We show a nearby Galactic spectral standard (HD13267), convolved to the same resolution as the WYFFOS spectra. Visible in the B-type spectrum are lines of He I, Si II and Mg II, and as He I disappears in the later types Si II 4128–30 and Mg II become stronger and Fe II (e.g. 4173–8) starts to appear. The Fe II lines are clearly visible in the F0Ib spectrum along with additional lines of Sr II and Ti II. Also shown are examples of a composite spectra, M61062 (the hydrogen lines are clearly split, and of approximately twice the strength of late-B early A-types) and a late-type Galactic foreground star, M32799).*

run scheduled in autumn 1999. With a spectral resolution of 2.5Å, we are able to reliably classify large numbers of targets, and typical results from these observations are shown in Figure 1.

Follow-up ground-based high resolution spectroscopy is also planned and in fact this has already begun with some successful runs on the Keck I with the HIRES spectrograph (McCarthy et al. 1997, Venn et al. 1998). For M31 however, a lot can be achieved for B-type supergiants with intermediate resolution spectroscopy, concentrating on the strong lines in the earlier spectral types. Last year, we were fortunate enough to have a WHT/ISIS observing run with sub-arcsecond seeing (0.4 arcsec at one point), during which we obtained medium resolution (1Å FWHM spectral resolution) spectra of 18th magnitude supergiants. Early B-type supergiants have a strong tendency to show relatively broad metal line widths (e.g. virtually always having velocity broadening of greater than 60 km/s; Howarth et al., 1997) thus a spectral resolution of 1Å is sufficient to satisfactorily sample the line widths. One setting with the new EEV42-80 CCD on the blue arm of ISIS allows coverage from 3960 to 4720Å together with excellent efficiency. This provides all the blue atmospheric diagnostics required for model atmosphere analyses – allowing *detailed* abundance determinations in stars down to V~18.5 on a 4 m telescope. The quality of the spectra are shown in Figure 2, and compared to the spectrum of a nearby, Galactic standard B-type supergiant. This demonstrates quite clearly that the metallicities of the M31 supergiants are close to solar, which is not entirely unexpected given that the galactocentric radius sampled by our objects is expected to have roughly solar metallicity from H II region results (Blair et al., 1982).

Blue supergiants can also be used as standard candles as their mass-loss rates provide an estimate of their luminosity. The most important diagnostic of mass-loss in this context is the profile of the Hα line, which for the most luminous supergiants is in

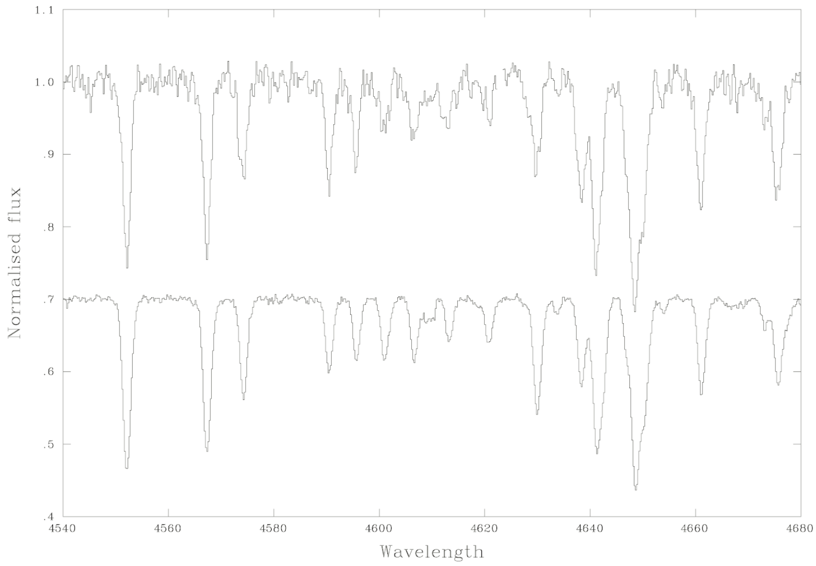


*Figure 2. This figure compares spectra of the M31 and Galactic B1Ia supergiants OB78-159 (top) and HD194279 (bottom). The spectral range covered contains the Si III triplet at 4553/4567/4574 Å, and a number of O II and N II lines between 4590 and 4680 Å. The M31 spectrum is a 1 hour exposure obtained with ISIS on the WHT at a resolution of 5000 in half-arcsecond seeing, the star has a visual magnitude of 17.97. The difference in the line strength ratios of O II 4590/4596 Å and the N II lines at 4601/4607 for example, is due to a slight temperature difference, OB78-159 being the hotter star. The detailed model atmosphere analysis of OB78-159 is underway, however we can already see that the metal line spectrum is consistent with a composition similar to supergiants in the solar neighbourhood.*

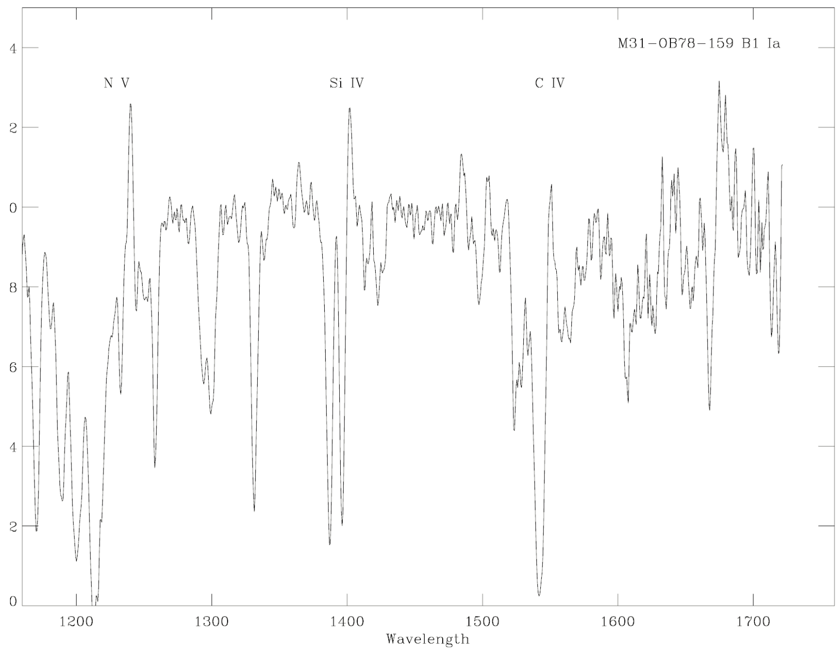


*Figure 3. HST/STIS spectrum of OB78-159 obtained in 3 orbits using the G140L grating, long slit and FUV-MAMA detector and a total exposure time of approximately 8000 seconds. Strong P-Cygni wind lines of N V, Si IV and C IV are clearly visible and can be used to derive the terminal velocity of the stellar wind.*

emission. Ideally one also requires observational constraints on the wind velocity law and terminal velocity which are best derived from ultraviolet spectra which contain strong wind lines. M31, together with the Magellanic Clouds, are important test beds for this approach. The most luminous stars are within the reach of the Hubble Space Telescope (HST) and its UV spectroscopic instruments and there is an ongoing HST spectroscopic campaign to obtain UV spectra of blue supergiants which have been well observed from the ground. The first such spectrum from the M31 campaign, obtained in January this year, is shown in Figure 3 for the B1Ia supergiant OB78-159 discussed above.

This project is continuing with the ING's wide field imaging and spectroscopic facilities, the Wide Field Camera and AF2/WYFFOS, which will lead to the detailed follow-up programs. We can already use ISIS on the WHT for detailed analysis of the brightest stars in interesting nearby galaxies such as the other Local Group spiral M33 and the dwarf irregulars like IC10, IC1613 and NGC6822. For the A-type supergiants (at higher resolution), and objects further afield we plan to extend this work using facilties on Gemini North (GMOS-N) and South (GMOS-S, HROS).

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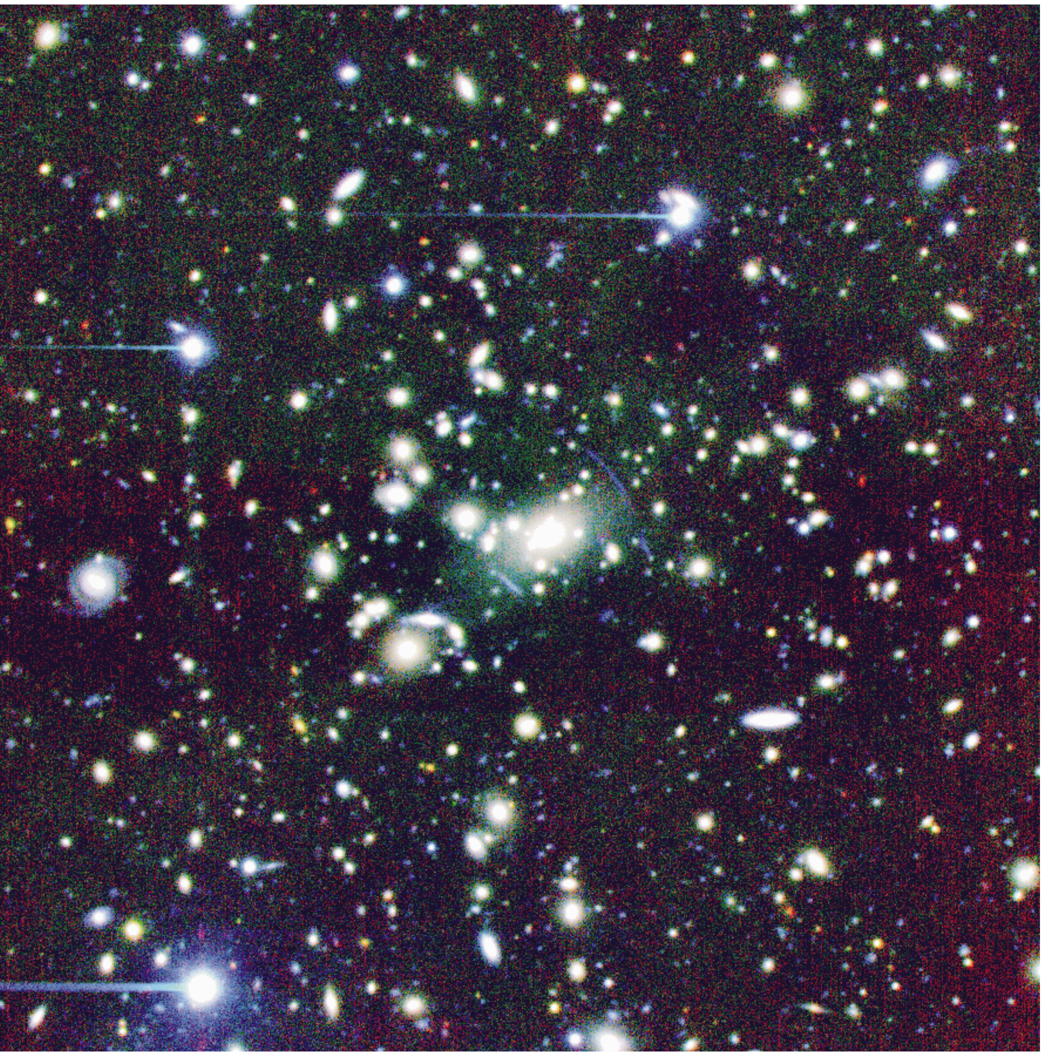
Danny Lennon (djl@ing.iac.es)

# The Cluster of Galaxies Abell 2219 as seen by CIRSI



*CIRSI is a panoramic wide field near infrared imaging camera which uses 4 Rockwell HgCdTe 1024 x 1024 detectors. The survey instrument is as scientifically versatile and as easy to use as a large format CCD camera and was first used on the INT in December 1997. It is particularly well-suited for surveys of star-forming regions, low mass stars, distant galaxies, clusters and QSOs. The CIRSI Project team consists of Dr Martin Beckett (Project Engineer), Dr Richard McMahon (Project Scientist), Dr Craig D Mackay (Project Manager), Mr Michael Hoenig (Graduate Student) with additional support from the rest of the Instrumentation Group at the IoA and many others.*

*The rich cluster of galaxies Abell 2219 (z=0.228) is a massive gravitational lens. This picture shows a 3 colour image of the galaxy cluster based on a 2.5 hour H band exposure obtained with CIRSI combined with B and I band optical CCD images. This image was obtained on the 4.2 m William Herschel Telescope in June 1998. It reveals evidence for lensed features. The observations are being used to trace the dark matter distribution within the cluster The field of view is 4.8 arcmin x 4.8 arcmin and the measured seeing in H band images is 0.7 arcseconds (this image is courtesy of Richard McMahon and Konrad Kuijken).*

# TELESCOPES AND INSTRUMENTATION

## Adaptive Optics at the WHT

Jeremy Allington-Smith, David Buscher, Richard Myers (University of Durham)

June 1999 on the WHT saw two runs with the University of Durham ELECTRA Adaptive Optics (AO) system. The first seven nights were for commissioning various new features and the remainder for service mode AO observing. The new features included the Durham TEIFU integral field unit which can feed WYFFOS with adaptively corrected optical spectra from 500 sky elements simultaneously. This capability will soon be enhanced to 1000 elements (hence TEIFU: Thousand Element Integral Field Unit).

### ELECTRA

Adaptive optics is familiar from CFHT's Pu'eo system and Adonis on the ESO 3.6 m and it is also now being introduced on larger telescopes such as Keck and Gemini. The idea of AO is to sense the instantaneous deformations which atmospheric seeing induces on astronomical wavefronts and to correct them in real-time using some form of adaptable mirror. This is illustrated schematically in Figure 1. The light to sense the wavefront distortions must at present come from a relatively bright guide star located within at most an arcminute or so of the science target. In future, however, this limitation will be largely overcome by the introduction of artificial laser guide stars created by resonant scattering of laser light in the upper atmosphere.

ELECTRA is quite a high-order system, having 228 degrees-of-freedom altogether and is designed to operate at short wavelengths, with partial correction available in the optical V, R and I bands as well as correction in the near-IR. In June the two modes available were near-IR imaging with the 1–5 micron 256×256 pixel imager WHIRCAM and optical area spectroscopy with TEIFU.

ELECTRA operates at the GHRIL bench at WHT Nasmyth as illustrated in Figure 2. The optical layout is illustrated schematically in Figure 3. ELECTRA's main subsystems are its adaptive mirror, wavefront sensor (WFS), tip-tilt mirror, calibration unit and computer control system.

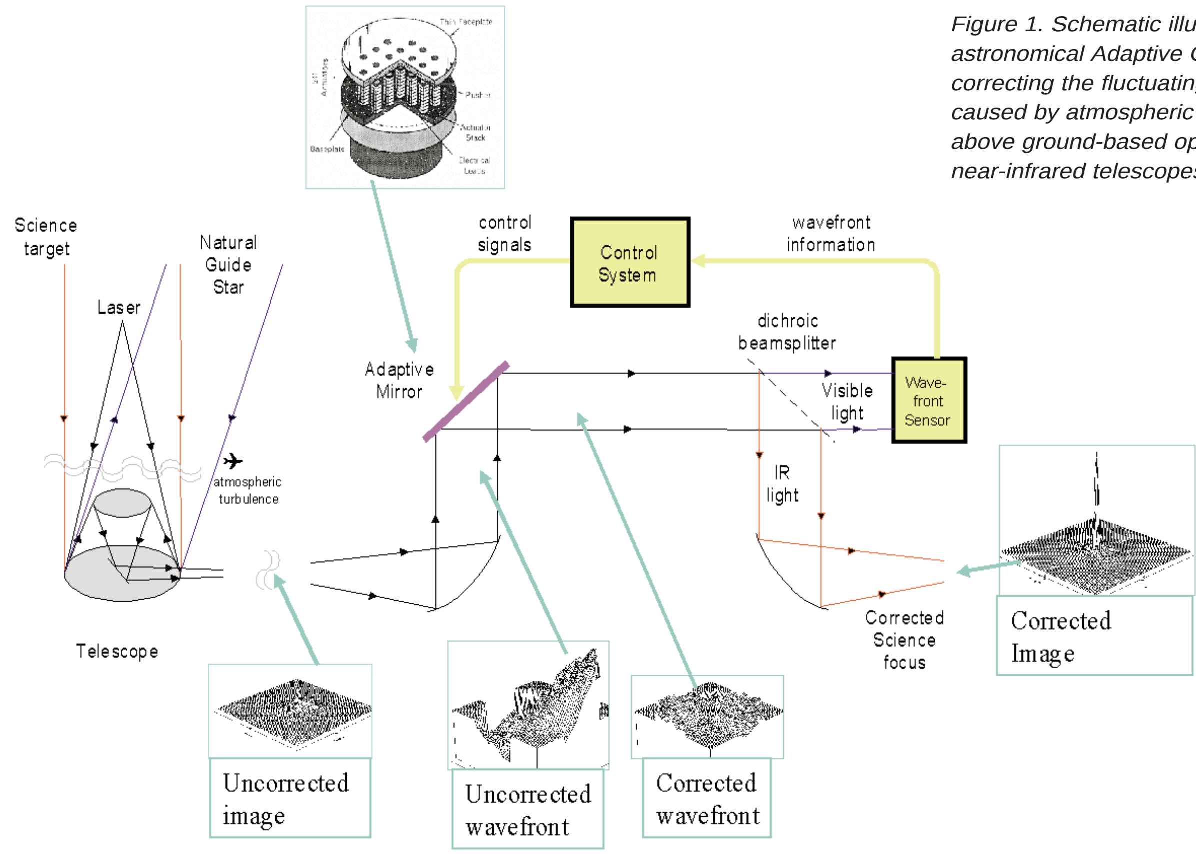



*Figure 1. Schematic illustration of astronomical Adaptive Optics for correcting the fluctuating aberrations caused by atmospheric turbulence above ground-based optical and near-infrared telescopes.*

The adaptive mirror was built by TTC in San Diego. It has 76 segments each of which can tip, tilt and piston (hence 228 degrees of freedom) under computer control and is equipped with strain-gauge position feedback which ensures a linear response to wavefront correction commands.

The WFS is a Shack-Hartmann sensor which uses a camera built at RAL and based on an 80×80 pixel EEV CCD-39. This camera can read out up to 2 million pixels per second from each of four readout ports. These signals are processed by an array of eight Digital Signal Processors (DSPs) in order to produce wavefront reconstruction commands which are then passed to an additional bank of eight DSPs. This second back uses digitised feedback from the adaptive mirror strain-gauges to accurately place the required wavefront correcting figure on the mirror.

Near-IR seeing correction with ELECTRA is illustrated in the ‘before’ and ‘after’ correction images of Figures 4a and 4b. The service mode AO data will be reduced by the requesting observers but an early indication of the subarcsecond detail available is illustrated in the raw image of a planetary nebula in Figure 4c.

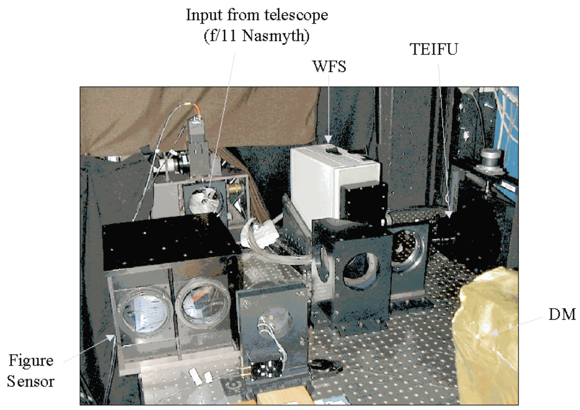



*Figure 2. Schematic layout of ELECTRA at GHRIL (WHT).*

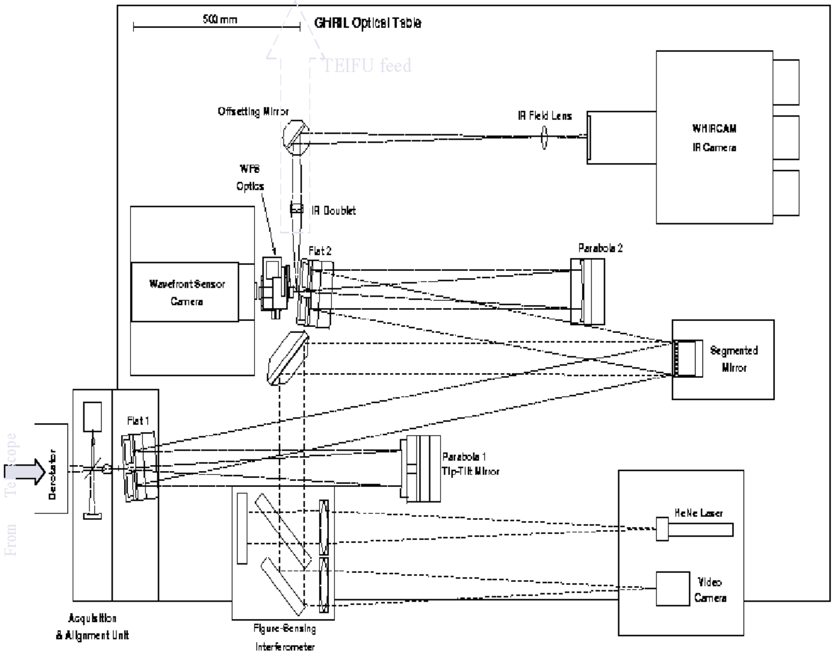
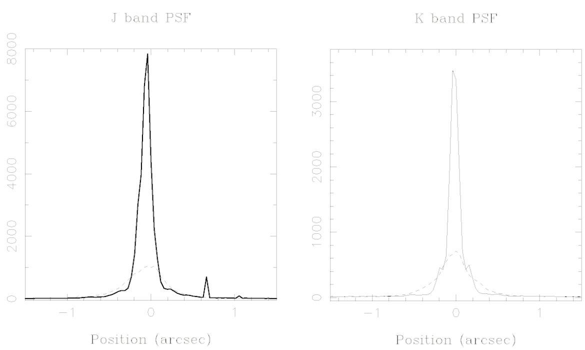
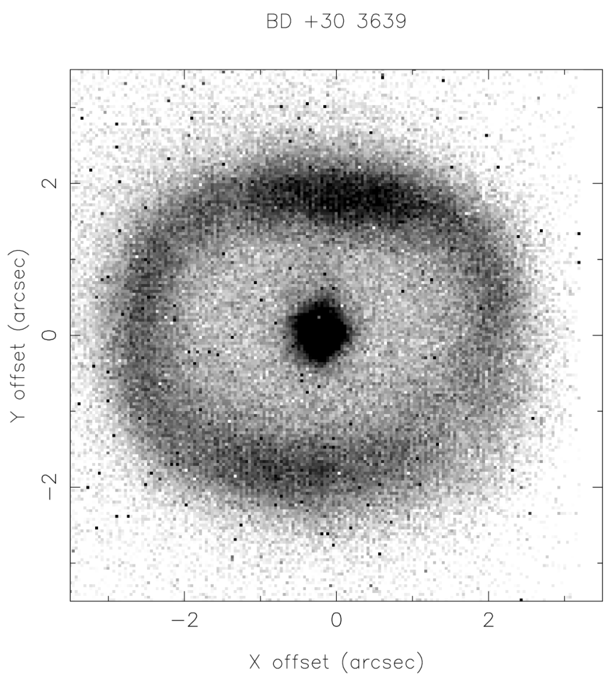



*Figure 3. Schematic layout of ELECTRA at WHT/GHRIL.*

*Figure 4. (a) ELECTRA K-band image before and after correction (b) ELECTRA J-band image before and after correction (c) Raw WHIRCAM image of planetary nebula taken with ELECTRA AO. The core of the central star image has an angular size of <0.2 arcsec, but the ring appears not to have any structure on scales smaller than ~0.5 arcsec.*



## NAOMI

ELECTRA is a complete AO system in its own right but has also been the means of developing the real-time control system of NAOMI (Nasmyth AO for Multiple Instrumentation). Unlike ELECTRA which is always supported by a team of at least two staff from Durham, NAOMI is an ING facility which will be permanently available at the WHT and will integrate fully with the instrumentation and telescope. It also has a more sophisticated guide star pick-off method than ELECTRA and will ensure optimum IR imaging with simultaneous correction at an optical port over a wide range of guide star separations. It is designed to work with considerably fainter guide stars and also has an upgrade path for working with a laser guide star.

The opto-mechanical and system software components of NAOMI are approaching completion at the UK Astronomical Technology Centre in Edinburgh. These components will then be shipped to Durham for final integration with the adaptive system in October of this year. The complete system will then be commissioned on the WHT commencing in April next year, after which the system will be available to the community. Judging by the volume of service proposals to use ELECTRA we anticipate a healthy uptake.

## TEIFU

The TEIFU system will be available for use with both ELECTRA and NAOMI. It is a lenslet-fibre areas spectroscopy system with consequently very high spatial fill-factor. A schematic illustrating its mode of operation is given in Figure 5. At present it feeds WYFFOS in the 300–1000 nm wavelength range and has a single field with 28×18 elements each with an angular extent of 0.25 arcseconds. In future it will have two separate fields with 1000 elements in total. These fields will have variable separation for simultaneous object and sky observation and will be available at three different image scales:

| | | | |
|---|---|---|---|
| *Sampling:* | 0.125 | 0.25 | 0.50 arcsec |
| *Field:* | 2×(3.5×2) | 2×(7×4) | 2×(14×8) $\mathrm{arcsec}^2$ |

In future TEIFU will also benefit from a new long camera on WYFFOS giving better sampling. TEIFU will also be adapted for operation in the near-IR.

The characterisation of TEIFU has been very pleasing showing around 50% throughput with an rms fibre-to-fibre uniformity of 6%. An example set of TEIFU spectra from the galaxy 3C327 is shown in Figure 6.

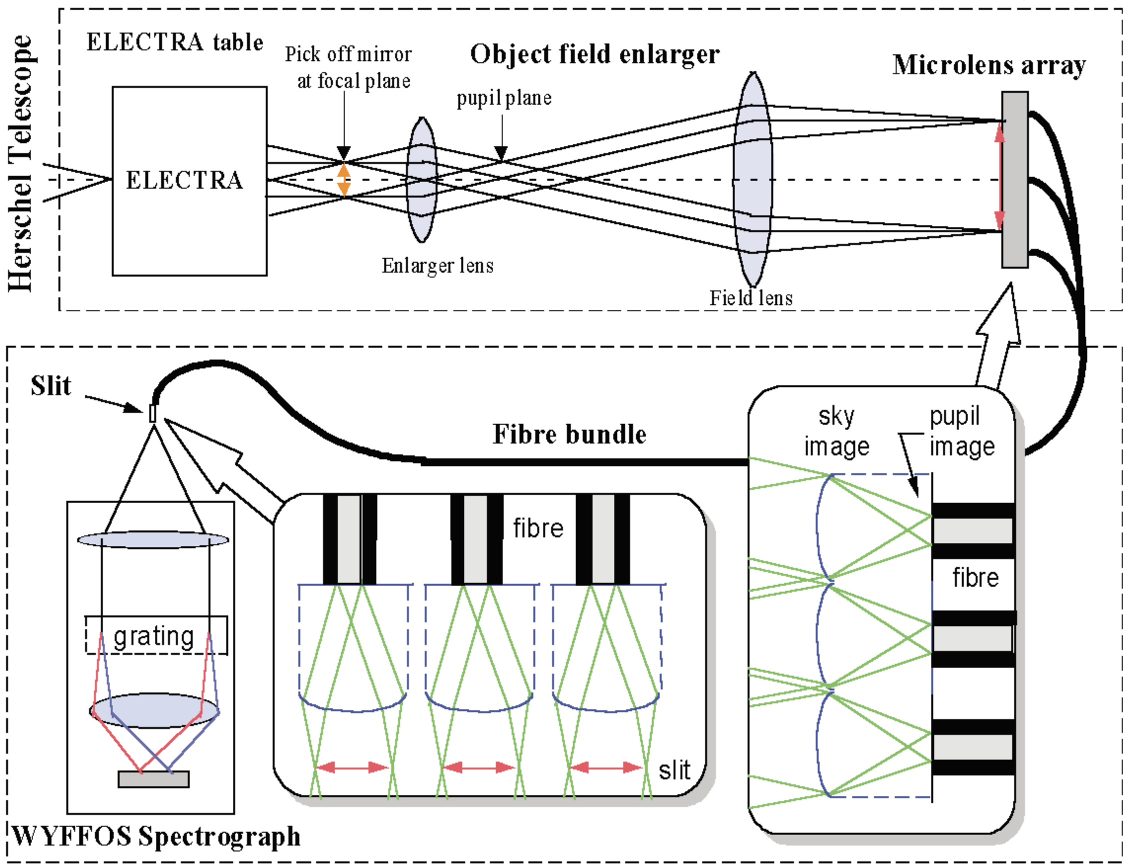



Figure 5. Principles of Operation of TEIFU.

## Acknowledgements

We would like to thank all AO and TEIFU staff at Durham without whom nothing would exist at all, Dr. Nick Waltham's CCD group at RAL for their great work on the WFS, all ING staff involved in the run for their invaluable help, and, in particular, Andy Longmore at UKATC (who would be a co-author if he were not currently observing elsewhere!) for his crucial contribution throughout. Funding was kindly provided by PPARC, the Royal Society Paul Instrument Fund (which funded the WFS) and the University of Durham. ¤

Jeremy Allington-Smith
(J.R.Allington-Smith@durham.ac.uk)

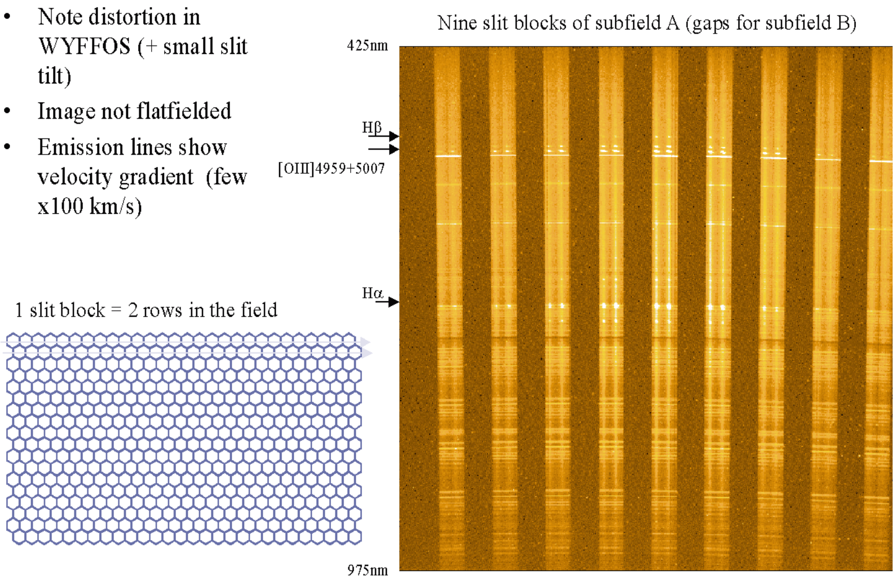



*Figure 6. 3C327 raw TEIFU spectra.*

# INGRID: A New Near-IR Camera for the WHT

## Chris Packham (ING)

The new near-IR camera to be operated at the WHT is now nearing completion ready for its commissioning date, now set for January 2000. INGRID (the Isaac Newton Group Red Imaging Device) was designed and partially built by the RGO and finished at the ING during the last year.

At INGRID's heart is a 1024×1024 pixel HgCdTe array developed by Rockwell International Science Centre and the University of Hawaii, which features good sensitivity from 0.8 to 2.5µm. The sensitivity of the Hawaii array is very competitive compared with that of a standard optical CCD from a wavelength of 0.8µm as shown in Figure 1. INGRID will typically be mounted at the folded Cassegrain focus near-IR port of the WHT, opposite to the optical auxiliary port imaging CCD camera, to provide a plate scale of 0.25 arcseconds per pixel to give a field of view of 4.27×4.27 arcminutes. This will allow rapid changes between optical to near-IR imaging facilitating colour mapping. INGRID will also be used in conjunction with NAOMI (described by Jeremy Allington-Smith et al. in this newsletter) as the imaging camera. With NAOMI, the pixel scale is 0.04 arcseconds per pixel in order to exploit the high resolution NAOMI can provide at near-IR wavelengths.

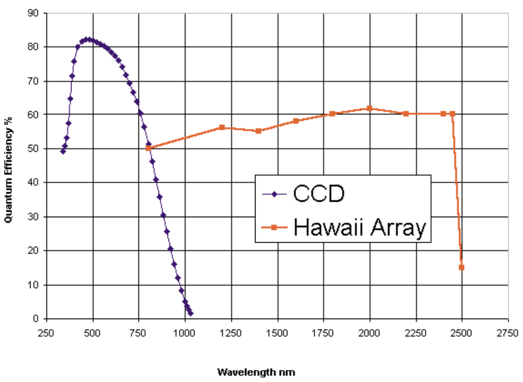



*Figure 1. Quantum Efficiency of a Hawaii Array compared to that of a CCD.*

Current members of the INGRID team include Gordon Talbot (project manager), Chris Packham (project scientist), Paul Jolley, Kevin Dee and Bart van Venroy (mechanical), Simon Rees & Mathieu Bec (software), Peter Moore (detector), Sue Worswick (optics) and Andrew Humphrey (librarian). The ATC and the IAC also provide valuable help as does Keith Thompson, the ex-RGO project scientist.

At the time of writing we are preparing to enter the performance and science verification stage. We envisage this stage to take around three months for precise characterisation and alignment of all elements of INGRID. Some initial verification has already been successfully achieved but many hurdles remain to be overcome. Shortly after the commissioning phase the ING will offer several nights of service time earmarked for INGRID observations to allow rapid science exploitation of the unusual capabilities INGRID can deliver. Please watch the INGRID's WWW for more information on this:

http://www.ing.iac.es/IR/INGRID/ingrid1_home.htm

The main design criteria for INGRID is excellent optical quality ready for the integration with NAOMI. The optics are all-refractive in design and are split into two parts. The camera is placed within the cryostat to minimise thermal background, and requires an alignment accuracy of 20µm between the four lenses. As ING will offer INGRID at two focal station, two warm collimators are available which enable a change of focal station without thermally cycling the cryostat. In order to minimise thermal background, selectable pupil stops are included which effectively undersize the secondary mirror and obscure the virtual image of the Cassegrain hole. Precise alignment of INGRID to the WHT science beam is achieved through a retractable pupil imaging mechanism that will allow alignment during the day.

A filter set is available which includes the standard Z, J, H, K and Ks broad band and 10 narrow band filters (see WWW page for details). All of these filters were purchased through the Gemini filter buying consortium and hence will provide INGRID users with data that is completely comparable to data obtained at many of the 8 m class telescopes. The filters are of excellent optical quality and are fully adaptive optics compliant for use with NAOMI.

During runs at the folded Cassegrain focus, INGRID will use a closed cycle cooler to remain cold. For rapid cool-downs and completely vibration free observations during NAOMI runs, we will use liquid nitrogen cooling. There are several read-out modes available for INGRID but all feature a full frame readout in 1.5 seconds. The typical readout mode will be double correlated sampling, but others include windowing (for high-speed observations), multiple non-destructive reads (for reduced read noise), image co-average (for reduced dead-time) and movie mode (for target acquisition). The dark current is low and as the read-noise of a double correlated sample is low (expected to be ~10 $e^-$ or lower per read), most exposures will be sky noise limited. All images are automatically displayed on an IRAF display tool that also plots the seeing and sky background against time. Pixel saturation is notified to the observer via a colour change of the affected pixels as seen on the display tool.

Estimates of the throughput of INGRID suggest a similar sensitivity to that of WHIRCAM but with a much lower thermal background and a gain in sky coverage of a factor greater than 17. The limiting magnitude, based on a 9000 second on-sky observation of a stellar source in 1″ seeing, is 24.3, 23.1 and 22.1 mag at J, H and Ks respectively. Observing is facilitated via the use of pre-prepared observatory and user generated UNIX scripting.

The potential science applications for INGRID are numerous, especially when integrated with NAOMI. Applications include quasar host detection, probing the centres of active galactic nuclei, brown dwarf detection, planetary nebulae, young stellar objects, crowded field photometry, etc. At the folded Cassegrain focus INGRID will be able to improve on the observations of WHIRCAM as well as providing the opportunity to observe from U to K. As INGRID will typically be mounted cold at the folded Cassegrain focus, target of opportunity observations (such as gamma ray bursts, supernova, etc.) are ideal for this instrument. ¤

Chris Packham (cp@ing.iac.es)

# Super Cool Technology

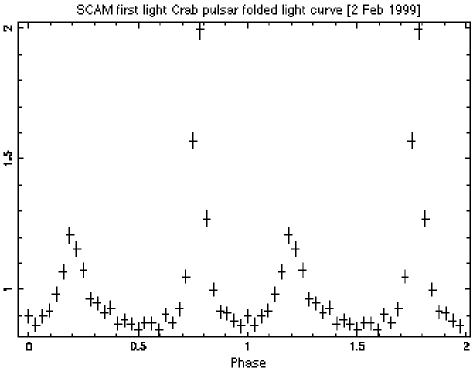
Peter Moore (ING), Nicola Rando (ESA)

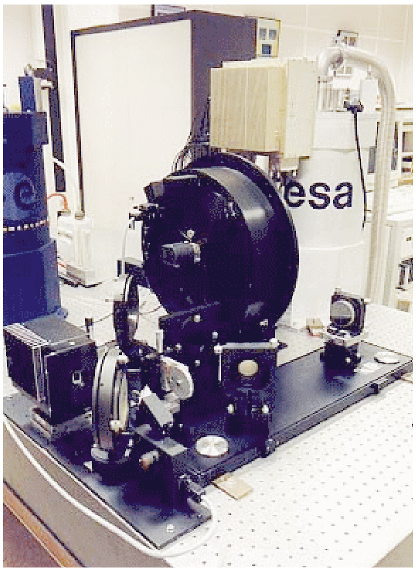
Historically, technological advances have literally opened up the sky for groundbreaking discoveries in astronomy. Such examples of this are the impact of CCD technology on photon-starved spectroscopy and the extension of the observable universe through infrared detectors. We here at Isaac Newton Group are privileged to be part of just such a technological advance, which promises to allow a more complete understanding of the universe.

On the evening of February 2nd this year, 'First Astronomical Light' was seen by a novel photon detector device, an array of superconducting tunnel junctions. These junctions, arranged into a small array, allowed us to measure simultaneously the time of arrival, the energy, and the spatial distribution of photons arriving from the Crab nebula. In contrast to current astronomical detectors, the Superconducting Tunnel Junction (or STJ) allows these three crucial parameters to be measured by one detection device in real time with very good quantum efficiency across a large wavelength range. The results of this first light technology proving run are published in *Astron & Astrophys*, **346**, L30 (1999). Figure 1 shows an extracted light curve of the Crab pulsar derived from this work.

A dedicated team of scientists and engineers at the Astrophysics Division of the European Space Agency (ESA) have brought this technology to fruition by adapting materials and techniques from X-ray detector technology to the visible and infrared spectrum. The instrument built by this team to demonstrate the STJ technology is called S-CAM (Figure 2) and combines the 6×6 pixel STJ array with stand alone support and acquisition equipment. This instrument couples to the Ground Based High Resolution Imaging Laboratory (or GHRIL) focal station of the William Herschel telescope and provides a limited field of view of 4×4 arcseconds within 36 pixels.

The principle of operation for the STJ detector, electron tunnelling, is exploited by sandwiching a thin insulating layer between two superconducting layers with attached electrodes. The energy gap of the superconducting material determines the intrinsic energy resolution as well as the operating temperature of the detector. In the S-Cam case, with Ta based STJs, the intrinsic resolving power ($\Delta\lambda$ fwhm) corresponds to 17 at $\lambda$ = 500 nm, at an operating temperature of about 300 mK. The actual instrument energy resolution is degraded by




*Figures 1 and 2. The Crab pulsar light curve (above) and the S-CAM Instrument (right).*

electrical and thermal background induced noise. By applying a small bias voltage across the junction and a suitable parallel magnetic field to suppress the Josephson current, an electrical charge proportional to the energy of the perturbing photon can be extracted from the device.

The introduction of the STJ as an astronomical detector is in many ways the natural next step beyond the CCD detector. In the latter silicon-based devices, the band gap between the ground state and the state excited by the absorption of an optical photon is comparable to the photon energy. As a consequence, only a single electron is extracted from the detector per absorbed photon irrespective of its energy. In contrast, the equivalent energy gap of superconducting niobium is some three orders of magnitude lower, which means that of the order of one thousand electrons are released per detected optical photon. More importantly the amount of charge generated is proportional to the energy of the absorbed photon. Thus by measuring the charge released by each detected photon, these can be sorted in energy to an accuracy limited by intrinsic detector resolution and by any additional electrical and thermal background induced noise. For a given junction geometry, the achievable wavelength resolution $\Delta\lambda$ varies as $(\lambda^{3/2})\times(\delta^{1/2})$, with $\delta$ being the superconductor energy gap. STJ based detectors have demonstrated the capability to provide spectroscopic information over a large energy range, from the NIR to the UV. By arranging a number of STJ devices into a two dimensional array, a true 'three dimensional' astronomical detector can be constructed, whose output is not just the number of photons registered in each pixel of the image, but their distribution in energy throughout the UV, visible and near-IR.

Having achieved successful first light, the team at ESA is now enhancing the S-CAM in light of the experience gained from the February run. These enhancements among other things include a slightly larger field of view (6×6 arcsec.) and increased bandwidth in the electronic processing to allow a higher dynamic range of stellar magnitudes. The awaited return of S-CAM to the WHT will take place in early December this year. It is anticipated that in parallel to the science projects to be conducted with S-CAM, development work will continue on the detector devices and their application to astronomy. In the forthcoming future this will allow a common user instrument to be offered by the ING with this unique detector technology at the WHT.

The impact that STJ detector technology will have on instrumentation for astronomy will be significant. Having the detector quantify photon energy theoretically removes the requirement for much of the optical processing of the instrument thus allowing all photons collected by the telescope to be gainfully measured, thus improving sensitivity dramatically. Time resolution photometry at different wavelengths becomes a parallel dream! Wide band imaging, from UV to IR, possible with just one detector! The potential of this technology lies in wait to reveal Nature's true colours!

Figure 3 shows the spectrum obtained with a Ta based device by setting the monochromator at 1.2 microns and removing the order separating filter. The spectrum spans wavelengths from 300 nm in the near UV to 1.2 microns in the near-IR, and shows the simultaneous detection of four spectral orders of the monochromator output.

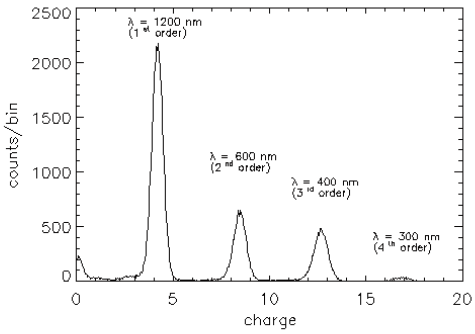



*Figure 3. Wide band response of STJ.*

Further information on STJ detectors and S-Cam can be found at the following URLs:

http://astro.estec.esa.nl/SA-general/Research/Stj/STJ_main.html

http://astro.estec.esa.nl/SA-general/Astronews/37-html/an37.html#stj

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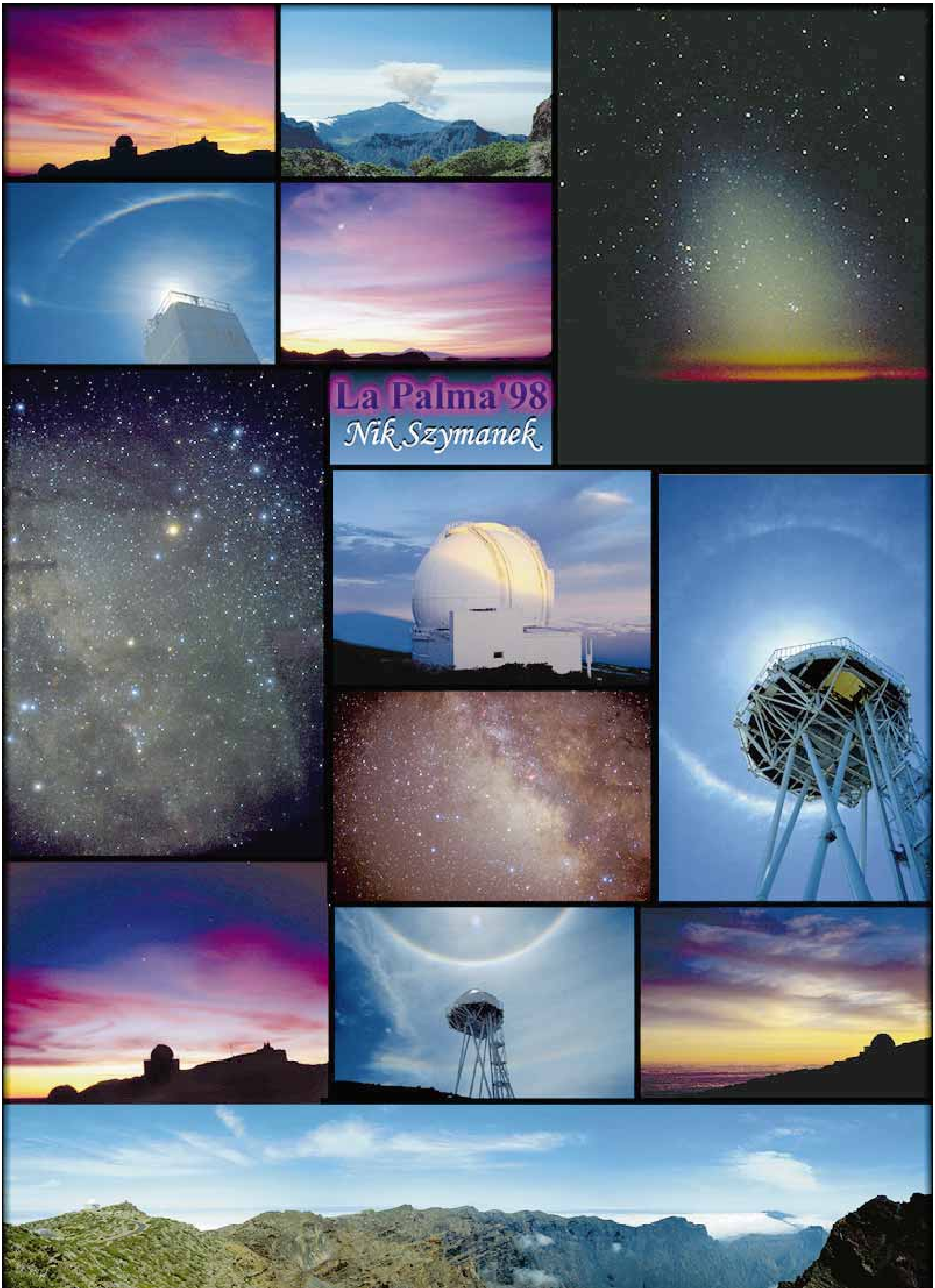
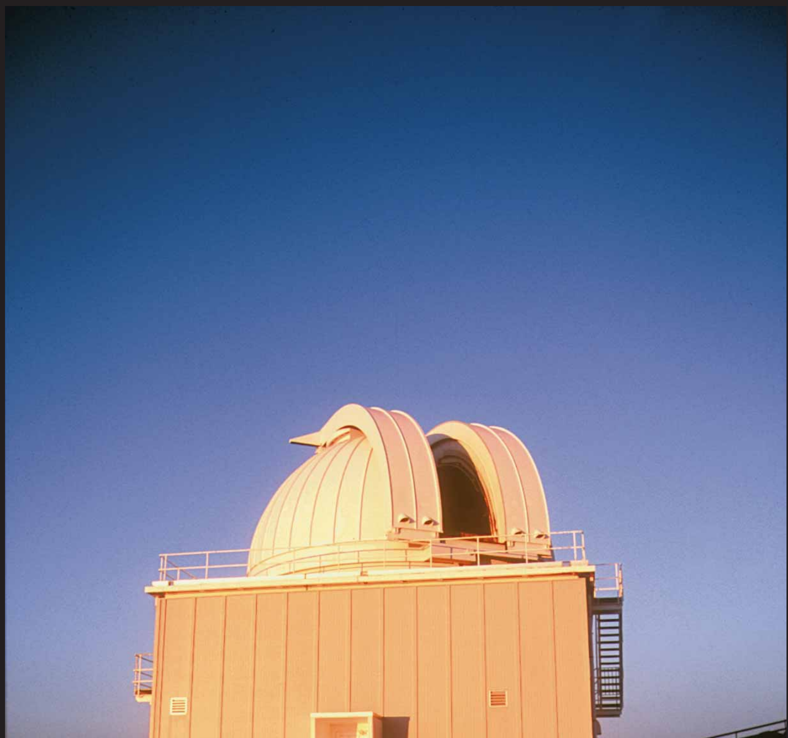
Peter Moore (pcm@ing.iac.es)


La Palma'98
Nik Szymanek

# The Isaac Newton Group of Telescopes

## Roque de Los Muchachos Observatory, La Palma



4.2m William Herschel Telescope

1.0 m Jacobus Kapteyn Telescope

2.5 m Isaac Newton Telescope

The Isaac Newton Group of Telescopes (ING) consists of the 4.2 m William Herschel Telescope (WHT), the 2.5 m Isaac Newton Telescope (INT) and the 1.0 m Jacobus Kapteyn Telescope (JKT), and is located 2,350 m above sea level at the Roque de Los Muchachos Observatory (ORM) on the island of La Palma, Canary Islands, Spain. The WHT is the largest telescope in Western Europe.

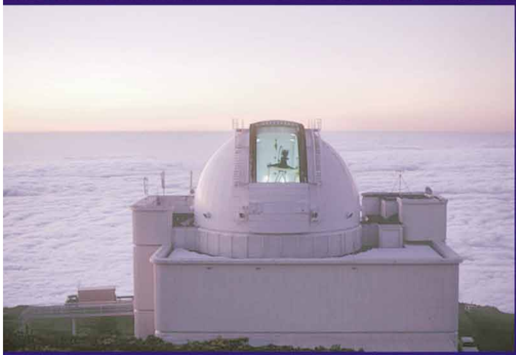
The construction, operation, and development of the ING telescopes is the result of a collaboration between the United Kingdom, the Netherlands and Eire. The site is provided by Spain, and in return Spanish astronomers receive 20 per cent of the observing time on the telescopes. The operation of the site is overseen by an International Scientific Committee, or Comité Científico Internacional (CCI).

A further 75 per cent of the observing time is shared by the United Kingdom and the Netherlands. The University of Porto (Portugal) has 28 nights of observing time on the JKT and access to the INT and WHT under open competition with other astronomers. The allocation of telescope time is determined by scientific merit. The remaining 5 per cent is reserved for large scientific projects to promote international collaborations between institutions of the CCI member countries.

The ING operates the telescopes on behalf of the Particle Physics and Astronomy Research Council (PPARC) of the United Kingdom and the Nederlandse Organisatie voor Wetenschappelijk Onderzoek (NWO) of the Netherlands. The Roque de Los Muchachos Observatory, which is the principal European northern hemisphere observatory, is operated on behalf of Spain by the Spanish Instituto de Astrofísica de Canarias (IAC), as the Teide Observatory on Tenerife is.

Credits: The pictures shown on this poster are courtesy of Nik Szymanek and Ian King.


La Palma '99



# Instrumentation Plans for the ING Telescopes

René Rutten (Director ING)

Observational astronomy has entered a phase of rapid change. The advent of a new generation of large ground based optical and infra-red telescopes has opened up new exciting possibilities for astronomical research and already has had a profound impact on key areas of astronomical research. These new facilities imply a shift in scientific emphasis of the smaller telescopes. Equally important is the economic impact of these new facilities as resources will naturally flow towards the largest telescopes and consequently the operation and development programmes for small and medium size telescopes will be under more pressure. In these changing circumstances the existing telescopes at ING will have to find a new role for the future. This implies that the use of the telescopes and future development of new instruments will have to be tightly focussed on future needs of the astronomical community.

At ING, the resources available for operation and enhancements of the facilities have declined very substantially over the past six years. Moreover, the resources for operational activities will have to be reduced further in order to make sufficient funds available for development of new instruments. A focussed approach to operation and development of the telescopes is now even more important than before.

These and other issues related to the optimal exploitation of the facilities at the observatory on La Palma were subject of a three-day workshop held in Sheffield in April 1999.

## Existing instrument suit

The current set of instruments on the telescopes at ING has been developed over a period of approximately two decades. The WHT supports a wide variety of spectroscopic and imaging instruments. Currently on the WHT there are seven major common-user instruments, and there are a number of new developments on the horizon, such as an IR imager and a common-user adaptive optics system, which will broaden the capabilities of the WHT even further. Within the limited resources available for telescope operation it becomes ever more difficult to optimally support the growing number of instruments. Consequently, some instruments will have to be withdrawn from the pool of facility instruments.

The existing suite of instruments on the WHT can be separated into three classes:

- Workhorse instruments (ISIS medium resolution spectrograph, UES echelle spectrograph, and Prime Focus imaging unit) that cover a wide range of basic observing options. These instruments must be maintained and enhanced to retain their competitive status.
- Development instruments (AUTOFIB/WYFFOS fibre spectrograph, INGRID IR imager and NAOMI Adaptive Optics system). These instruments are novel and are still being developed and enhanced to provide cutting edge science capability.
- Niche instruments (TAURUS Fabry-Perot spectrograph and LDSS multi-object spectrograph) that provide very useful capability but serve a relatively small user group.

All instruments are competitive and enjoy a reasonable level of interest from the community. The three workhorse instruments are the most popular with users, and also produce the bulk of the published papers. The newly developed instruments enjoy a still growing number of users, as one would expect. These instruments form also the key to the development programme on the WHT.

The two niche instruments, LDSS and TAURUS are used by a small but active and productive group of astronomers. Both instruments do fill a need in areas where they are still competitive. LDSS combines high throughput with the multiplex advantages of multi-slit spectroscopy, which is important for studies of densely packed clusters of stars or galaxies. TAURUS with its Fabry-Perot etalon imaging is a useful tool for studies of kinematics in nearby galaxies and nebulae. The recently developed tuneable narrow-band imaging mode for TAURUS offers a new and unique tool for a wide range of studies.

It was recently decided to stop offering the latter two instruments as common-user instruments in order to allow observatory staff to focus effort on a smaller number of instruments. An opportunity has been created for interested user groups to adopt and develop LDSS and TAURUS as private instruments. In this way it is hoped that through continued interest in these instruments they will remain available, albeit as private instruments fully supported by the interested user group.

## Future role of the telescopes

The future development programme for the WHT will need to focus on specific target areas, taking into account the likely role of the telescope in the era of the 8-m class telescopes. These targets must concentrate on areas where 4-m class telescopes can remain competitive, either because medium size telescopes offer some unique advantage over the larger telescopes, or because these telescopes will provide the required observing time for larger scale projects (e.g. surveys and time dependent phenomena).

There will also be an important role for medium-sized telescopes to carry out observations in support of the largest telescopes, as target selection engines and other preparatory and follow-up observations. Such preparatory work will require substantial amounts of telescope time.

The areas for development identified for the WHT concentrate on high spatial resolution imaging and spectroscopy through adaptive optics, in particular at shorter wavelengths, and exploitation of the available wide field in the prime focus for spectroscopic purposes at visible and near IR wavelengths. Both these development areas will allow the WHT to remain competitive next to the larger telescopes.

Image quality is a decisive factor not only to resolve objects, but also to detect faint objects against the sky background or above the detector read noise. This is where the potentially great advantage of adaptive optics techniques comes in. With current technology and on a good observing site like La Palma, a 4-m class telescope is ideally placed to optimally exploit the techniques of wavefront correction to achieve an image quality much better than could be expected under even the best seeing conditions. The deployment of laser guide stars would provide an even bigger advantage, above all by dramatically increasing the sky coverage of the AO system. The ongoing development of the NAOMI common-user adaptive optics system on the WHT is well placed to exploit this advantage for a wide variety of science projects.

Also in the area of wide-field observations 4-m class telescopes offer a capability that will not be available on larger telescopes and therefore this is seen as a key development area for the WHT. Various telescopes are already developing wide field optical and IR imaging facilities (e.g. CFHT, ESO-VST, NOAO, VISTA, UKIRT), and therefore the WHT is seen to concentrate on a complementary role by exploiting its wide field in the prime focus for spectroscopic observations. In the first instance, further development of the fibre fed WYFFOS spectrograph is seen as the natural route to exploit this area further. The immediate need for wide field imaging at the ING is covered by the Wide Field Camera on the INT and the existing prime focus imaging camera on the WHT.

In order to inspire new ideas for instrument developments for the WHT an Announcement of Opportunity was recently issued. It is anticipated that this announcement will inspire the next major common-user instrument, commensurate with the needs of the astronomical community.

Although the development programme for the WHT will necessarily be focussed, for the foreseeable future there will remain a strong need to retain a relatively wide range of instruments on the WHT, allowing a variety of science objectives to be pursued. It is also expected that the WHT will remain an important platform for visiting instruments. These requirements imply that the level of engineering and astronomy support for the WHT needs to remain at a high level.

The role of the INT in the coming years will focus on the exploitation of the Wide Field Camera. Survey activities, both in support of observations on 8-m class telescopes as well as for science objectives in their own right are expected to become more important. The recently initiated survey activities on this telescope are a good example of this.

The operational support for the INT will reduce further. Recently, Telescope Operator support was withdrawn from the INT for some of the nights. The modernised control systems now allow easy and safe operation of the telescope and instruments by a single user.

Finally, no developments are envisaged for the JKT. Operational support will be at a minimum level. This telescope still provides a useful tool for photometric studies of various relatively bright objects, and serves as a useful training platform for students. ¤

René Rutten (rgmr@ing.iac.es)

# OTHER NEWS FROM ING

Artist's impression of GranTeCan on the Roque de Los Muchachos Observatory.

## ING and GranTeCan

René Rutten (Director ING)

Within the next few months groundwork will commence in preparation for a new telescope that will become the centrepiece of the facilities at the observatory on La Palma. The new facility under construction is the Gran Telescopio de Canarias, also known as GranTeCan, or simply GTC. This Spanish telescope project will have a profound impact on the observatory on La Palma. Following from an invitation for international partners to join the project, ING has been exploring ways in which the UK and NL astronomical communities could become a partner in this exciting large telescope project.

GTC is a segmented 10-m aperture telescope based on the Keck telescope design. The project if fully funded by the Spanish Government and by the Canarian Government, including EU money. The project is well under way and various key contracts have now been let. Completion of the telescope is planned for 2003. The GTC project office is based in Tenerife, close to the Instituto de Astrofísica de Canarias, and employs over 30 staff (for more information see http://www.gtc.iac.es/).

The science drivers for GTC are diverse, and for that reason the telescope is designed to be a general-purpose work horse facility. In particular image quality, optimisation for operating wavelengths between 0.3 and 2.5 microns, and operational efficiency are key elements of the telescope design. A set of three 'day-one' instruments has been approved to proceed to preliminary design stage. These instruments are an IR imaging spectrograph (Canari-Cam), a multi-object IR spectrograph (Emir), and an optical imager and spectrograph (Osiris). The selection of these instruments is primarily based on the scientific priorities in the Spanish community, but the interest from in particular UK scientists is reflected in the participation of astronomers in the UK in the definition of these instruments.

The advent of GTC is expected to dominate the scientific work on La Palma in general, and impact on the work carried out at ING. There will be a logical need to co-ordinate science programmes, and very likely scientific collaboration between Spain, the UK and the Netherlands will become stronger once GTC enters into operation. There is an opportunity now to guarantee access for the UK and NL to GTC by formalising the collaboration between the countries currently participating in ING. This opportunity is being explored.

Support from the UK astronomical community for collaboration in the GTC telescope project was highlighted by the broad support which enjoyed the proposal for the UK to join GTC through the 'JIF' opportunity last year. Although this request was unfortunately not successful, it did underline the fact that there is a strong need for more access to large ground-based telescopes. This has also been reflected in PPARC's strategy framework that identifies the lack of access to large telescopes as a serious gap. GTC has the potential to fill this need, at least in the Northern hemisphere. Priorities for the Dutch community have logically been focussed on exploitation of the ESO-VLT as the main ground-based optical-IR facility. Therefore the urgency for the Netherlands to obtain access to more 8-m class telescopes may not be so great, although GTC will provide Dutch astronomers with guaranteed telescope time in the north.

Last year Spain opened the possibility for external partners to join GTC by offering up to 30% of the project to potential partners. This announcement prompted the UK and the NL to jointly pursue the possibility of setting up a partnership between ING and GTC through which the UK/NL would contribute of the order of 10% of the project cost and would obtain an equivalent share of the observing time. The baseline funding for this participation would have to come out of the existing ING budget. Clearly this would have an important impact on the support and development of the existing ING telescopes, but it was felt that this opportunity should not be missed. At the basis of a collaboration with GTC would be a partnership in the operation and development of the telescopes. Efficiency saving at ING through an appropriate base at sea level, a more focussed deployment of instruments, some reduction of support services, and a reduction in the development budget would be inevitable. However, even with these savings the WHT would be able to continue to deliver front-ranked science and still have a significant development budget. Clearly any collaboration with GTC through ING must not undermine the long-term future for the WHT.

A possible collaboration between ING and GTC would not only be very attractive from the scientific perspective, but is also of strategic importance for the long-term future and stability of ING into the era of 8-m class telescopes. Detailed negotiations are still at an early stage, but I am hopeful that a collaboration will emerge and I am looking forward to establish close ties with GTC scientists, engineers, and management. ¤

René Rutten (rgmr@ing.iac.es)

# News from the Computing Facilities Group

Nick Johnson (Head of CFG, ING)

1999 is a busy year for the Computing Facilities Group (CFG) as we simultaneously roll out improvements to network bandwidth, processing speed and storage capacity to ready ING for the next millennium. Did I mention Y2K compliance? Yes, we too will be ready for the New Year.

This year we are installing large network switches into the WHT and INT to carry ten times more capacity between our telescopes. Each building is being recabled completely, from telescope control rooms and their data acquisition systems all the way to offices and their word processing systems. The result is a managed network where the CFG team can monitor the health of every computer, printer, hub and switch within ING. Pre-emptive fault diagnosis means we now call users and tell them of any problems, usually before they have noticed.

Upgrading to Sun Ultra 10 computers for all telescope data acquisition, reduction and instrument control is well under way. The INT now boasts one of the fastest workstations in the Canary Islands with its dual processor Sun Ultra 60 and 1GB of RAM, which offer a tenfold increase in performance for reduction of WFC data. In a year, we will be using the same type of computers throughout all the telescopes making system management easier, and substitution easier should faults occur. Single point of failures in the networked file server system have been identified and by the end of the year, every important network service will have custom primary and secondary servers.

A new astronomical data capture and archiving system is being installed so that all images are routed around a dedicated private network, guaranteed free of any data traffic generated by other users. The destination for the images is a new set of DVD Towers that increase the capacity of our current system seven fold.

Data communications to the mainland are being improved with the installation of ISDN standby routers to provide diverse routing of our data paths. Satellite links direct to the UK and Netherlands Internet Service Providers and universities are also being investigated. Our internal and external webservers are being replaced, ready for an overhaul of the ING website. Our vigilance of our computer systems has increased following the growth of malicious use of the Internet in the last year. Our aim is security without handcuffs. Users will have to learn to use new applications, yet not lose the basic flexibility and network performance that they have come to expect. ¤

Nick Johnson (nrj@ing.iac.es)

## [INGNEWS] Mailing List

[INGNEWS] is an important source of breaking news concerning current developments at the ING, especially with regard to instruments.

You can subscribe to this mailing list by sending an email to majordomo@ing.iac.es with the message *subscribe ingnews* in the body of the message. Please leave the subject field and the rest of the body of the message empty.

Once subscribed, you can subscribe a colleague by sending to majordomo@ing.iac.es the command *subscribe ingnews <your colleague's address>*, where *<your colleague's address>* should contain your colleague's email address, e.g. einstein@xyz.ac.uk. To unsubscribe from [INGNEWS] send to majordomo@ing.iac.es the command *unsubscribe ingnews*. More information on [INGNEWS] can found on this web page: http://www.ing.iac.es/INGinfo/bulletin/

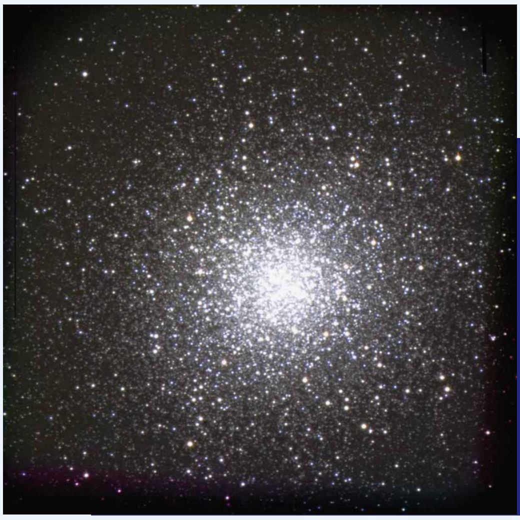
These are the contents of the last messages sent to the list:

**13 July**

- "Announcement of Opportunity to adopt LDSS-2 and TAURUS-2"
- "Support astronomer vacancies"

**25 June**

- "Instruments for the WHT– Announcement of Opportunity for Instrumentation Proposals"
- "International Scientific Committee (CCI). Announcement of the Availability of International Observing Time with the Telescopes at the Observatorio del Roque de Los Muchachos (La Palma), Observatorio del Teide (Tenerife)"



# New Detector on the JKT

The JKT now has a new detector: SITe 2. This 2k square CCD overfills the JKT imaging port and gives a field of view of 10′×10′. This detector previously had problems with readout speed and linearity. Both these have now been solved. The detector is highly linear and when windowed down to 1k×1k pixels will read out in approximately the same time as a TEK CCD. Pending on the result of user feedback this may become the JKT default detector. A true-colour picture of M13 taken with this new detector is shown on the left. Picture credit : Daniel Folha, Simon Tulloch.

# The ING Service Scheme: Performance and Feedback from Users

Stephen J. Smartt (ING Service Manager)

The operational running of the ING service scheme was changed at the beginning of 1997, with the implementation of several novel features. Since proposals live for one full year since their submission date, we now have complete data on the proposals submitted during semesters 97A+97B which have all completed their life cycle. We have resisted compiling a report sooner (e.g. just for the full lifetime of 97A proposals) as the limited statistics involved may not have given a true reflection of the success of the scheme. This short report summarises the main features of the ING Service scheme, gives the relative chances of a proposal being completed, and the feedback from the user community who have had data from the scheme.

The main features of the scheme which has been fully running since February 1997 are:

1. The proposal submission procedure is completely automated through a set of web based fill-out forms.
2. All proposals are sent to nominated members of the respective TAG panels for scientific grading.
3. Service night information from the ING support astronomer carrying out the observations is sent promptly (usually next-day, again using automated software procedures) to all applicants whose proposals had been attempted.
4. The service data is available for anonymous ftp immediately applicants are informed that their proposal has been attempted. From Spain, UK and the Netherlands the band-width is suitable for distributing the data in this way, and is indeed preferable judging from user feedbacks (see below).
5. The progress of individual proposals is visible on a set of ING Web pages, together with a running total of time used by each of the three nationalities broken down by the colour of the Moon.
6. The availability of these statistics allows the Service manager to quickly correct any imbalances in the nationality time quotas.
7. Service applicants are given the opportunity to comment on the quality of their data in particular, and ING performance as a whole, on each occasion that data was taken for them.
8. Urgent requests for Targets of Opportunity (ToO) are dealt with quickly and fairly. Many ToOs for which it has been logistically possible to get data for have been carried out (often after immediate refereeing).

Naturally applicants want to know when their observations will be attempted, and what priority will be given to them after they are informed of the science grade. All proposals are given a grade of either $\alpha$, $\beta$ or *reject*. The $\alpha$ and $\beta$ graded proposals are put into the 'queue', while the *rejects* are not. We are not running a full queue-observing scheme – this would require significantly more ING and assessment panel resources. Proposals to be attempted on each ING service night are at the discretion of the Support Astronomer who first notes directives from the Service Manager on nationality priority (to maintain the appropriate balance of time allocated from the different TAGs). Hard-copies of the proposals are kept in each telescope control room, and the SA attempts to complete as many $\alpha$ graded proposals as possible while keeping the overheads of instrument adjustment and calibrations to a minimum. Due to instrument availability restrictions, and sky/weather requirements of applicants, we cannot (in the present scheme) guarantee to complete all $\alpha$-graded proposals. As support astronomers try to make as efficient use of the Service nights as possible by minimising changes of optical components during a night (e.g. number of grating/dichroic changes on an ISIS night for example), and given that prevailing sky conditions need to be matched to those requested it would be impracticable for us to work with grading on a finer scale. We can discriminate on the basis of a 2 grade system as shown in the statistics below, but further grade categories *within the present model* would not in reality contribute finer selection criteria.

A key to the success of the scheme is the completion rate of proposals – where the data quality is necessarily of satisfactory scientific use. Of all the proposals counted as completed in the following statistics, applicants have been satisfied with the quality of their data, and those which were not had additional or replacement data taken.

## Completion rate statistics for UK Service time

For the WHT the completion rate for $\alpha$ proposals was 75% over the two semesters 97A and 97B. For the $\beta$ ranked proposals the rate was naturally lower, with a 50% completion rate. Some of the non-completed proposals were for instruments which have limited exposure to Service time. For example, instruments such as AF2, TAURUS, WHIRCAM and LDSS may have one service night each per semester, but much of this is used for setup before the scheduled runs as the Service night is generally the first after an instrument change. Although at the time of press we have only complete data for 97A and 97B (some 98A proposals still being 'active' at this time), an estimation of the ongoing completion rate on the WHT for $\alpha$'s is above the 75% value. One should note that we had to carry over some proposals submitted in 96B to be fair to the applicants during this transitional 1 semester period, and nominally considered them $\alpha$ grades. The figures in Table 1 do *not* include these proposals. Given this factor, and considering the (as yet incomplete) statistics of 1998, we estimate that the chances of an $\alpha$ graded proposal being completed on the WHT within its 1 year lifetime is approximately 80%. On the INT an even better completion rate for $\alpha$ graded proposals (86%) is achieved. Although on the JKT UK Service was probably under-used in these two semesters, the demand has risen considerably since then (a total of 24 proposals have been submitted during 98A–99A), and we still estimate that we are completing 100% of JKT $\alpha$ proposals. The completion rate for $\beta$'s is approximately 50% across the board, reflecting that the grading certainly does differentiate between proposals. Some $\beta$ proposals are completed due to, for example, $\alpha$'s not being available for a particular RA, sky conditions and instrument setup.

## Completion rate statistics for NL Service time

The completion rate for the Dutch $\alpha$ grades on the WHT was 90%, with the incomplete application requesting observations on 5 simultaneous nights which was not feasible. On the INT, only three Dutch proposals were submitted during the semesters 97A and 97B and all three were completed. On the JKT there were only two proposals submitted and one was completed while the other was approximately half done. This admittedly appears to be a failure of the scheme to not get the only two Dutch JKT proposals completed, but it is probably more a case of bad luck! As there are few JKT service nights each semester the requested observing conditions at usable RA ranges were not available to get this proposal done when the weather was agreeable. On a more encouraging note, 5 more Dutch JKT proposals have all been submitted from 98A to the present time, and these have been completed satisfactorily. The Dutch use of Service has risen significantly since 97A and 97B, and ING are continuing to complete the proposals at around the 90–100% level on all three telescopes. We would encourage the Dutch community to make use of the scheme, as in the past there has been a feeling that their required time quota within the overall Service time is not being realized. The Service scheme is certainly completing the submitted Dutch proposals on a continuing basis, and the amount of total time spent is dictated by the number of submitted proposals.

## Completion rate statistics for CAT Service time

The Spanish community regularly submits large numbers of proposals to the WHT, requesting much more time than is generally made available to Service by the CAT committee. This results in large pressure on the Spanish time within Service and the relatively low (compared to the UK and NL) success rates of $\alpha$ proposals (50%). It is clear from Table 3 that the we are indeed using the $\alpha/\beta$ discrimination, as the $\beta$ completion rate is much lower. However to achieve a greater completion rate of $\alpha$ proposals on the WHT, the CAT committee should either increase the amount of time they give to the Service scheme, or be more selective in awarding their $\alpha$ grades (hence targeting the proposals they see as particularly worthy of time). The statistics for the INT and JKT indicate that there is a very good chance of $\alpha$ rated CAT proposals being completed on these telescopes, and the scheme appears to be working well for the Spanish community.

## Feedback from applicants who have had data taken

After each service night, a night-report form completed by the Support Astronomer is mailed to each applicant whose proposal has been attempted.

*Tables 1-3. Completion rate statistics for UK, NL and CAT (in descending order) Service proposals in the Semesters 97A and 97B.*

| Status | $\alpha$ | $\beta$ | *reject/withdrawn* |
|---|---|---|---|
| WHT Completed | 33 (75%) | 4 (50%) | 0 |
| WHT Not completed | 11 (25%) | 4 (50%) | 6 |
| WHT Total | 44 | 8 | 6 |
| INT Completed | 24 (86%) | 5 (55%) | 0 |
| INT Not completed | 4 (14%) | 4 (45%) | 2 |
| INT Total | 28 | 9 | 2 |
| JKT Completed | 4 (100%) | 2 (55%) | 0 |
| JKT Not completed | 0 (0%) | 1 (45%) | 2 |
| JKT Total | 4 | 3 | 2 |

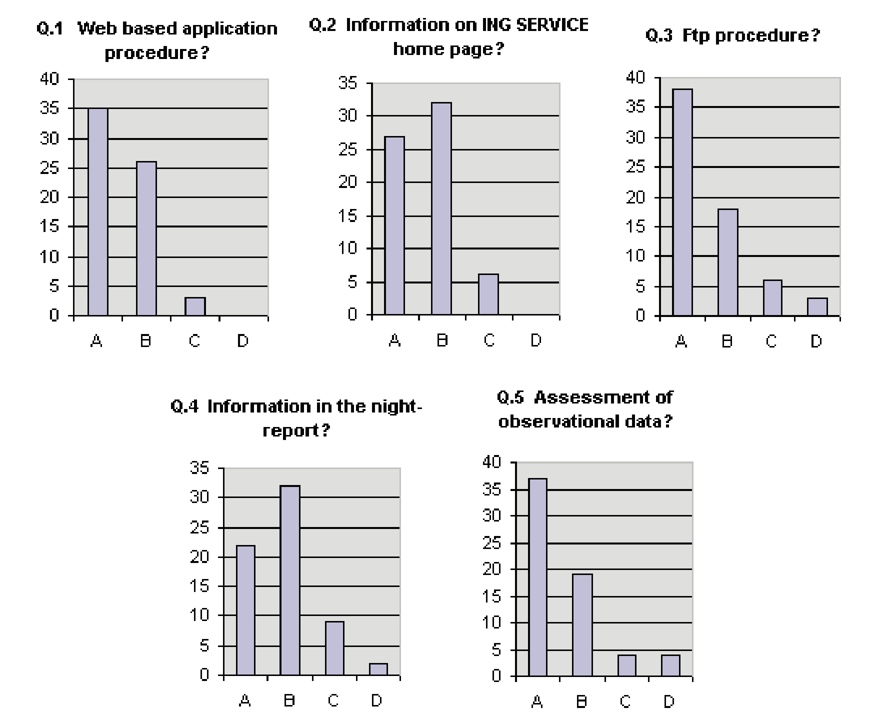
| Status | $\alpha$ | $\beta$ | *reject/withdrawn* |
|---|---|---|---|
| WHT Completed | 9 (90%) | 0 (0%) | 0 |
| WHT Not completed | 1 (10%) | 3 (100%) | 0 |
| WHT Total | 10 | 3 | 0 |
| INT Completed | 3 (100%) | 0 | 0 |
| INT Not completed | 0 (0%) | 0 | 0 |
| INT Total | 3 | 0 | 0 |

| Status | $\alpha$ | $\beta$ | *reject/withdrawn* |
|---|---|---|---|
| WHT Completed | 11 (50%) | 2 (22%) | 0 |
| WHT Not completed | 11 (50%) | 7 (78%) | 2 |
| WHT Total | 22 | 9 | 2 |
| INT Completed | 6 (75%) | 5 (50%) | 0 |
| INT Not completed | 2 (25%) | 5 (50%) | 4 |
| INT Total | 8 | 10 | 4 |
| JKT Completed | 4 (100%) | 0 | 0 |
| JKT Not completed | 0 (0%) | 0 | 0 |
| JKT Total | 4 | 0 | 0 |

This includes details of the instrument setup, what was observed, weather and sky conditions, comments on the individual exposures which may be helpful in assessing and reducing the data, and finally how to connect to our site and ftp the data home. A copy of the night log is also made available. A further email is automatically sent with each night-report containing a feedback questionnaire to allow the applicants to comment on different aspects of our scheme. We specifically ask them 5 questions, and further allow free comment on these or any other aspect they see relevant. The feedback has been overwhelmingly positive, as can be seen in Figures 1–5. We are particularly encouraged that such a high percentage of applicants consider the data provided to them to be of 'excellent' quality for their scientific purposes.

We are currently looking at ways to improve the scheme and welcome comments from the community, and suggestions on how we can provide a better service to you. ¤

Stephen Smartt (sjst@ing.iac.es)
Service Programme (service@ing.iac.es)




*Figures 1-5. The bar charts show the number of responses to each of the five questions. The statistics were compiled from responses over the last year and a half. The questions we ask in the feedback questionnaire are:*

1. *How did you find the application procedure with the Web based form?*
2. *How do you rate the information provided on the ING SERVICE home page?*
3. *How did you find the procedure of ftp as a means of getting hold of your data quickly?*
4. *How would you rate the information provided in the night-report? (Including additional comments by the Support Astronomer).*
5. *Give an assessment of the quality of your observational data, considering what you have requested and what the Support astronomer has provided. (Please take into account the weather conditions, and use your answer as an assessment of OUR performance).*

*The applicants were given the option of choosing responses from a: excellent, b: good, c: satisfactory, d: unsatisfactory.*

## Other Recent ING Publications

**Technical Notes**
Available at
http://www.ing.iac.es/~manuals/man_tn.html

- No 123. *Wavelength Dependent Pixel-to-Pixel Response Variations of a Typical EEV42-80 CCD: the role of flat-fielding astronomical data,* F Crompvoets (Katholieke Universiteit Nijmegen) and S Smartt (ING), August 1999.
- No 122. *Star Pairs for Blind Offset Check,* R Laing (Univ of Oxford and RAL), J Sinclair (RGO), June 1999.
- No 121. *ING Bibliography and Publication Rate (1998),* J Sinclair (RGO), May 1999.
- No 120. *CCD Camera EEV#13,* S Tulloch (ATC), February 1999.

**Annual Reports**
Available at:
http://www.ing.iac.es/PR/annualreports_index.html

# IV Site Managers' Meeting

## Gordon Talbot (ING)

The Isaac Newton Group has recently hosted the IV Site Managers' Meeting in La Palma. The aim of this meeting (as with the previous ones) is for the principals of operations at various observatories to share common problems and their solutions with others who have similar challenges. The meeting's organisers are: Bruce Gillespie – Apache Point, Dave Sawyer – WIYN (Kitt Peak) and Mark Adams – McDonald Observatory.

The history of the meeting was explained by Bruce Gillespie: "A small handful of us happened to be at the same SPIE meeting in Hawaii a couple of years ago, and over beers or breakfast we discovered it would be useful to periodically get together at each others' observatories to discuss common ground and problems. Observatories tend to 'live' in relative isolation, and we discovered that we had all re-invented the wheel more than once, and that by sharing our experience we could each improve our lot without the extra work. Besides it's useful to visit other observatories to see how things are done.

Anyway we decided to meet first at McDonald observatory and to keep the meetings small, informal and low maintenance. The second and third meetings at Apache Point and Palomar were each a little bigger, but not so that the original charter was compromised. We did grow to nearly a couple of dozen in size, including representatives from Hawaii, Chile and Europe as well as space astronomy and radio observatories".

As well as the organisers, the meeting attracted representatives from (approximately west to east) Keck Observatory, Canada-France-Hawaii Telescope (CFHT), Lick Observatory, Palomar Observatory, National Solar Observatory, Telescopio Nazionale Galileo (TNG), Nordic Optical Telescope (NOT), ROYAC, Gran Telescopio de Canarias (GTC), and Instituto de Astrofísica de Canarias (IAC). There was an invitation from the organisers for general participation of ING staff, and a good number were able to attend.

The format for the meeting held on the 28 to 30 July was two days of discussions, broken by a full day tour of not just ING's facilities at the Roque de los Muchachos but also tours of ROYAC, TNG and NOT. Topics presented included: GTC maintenance plan, Keck preventative maintenance plan, man-made seeing at the NOT, ING dome seeing programme, the ING engineering operations team, optics cleaning and results, Year 2000 readiness and visiting instruments.

The aim for informal discussion was soon achieved. The introduction where each delegate was asked to briefly describe their institution, their position and responsibilities, generated so many questions and discussion that it took up the whole morning session of four hours!. It was generally agreed that there wasn't enough time to fully talk about the subjects on the agenda, much less the reserve topics, which were held over to next time, or the time after that. These topics are:

- Laser operation at astronomical observatories.
- Site performance monitoring.
- Performance metrics for telescopes.
- Safety procedures and compliance issues.
- Staff performance appraisals.
- Maintaining a safe and civil work environment.
- Volunteer support at observatories.
- RFI suppression.
- Light pollution.
- Government and local interactions.
- Telescope operation standard nomenclature.
- Computer and network security.
- Operations budgets.
- Engineering time policies.
- Engineering and environmental issues.

The meetings themselves were held in the Hotel Taburiente at Los Cancajos. ING also arranged the meeting dinner to which delegates and their guests together with ING staff and their families were invited. This was a great success – 137 people turned up.

ING would like to thank first of all the organisers for accepting our invitation to come, ROYAC (Goran Hosinsky), TNG (Adriano Ghedina) and NOT (Hugo Schwarz) for the tours of their facilities. I would like to thank all ING staff that helped and contributed including particularly Doug Gray, Alan Chopping and Clive Jackman for the tour and other help, Mavi Hernández for organising lunch at the Residencia and Chris Packham for his talk. Also Rachael Miles deserves a special mention for arrangements for travel, meeting room bookings, other catering arrangements and especially running round at the last minute for things I had forgotten.

For the future a fifth Site Managers' Meeting is provisionally planned for next year in late May at Kitt Peak. Dave Sawyer of WIYN will host. It is also planned to publicise the group further at the SPIE conference in Munich (March 2000) and seek wider participation. Particularly the hope is to extend the information exchange with Europe and the Southern hemisphere.

Currently information is disseminated via an e-mail exploder, 'mountain_honcho', but in the future a web page is planned. Anyone interested in the group and or the next meeting should contact Bruce Gillespie (gillespi@apo.nmsu.edu), Mark Adams (mta@astro.as.utexas.edu) or Dave Sawyer (dsawyer@noao.edu). ¤

Gordon Talbot (rgt@ing.iac.es)

## Seminars and Talks given at ING

Visiting observers are politely invited to give a seminar at ING. Talks usually take place in the sea level office in the afternoon and last for about 30 minutes plus time for questions afterwards. Astronomers from ING and other institutions on site are invited to assist. Please contact Chris Packham (cp@ing.iac.es) for more details. These were the seminars and talks given in the last six months:

12 February
*IR intrumentation on GTC: The EMIR multiobject spectrograph,* Mark Balcells (IAC)

24 February
*The Liverpool Robotic Telescope*, Ian Steele (Liverpool John Moores University)

8 March
*Finding the loaded gun - searches for double degenerates*, Pierre Maxted (University of Southampton)

14 June
*Amateur CCD Astronomy*, Nik Szymanek and Ian King (Society for Popular Astronomy)

28 June
*The IRSI-Darwin space interferometer*, Alan Penny (Rutherford Appleton Laboratory)

15 July
*Using Planetary Nebulae as probes of galaxies*, Jeremy R. Walsh (Space Telescope European Co-ordinating Facility, ESO)

## Personnel Movements

**Robert Greimel** recently arrived on the island to take responsibility for astronomical software products and the development of quick-look and pipeline data reduction tools.

**Lourdes González Rodríguez** took up a temporary position at ING as cashier whilst Arami Felipe is on maternity leave.

**Sebastián Sánchez Sánchez** commenced work at ING as administrative assistant in the astronomy group.

**Janet Sinclair** recently retired from PPARC service. Janet for many years worked in support of the ING programme, based at the Royal Greenwich Observatory in Cambridge. Most of the time she worked closely together with Bill Martin, forming a tight team on which ING could always rely. Since the closure of the RGO Janet moved office to the Cavendish Laboratory. We thank her for the years of service.

**Ian Skillen**, previously employed at the ESA tracking station near Madrid, has taken up the post of scheduler of the ING telescopes.

**Stephen Smartt** has been working as support astronomer at ING for the last few years, but will now return to the UK to take up a position at the Institute of Astronomy in Cambridge. Stephen has made important contributions to ING. We thank him for his efforts and wish him well in his future career.

## Opening Policy During the Millennium Rollover

René Rutten (Director ING)

Since early in 1998 ING staff has been involved in a comprehensive programme to test all critical systems for Year-2000 compliance, also known as the millennium bug. Although we expect to be prepared for the year rollover and have all relevant telescope sub-systems operational, there may well be external aspects hampering normal operation. For instance, it may be difficult for observers to travel to and from La Palma during the first few days of the year 2000. Our policy for telescope operation during the year-end rollover includes a stand-down night for December 31st with a controlled power-up of all systems the next day, followed by two service nights on January 1st and 2nd. From that date normal scheduled operation will continue. ¤

## Amateurs' Impressions of the Observatory

The pictures on the central pages were taken by Nik Szymanek (of the amateur UK Deep Sky CCD imaging team of Nik Szymanek and Ian King) in June 1999. Nik's usual equipment is a Meade 10″ LX200 telescope, a SBIG ST-7 CCD, and an AO-7 adaptive optics unit. Nik is also advisor for the Society for Popular Astronomy.

Nik and Ian are one of the foremost amateur teams in the UK specialising in tri-colour (true colour) deep sky CCD images and often have their work displayed in mazagines such as *Sky & Telescope* and *Astronomy Now*. For a sample of their work visit this web page: http://www.ing.iac.es/PR/postcards.html

They came to La Palma again in 1998 and 1999 and they composed the mosaics on the central pages for us.

# TELESCOPE TIME

## Applying for Time

Danny Lennon (Head of Astronomy, ING)

For instrumentation and detector combinations on offer please refer to

http://www.ing.iac.es/INGinfo

or PPARC's PATT newsletter which is issued electronically about one month before semester deadlines. Applications should be submitted by email only, by the appropriate deadline, to ingpatt@ing.iac.es. Application forms and style files may be obtained from the ING web pages.

## What's New

### Detectors

The ING's new data acquisition system, Ultradas, was successfully tested on the IDS/INT using an EEV 4k×2k CCD. This is encouraging since, in semester 1999B, there are plans to commission the Ultradas system on IDS and the WFC on the INT. Also in this semester, the 2-chip CCD camera will be commissioned, with Ultradas, at prime focus on the WHT and on UES. Ultradas will produce a marked improvement in readout speed and data quality. Another recent improvement in the detector area has been the commissioning of a second 2k×2k SITe detector. This is currently undergoing testing on the JKT (see page 22), and this will either stay at the JKT or become the ISIS red arm detector. The ING has also been actively pursuing the purchase of new red sensitive chips like the MIT/LL devices and a decision is imminent. These devices will be especially useful as replacements for the suite of TEK/SITe detectors currently in use, for example, on the red arm of ISIS. This step is necessary since the EEV 4k×2k devices, while providing excellent blue performance, suffer from severe fringing in the red which is particularly damaging to spectroscopy.

### Instruments

As mentioned above, the two-chip CCD camera will be commissioned at prime focus on the WHT in 1999B, this camera will contain two EEV 4k×2k CCDs covering a field of approximately 16×16 arcminutes. A major event is that INGRID, the WHT's long-awaited replacement for WHIRCAM, is due to be commissioned towards the end of 1999B. Further details of INGRID can be found in Chris Packham's article in this issue. Also in this issue is a report on the recent commissioning run of ELECTRA, the prototype AO system and fore-runner of the ING's common user AO system which is due to be delivered to the ING in 2000A.

### Other News

The Half-Arcsecond Program (HAP) has recently completed an important study of seeing at the La Palma site and at the WHT, a paper summarising the findings is currently in press with *MNRAS* (Wilson, O'Mahoney, Packham & Azzaro). Briefly, this study demonstrates that the intrinsic seeing at the site is comparable to that at Paranal and Mauna Kea with a median value of 0.69 arcseconds. Furthermore, the image quality and tracking of the WHT are such that they do not significantly degrade the intrinsic site seeing, in other words dome/mirror seeing at the WHT is now not a significant problem. Note that there are significant seasonal variations which observers should be aware of, the summer months being significantly better that the winter months. More complete details of HAP can be found at:
http://www.ing.iac.es/hap/haphomepage.htm
and in the MNRAS preprint, a copy of which may be requested from Chris Packham (cp@ing.iac.es). The emphasis of the HAP has now been switched from the WHT to the INT where it is clear that the seeing obtained at the telescope is consistently and significantly worse than the intrinsic seeing. In fact the Wide Field Survey is assisting in providing important quantitative information on this problem. Clearly, if we can obtain sub-arcsecond seeing at the INT on a regular basis this would be of enormous benefit to WFC science in particular. The HAP is therefore attempting to identify potential contributors to this problem and to quantify their contributions to the net degradation of seeing.

## Telescope Operator Availability

Due to the reduction in the number of Telescope Operators (TO) working at the ING, it has been ING policy over the past two semesters to offer TO support on the first 2 nights and the last night of Wide Field Camera runs on the INT. This particular instrument/telescope combination was targetted because of the ease with which it is possible to operate the combined systems by a single person. This scheme has proved to be successful, there has been no significant increase in down-time due to the absence of a TO, however the workload on the TO group is still very high with little scope to cover eventualities such as absence due to illness or training. In semester 2000A we are therefore withdrawing TO support on the last night of WFC runs. Observers who feel uncomfortable with the work-load that this implies, paticularly at the beginning and end of each night, should consider applying for PATT funding of an additional observer.

This measure will only improve the situation for the TO group in a small way. In the longer term we will work towards improving the observing system for IDS such that it is possible to operate IDS and the INT in a manner similar to the WFC/INT combination so that we can reduce TO support on these observing runs. This is one measure we are taking to ensure that the operating cost of the INT is reduced, thus strengthening its prospects for a productive future in the long-term.

## JKT Support

The JKT has been a single user telescope for some time, with an introduction on the first night being provided by a Support Astronomer. In semester 2000A we propose to discontinue night-time support by a PhD level astronomer. We will examine and test two alternatives:

1) A day-time introduction being provided by the SA on the afternoon before the observing run begins, with the observer made responsible for being present the previous night to acquire some on-sky instruction from the previous observer.

2) A night-time introduction is provided by students rather than a PhD level SA.

As the JKT is a single user telescope with no TO support whatsoever, users should be aware of the ING's standing policy that visiting observers should be experienced observers. Occasionally we have had JKT observers with little or no previous observing experience. This was unsatisfactory in the past and will clearly be extremely risky under either of these new schemes.

## Scheduling Restrictions

For operational reasons, restrictions have been set on the number and types of instrument changes which the ING supports. Applicants should be aware of this since there may well be instances when a well regarded program does not get time due to scheduling constraints.

If for good scientific reason the TAGs or the LPCC consider the guidelines too restrictive, exceptions can be negotiated with the Director of ING on a case-by-case basis. Likewise, the Director of ING may have to restrict the scheduling of instruments beyond what has been agreed in this document for reasons of engineering work, shortage of key staff, etcetera. The Director of ING will inform the TAGs on any additional constraints before the scheduling meetings take place.

Apart from the guidelines stated here, there are additional scheduling constraints to minimize the operational cost and risk which have to be taken into account (e.g. no instrument changes during weekends and public holidays, and no more than one instrument change per day).

Negotiations with the Director of ING should be channelled through the ING scheduler or the Head of Astronomy. If agreement can not be reached the authority of the ING Board may be called upon for arbitration.

### William Herschel Telescope

- A maximum of 12 instrument changes per semester is accepted.
- A maximum of 3 separate observing periods with 'expert' instruments (AUTOFIB, LDSS, and TAURUS) per semester is accepted. (Each observing period may contain various observing programmes.)
- No limit to the duration of an observing programme is set.
- All scheduled observations will be carried out by the applicants or associated scientists, unless explicitly agreed otherwise with the Head of Astronomy or the Director of ING.

### Isaac Newton Telescope

- A maximum of 12 instrument changes per semester is accepted.
- Observing time is allocated in blocks of one week on average.
- No observing programmes shorter than 4 nights are accepted, unless explicitly agreed by the Head of Astronomy or the Director of ING.
- A maximum grand total of 27 observing runs per semester are accepted. This grand total applies to the total of PATT (including Eire and Porto), NL TAG, CAT, survey programmes, and International Time. Service and discretionary nights, and queue observing nights are not counted in this grand total.
- All scheduled observations will be carried out by the applicants or associated scientists, unless explicitly agreed otherwise with the Head of Astronomy or the Director of ING.

### Jacobus Kapteyn Telescope

- The JKT only supports one common-user instrument, and hence private instruments are not accepted on this telescope.
- Observing time is allocated in blocks of one week.
- No observing programmes shorter than 5 nights are accepted.
- A maximum grand total of 27 observing runs per semester are accepted. This grand total applies to the total of PATT (including Eire and Porto), NL TAG, CAT, and International Time. Service and discretionary nights, and short observations taking up to only one night are excluded from the grand total.
- All scheduled observations will be carried out by the applicants or associated scientists, unless explicitly agreed otherwise with the Head of Astronomy or the Director of ING. ¤

Danny Lennon (djl@ing.iac.es)

## Important Dates

### *Deadlines for submitting applications*

PATT and CAT: **31 March, 30 September**
ITP: **30 June**

### *Semesters*

Semester A:
**1 February – 31 July**
Semester B:
**1 August – 30 January**

# Telescope Time Awards Semester 1999B

## ITP Programmes on the ING telescopes

- Browne (NRAL), *The CERES project: cosmology, luminosity functions and AGN unification*
- Ramella (Trieste), *Gravitational lensing: a cosmological and astrophysical tool*

## William Herschel Telescope

### UK PATT

- Bailey (AAO), *Spectro-astrometry of Pre-Main-Sequence stars*
- Barbieri (Padova), *Na emission from the Moon's atmosphere during the Leonids meteor shower*
- Barnes (St.Andrews), *Differential rotation patterns on α Persei dwarfs*
- Barstow (Leicester), *Metal abundances and temperatures scale of hot H-rich white dwarfs*
- Bowen (Ed. RO), *Spectroscopy identification of galaxies responsible of high-ionization QSO absorption lines*
- Browne (NRAL), *Search for 6" to 15" separation gravitational multiple imaging in JVAS/CLASS*
- Carter (J. Moores), *Kinematics of the Halo of M31*
- Charles (Oxford), *An optical/UV/X-ray study of luminous LMXB in a globular cluster*
- Crawford (Cambrige), *The composition of massive star formation in cooling flow galaxies*
- Davies (Durham), *SAURON observations of galaxies along the Hubble sequence: Bulges of spirals and lenticulars*
- Dhillon (Sheffield), *The mass ratio of AC Cnc*
- Ferguson (Cambridge), *Gas-phase chemical abundances in the extreme outer regions of disk galaxies*
- Fitzsimmons (Belfast), *The Exospheres and lonospheres of Io and Europa*
- Jeffries (Keele Univ), *Plumbing the depths of the substellar mass function*
- Jeffries (Keele Univ), *Does Li I 6708Å line yield true photospheric lithium abundances in the Pleiades?*
- Knappen (Hertsfords.), *H-alpha survey of nuclear star-forming rings in spirals*
- Laine (Herfordsh.), *Stellar and gaseous kinematics in the bars of NGC 936 and NGC 7479*
- Liu (UCL), *High resolution spectroscopy of low-mettallicity blue compact dwarf galaxies and the primordial He abundances*
- Mathieu (Nottingham), *Kinematics of planetary nebulae in SBO galaxies: dark Halos and Bars*
- McHardy (Southampton), *Deep R-band imaging of a Very deep XMM survey field*
- Merrifield (Nottingham), *What heats disk galaxies?*
- Oudmaijer (Imp.Coll.), *Are Hergib Ae/Be stars disk accretors?*
- Pinfield (Belfast), *The are of Praesepe and the intial-final mass relation for white dwarfs*
- Rawlings (Oxford), *The cosmic evolution of radiosources using the TEXOX 1000-radiosource redshift survey*
- Robinson (Hertfordsh.), *Scattering geometries in radio-loud quasars*
- Shearer (Galway), *Simultaneous radio and high speed optical photometry of Geminga and Crab pulsars*
- Skidmore (Wyoming), *Rapid spectroscopy of the mysterious pulsations in the dwarf nova WZ Sge*
- Smartt (ING), *Wolf-Rayet content of the starburts galaxy IC10: an anomaly for stellar and galactic evolution?*
- Smartt (ING), *A survey of massive, luminous blue supergiants in M31*
- Smith (Durham), *Investigating the role of compact groups in early-type galaxies evolution*
- Steeghs (St Andrews), *Spiral density waves in quiescent disc*
- Tanvir (Cambridge), *Rapid imaging of GRB error boxes and spectoscopy of GRB-related optical/IR transients*
- Wood (Keele), *Surface compositional anomalies in Close Binaries*

### NL NFRA PC

- de Zeeuw (Leiden), *SAURON observations of galaxies along the Hubble sequence: giant elliptical and lenticulars*
- Ehrenfreund (Leiden), *Environment of diffuse interstellar bands in Perseus OB2 and Cepheus*
- Gerssen (Groningen), *Patterns speeds of Bars*
- Groot (Amsterdam), *Spectroscopy of variable sources detected in the INT/WFC faint sky variable survey*
- Higdon (Groningen), *Metal abundances in extragalactic Tails and Bridges*
- Luu (Leiden), *Spectroscopy of outer Jovian satellites*
- Luu (Leiden), *Rotational Kuiper Belt Objects*
- Swaters (Groningen), *Stellar velocity dispersion measurements of late dwarf galaxies*
- v.d. Berg (Utrecht), *Spectroscopy of peculiar X-ray stars in the open clusters NGC752 and NGC6490*
- Vreeswijk (Amsterdam), *Rapid imaging of GRB error boxes and spectroscopy of GRB-related optical/IR transients*

### SP CAT

- Aretxaga (INAOE), *Spectro-photometric tracking of compact remnants of supernovae*
- Benítez (Berkeley), *A new method for cluster mass reconstruction*
- Centurión (IAC/OAT), *Deuterium abundance in high redshift QSO absorption systems*
- Díaz (UAM), *Determination of the electronic temperature in H-II high-metallicity regions*
- Fernández-S (NS Wales), *The definitive primordial D/H measurement: Phase I: Object selection*
- Israelian (IAC), *Searching for the evidence of supernova events in the low mass X-ray binary systems Her X-1 and Cyg X-2*
- Mediavilla (IAC), *2D Spectroscopy in gravitaional lens systems*
- Muñoz (IAC), *Spectroscopic study into the birth of dwarf galaxies around mergers*
- Pérez (IAA), *Stellar dinamic and circumnuclear structure in isolated active galaxies*
- Pérez (IAC), *Kinematical study of the merger NGC1144*
- Rebolo (IAC), *Oxygen abundances in extremely metal-poor stars and the first nucleosynthesis events in the Galaxy*
- Serra (IAC), *Limits to Omega_o and Lambda_o using stadistic analysis of radio-sources*
- Solano (LAEFF), *Multiobject spectroscopy of the globular cluster M15*

# Isaac Newton Telescope

## UK PATT

- Bode (LJMU), *Large scale nebulae associated with previous evolutionay phases of interacting binaries*
- Dhillon (Sheffield), *The masses of cataclysmic variables*
- Fitzsimmons (QUB), *The composition of Kuiper Belt comets*
- Hewett (IoA), *Probing the dark halo of M31 with pixel microlensing*
- Jefferies (Keele), *Plumbing the depths of substellar mass function*
- Keenan (QUB), *The origin of runaway B-type stars in the Galactic halo*
- McClure (Edinburgh), $H_\beta$ *emission-line determination of the black-hole masses in radio-quiet and radio-loud AGN*
- McHardy (Soton), *Deep U and B-band imaging of a very deep XMM survey field*
- M-Rueda (Soton), *Spectroscopy of dwarf novae in outburst*
- Naylor (Keele), *A new method of determining component masses in CVs*
- Ray (Dublin), *Proper motions of large scale Herbig-Haro flows from young stars*
- Tanvir (Cambridge), *Rapid imaging of GRB error boxes and spectroscopy of GRB-related optical/IR transients*
- Wilkinson (NRAL), *Constraints on the frequency of cluster lensing: spectrocopy of lens search targets*
- Wood (Keele), *Is magnetic activity suppresed in rapidly rotating M-dwarfs in close binaries?*

## NL NFRA PC

- Foing (ESA), *Surface structures and flares on active stars observed by AXAF*
- Le Poole (Leiden), *Assessing the quality of the GSC-II photographic photometry at the faint magnitude limit*
- Sackett (Kapteyn), *The MEGA survey: mapping microlensing in M31*
- Stempels (Upsalla), *Spectroscopy of Hydrogen Balmer lines*
- Tschager (Leiden), *The optical hosts of young radio sources - redshifts (2)*

## UK/NL WFS Programmes

- Dalton (Oxford), *A Deep UBVRI Imaging Survey with the WFC*
- McMahon (IoA), *The INT Wide Angle Survey*
- Paradijs (Amsterdam), *Faint Sky Variability Survey*

## SP CAT

- Aparicio (IAC), *Old Halos in Dwarf Galaxies*
- Esteban (IAC), *Interacting and merging phenomena in H-II galaxies*
- F-Figueroa (UCM), *Simultaneous behaviour of several activity indicators in active binary stars*
- Gallego (UCM), *Evolution of the Star Formation Rate density of the Universe at intermediate redshift*
- García (IAC), *Optical counterparts and lithium abundances of ROSAT-discovered candidates in α Per, Orion and Taurus*
- Gómez (IAC), *Spectra of type IIn-Seyfert-1 supernovae in the nebular phase: interaction with the circumstellar medium*
- González (IAC), *Doppler tomography of the cataclysmic variable WX Arietis*
- Ribas (Barcelona), *Measurement of the distance to M31 from eclipsing binaries*
- R-Lapuente (Barcelona), *High redshift supernovae: towards the determination of Omega matter and Omega Lambda and the high-z supernova rate*
- Serra (IAC), *Limits to Omega_o and Lambda_o using statistic analysis of radio-sources*

# Jacobus Kapteyn Telescope

## UK PATT

- C-Brown (QUB), *Search for evidence of outgassing in Kuiper Belt objects*
- Dhillon (Sheffield), *The masses of cataclysmic variables*
- Fitzsimmons (QUB), *The composition and origin of Near-Earth Asteroids*
- James (St Andrews), *Rotation period determinations in the intermediate-aged open cluster NGC 1039 (M34)*
- Knapen (Hertfordsh.), *Arm vs. interarm star formation processes in spiral galaxies*
- Rolfe (OU), *Red and blue photometry of PX And*
- Seigar (Ghent), *Optical properties of the disk of spiral galaxies*
- Smith (Cork), *Characterising the properties of the newly discovered Intermediate BL Lac objects*
- Steele (LJMU), *Low mass star evolution from ~100 to ~1000 Myr*
- Tanvir (Cambridge), *Rapid imaging of GRB error boxes and spectroscopy of GRB-related optical/IR transients*
- Walton (ING), *Photometric follow-up of intermediate redshift type Ia SN*
- Warren (IC), *Remote halo blue horizontal branch stars and the mass of the Milky Way*
- Williams (QMW), *Astrometry and photometry of the satellites of Saturn*

## NL NFRA PC

- Barthel (Groningen), *Completion of multi-color search for very high redshift QSO candidates*
- Le Poole (Leiden), *Photometric Calibrations for the second generation Guide Star Catalog (GSC-II)*
- Tschager (Leiden), *The optical hosts of young radio sources - optical identification (3)*

## SP CAT

- de Diego (IAUNAM), *Spectral characterisation of microvariability in quasars*
- Delfosse (IAC), *Accurate optical and infrared photometry of field very low mass stars and brown dwarfs*
- Kemp (IAC), *The structure and colours of the envelopes of cD galaxies*
- Oscoz (IAC), *Fast fluctuations in the gravitational lens Q0957+561*

*Abbreviations*

| | |
|---|---|
| **CAT** | Comité para la Asignación de Tiempo |
| **NFRA** | National Foundation for Research in Astronomy |
| **NL** | The Netherlands |
| **PATT** | Panel for the Allocation of Telescope Time |
| **PC** | Programme Committee |
| **SP** | Spain |
| **UK** | United Kingdom |
| **WFS** | Wide Field Survey |

# Contents



## Contacts at ING

| | | Tel. (+34 922) | E-mail |
|---|---|---|---|
| Site Receptionist | *Mavi Hernández* | 405655 | mavi@ing.iac.es |
| Sea-level Office | | 425400 | |
| Director | *René Rutten* | 425420 | rgmr@ing.iac.es |
| Personal Secretary | *Rachael Miles* | 425420 | miles@ing.iac.es |
| Head of Astronomy | *Danny Lennon* | 425441 | djl@ing.iac.es |
| Head of Engineering | *Gordon Talbot* | 425419 | rgt@ing.iac.es |
| Public Relations | *Javier Méndez* | 425464 | jma@ing.iac.es |
| Telescope Scheduling | *Danny Lennon* | 425441 | djl@ing.iac.es |
| Service Programme | *Ian Skillen* | 425463 | wji@ing.iac.es |
| WHT Manager | *Chris Benn* | 425432 | crb@ing.iac.es |
| INT Manager | *Nic Walton* | 425440 | naw@ing.iac.es |
| JKT Manager | *John Telting* | 425430 | jht@ing.iac.es |
| Instrumentation Scientist | *Nic Walton* | 425440 | naw@ing.iac.es |
| Engineering Operations Manager | *Clive Jackman* | 425446 | cwmj@ing.iac.es |
| Freight | *Juan Martínez* | 425414 | juan@ing.iac.es |