ISAAC NEWTON GROUP OF TELESCOPES

La Palma

Annual Report

1995 1996

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Note: Pictures on page 4 are courtesy of Javier Méndez, and pictures on page 34 are courtesy of Neil O'Mahoney (top) and Steve Unger (bottom).

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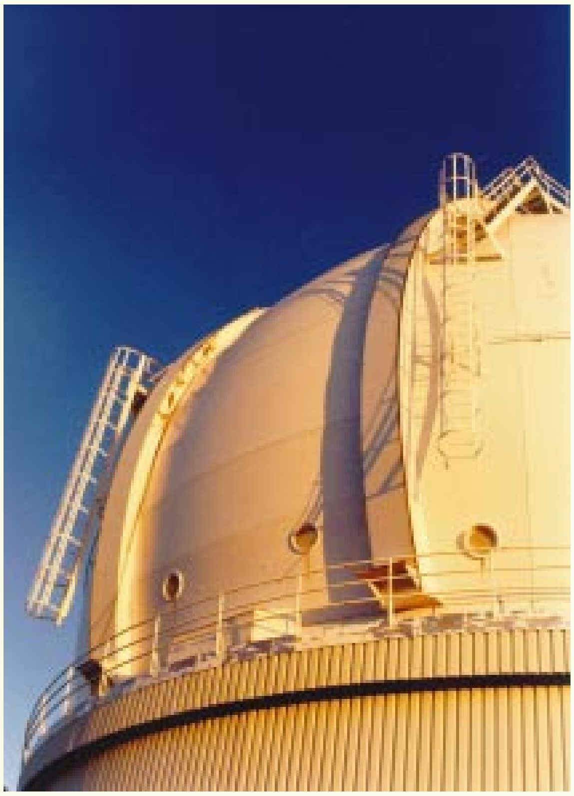
Annual Report

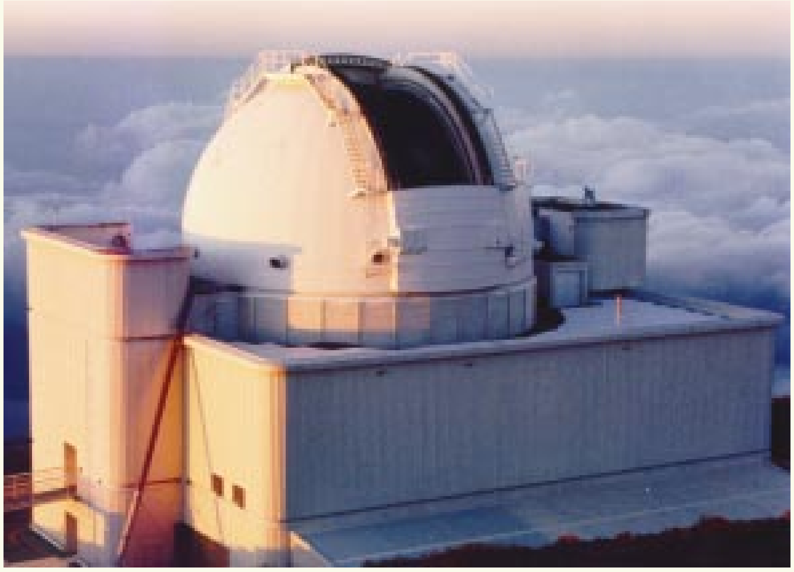
of the
PPARC-NWO Joint
Steering Committee

1995-1996

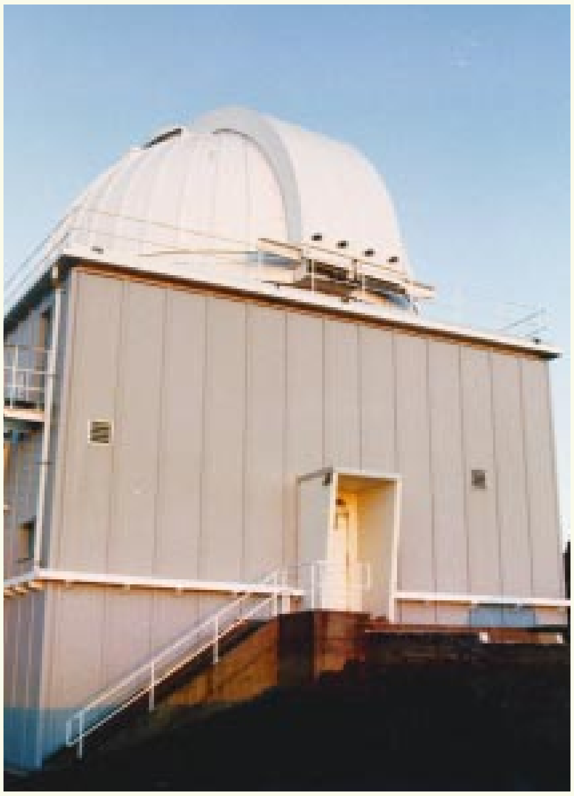
Isaac Newton Group



William Herschel Telescope



Isaac Newton Telescope



Jacobus Kapteyn Telescope

# of Telescopes

The Isaac Newton Group of telescopes (ING) consists of the 4.2m William Herschel Telescope (WHT), the 2.5m Isaac Newton Telescope (INT) and the 1.0m Jacobus Kapteyn Telescope (JKT), and is located 2350m above sea level at the Roque de Los Muchachos Observatory (ORM) on the island of La Palma, Canary Islands. 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 UK, 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 UK, Netherlands and Eire. 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 Isaac Newton Group is operated on behalf of the UK's Particle Physics and Astronomy Research Council (PPARC) and the Netherlands' Nederlandse Organisatie voor Wetenschappelijk Onderzoek (NWO).

The Roque de Los Muchachos Observatory, which is the principal European northern hemisphere observatory, belongs to the Spanish Instituto de Astrofísica de Canarias (IAC), as does the Teide Observatory on Tenerife.

CONTENTS

FOREWORD

It gives me great pleasure to write a few words on behalf of the Joint Steering Committee as an introduction to this biennial report of the Isaac Newton Group of telescopes. The two years that this report covers have seen the ING produce results which have advanced astronomical research across a very broad front. Some of the highlights are detailed later in these pages.

In extragalactic astronomy we have seen the telescopes being used to perform some of the deepest ground-based surveys of the distant universe yet attempted. Our knowledge of galaxy evolution has been furthered by the discovery of a radio galaxy at z=4.41, observations of a lensed star-forming galaxy at z=2.515 and the observational determination that dwarf irregulars are old systems.

Many of the programmes performed on the ING are international collaborations using several telescopes. Of particular note is the WENSS survey which has been performed under international collaborative time using all three ING telescopes to follow up sources detected in the low-frequency Westerbork radio survey.

In the area of star formation and stellar evolution, the INT has been used to determine the relationship between spiral structure, star formation rate and the IMF in spiral galaxies. The results clearly show a bimodal IMF, favouring a larger fraction of massive stars in the arms than in the inter-arm regions. At the other end of the stellar mass scale, optical spectroscopy and infrared photometry with the WHT helped provide conclusive proof that the object Teide 1 is indeed a brown dwarf star, the first to be unambiguously identified. Since this important discovery, several more candidates have been detected using the INT. Again, this programme was conducted using international time.

The event that caught the imagination of the public more than any other during this period was undoubtedly the apparition of comet Hale-Bopp. Again, all three telescopes were used to obtain spectroscopic and imaging data. Spectrophotometry was used to probe the outgassing rate of molecules confirming that in Hale-Bopp this was particularly high. Imaging from the JKT helped to identify 6 jets emanating from the nucleus which were the source of much of the ejected material.

Operationally, the ING has continued to improve its service to astronomers. Down-time due to faults was well below 3% on all three telescopes (compared to the recognised target of 5%). Technical down-time may be reduced still further if the promising results of the CO_2 snow cleaning technique do indeed lead to less frequent re-aluminising of telescope primary mirrors. Improvements to the working environment have also been made, and the long-awaited sea-level base is now operational. The programme of seeing and heat source evaluation has continued and has led to real gains in terms of deliverable image quality.

A primary goal we all share is to keep the ING internationally competitive. A vital part of this is the provision of new instrumentation. Thus the report contains details of the commissioning of several new instruments including WHIRCAM, MARTINI-3, Autofib/WYFFOS, the Tokyo Mosaic Camera and MUSICOS. In addition, there is a continuous programme of instrument upgrades.

Finally, on behalf of the JSC, I would like to congratulate all the staff of the ING for their efforts in helping to make 1995 and 1996 such successful years, against a background of increasing financial pressures and uncertainty, and in particular Dr Rene Rutten for the production of this excellent report.

Professor Mike Bode, Chairman of the Joint Steering Committee

INTRODUCTION

I should start by apologising for the lateness of this annual report. I find it rather embarassing in March 1998 to be writing an introduction to the 1995/96 ING annual report! My only (rather weak) excuse is that the period covered by the report was extremely hectic, and that production of annual reports was not a priority.

My own memories of this period are dominated by budget cuts and restructuring exercises. 1995 started with the publication by the UK Particle Physics and Astronomy Research Council of the findings of the Optical/IR/mm review panel, chaired by Professor Jim Hough. A key recommendation of this report was that there was substantial scope for efficiency savings at ING. I accepted this recommendation, and initiated a major restructuring programme, whose elements included tighter operational procedures, re-engineering of obsolete engineering systems, reduced dependence on UK-based operational support and the establishment of a sea-level base on La Palma. This programme has in general been a great success, for which I thank the staff at ING - though, as usual, more work remains to be done.

The major frustration during this period was that however succesfully we restructured, there always seemed to be another budget cut. By the end of 1996 ING was having to cope with a budget cut twice the size of that originally recommended by the Optical/IR/mm review. And during 1996 we had the additional distraction of the ‘Prior Options’ process - the then UK Government’s requirement for public services to be subject to competitive tendering, in this case the management of the telescopes and delivery of the instrumentation programme.

So my main emotion on reading this annual report is of relief that, despite the top-level financial and organisational difficulties, this was a period of great achievement for ING. Clearly someone was able to get some real work done! Highlights reported here include:

- The delivery by the Royal Greenwich Observatory and the University of Durham of Autofib/WYFFOS - a world-beating multi-object spectrograph for the William Herschel Telescope.

- The delivery of WHIRCAM, extending the range of the William Herschel Telescope into the near-infrared, and laying the foundations for future work on adaptive optics.

- Dramatic improvements in operational performance. By the end of this period, technical downtime on the WHT was running at about 3%, as compared to a target figure of 5%.

- Most important of all, high scientific productivity. With 200 papers in 1995 and 236 papers in 1996, and more highly-cited papers than any other UK observatory, ING is one of the most productive observatories in the world. Specific highlights include the deepest ground-based count of galaxies in B-band or the first detection of Brown Dwarfs.

I would like to end by paying tribute to the observatory staff at ING, and also at the Royal Greenwich Observatory in the UK, whose commitment, skill and experience made these achievements possible. And who made my time as Director of ING so rewarding.

Dr Steve Unger, Director of ING (to November 1997)

Chapter 1

SCIENTIFIC HIGHLIGHTS

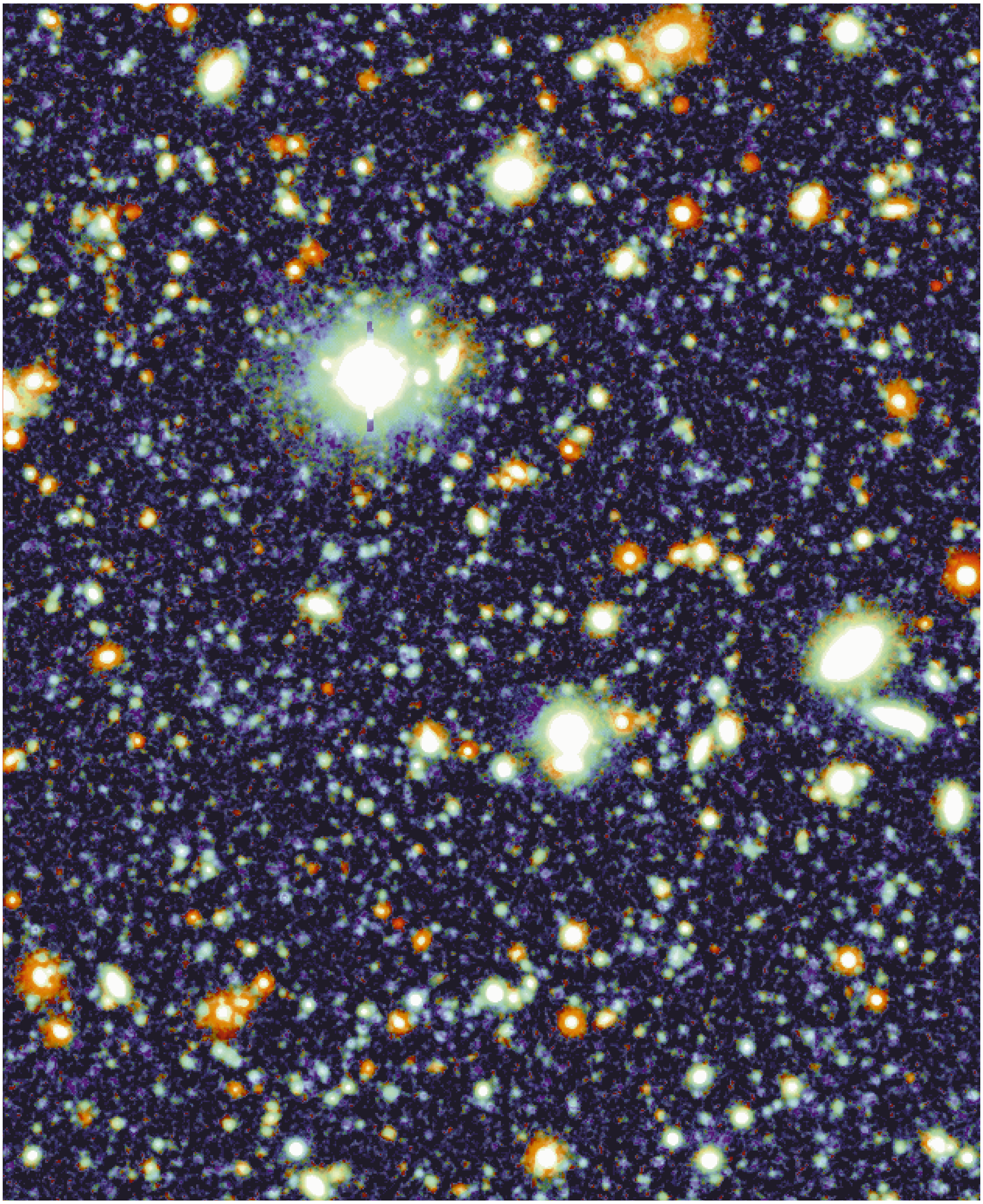
IN THE LIMITED SPACE AVAILABLE, IT IS IMPOSSIBLE TO MAKE A comprehensive survey of the science being carried out by the ING telescopes. The following is therefore necessarily only a selection of highlights, intended to be representative of the scientific quality and range of research being undertaken.

THE DEEPEST GROUND-BASED COUNT OF GALAXIES

INT+Prime Focus, WHT+Cass Aux Camera

By combining a 26-h exposure taken with the prime focus CCD camera on the INT and an exposure taken with the CCD camera at the cassegrain auxiliary focus of the WHT astronomers have extended their determination of the form of the galaxy number-magnitude count relation on one CCD field to a blue magnitude limit of B=27.5 magnitudes. These data are deeper than any previously published B-band count.

In recent years sensitive optical surveys have revealed a large population of “faint blue galaxies”, which are believed to be young galaxies observed close to their time of formation. But there has been considerably uncertainty regarding the epochs at which these galaxies are observed, owing to the difficulties inherent in determining spectroscopic redshifts for very faint objects. Using the data from the long exposures taken at the ING telescopes and those from the HST Deep Field, a team of astronomers from the University of Durham, by modelling the numbers and colours of galaxies at the faintest detection limits, has come to the conclusion that the faint blue galaxies are likely to lie at high redshift (z »2).



True-colour image of faint blue galaxies at the edge of the observable Universe, formed from a 26-hour B-band and R-band exposure at INT and a 13-h exposure in B-band at WHT. Detailed analysis of the colours shows that the bulk of the faint blue galaxies lie at redshifts of about 2 and are probably in their first phase of star formation (courtesy of Tom Shanks).

It is remarkable that the galaxy number counts derived by the HST in the B-band is only one magnitude fainter than the ground-based counts from the WHT.

References:

N Metcalfe et al, 1995, “Galaxy number counts - III. Deep CCD observations to B=27.5 mag”, *MNRAS*, **273**, 257

N Metcalfe et al, 1996, “Galaxy formation at high redshifts”, *Nature*, **383**, 236

C Frenk, 1997, “How galaxies formed”, *1996/1997 PPARC Annual Report*, 22

FIRST DETECTION OF BROWN DWARFS

WHT+ISIS, INT+Prime Focus

For decades researchers have speculated about the existence of brown dwarfs - celestial objects which probably constitute a link between stars with lower masses and giant planets, such as Jupiter, whose mass is approximately one thousandth of the mass of the Sun. There is no reason to assume that these substellar objects cannot form randomly in space through a process similar to that of the stars; i.e. as a result of gravitational collapse and fragmentation of dust and gas clouds. However, despite many searches carried out, their existence had not yet been unequivocably proved.

A brown dwarf is a self-gravitating gaseous object composed mainly of hydrogen and helium, whose mass is too small to induce stable hydrogen fusion in its interior. All the theoretical surveys conducted agree that the limiting mass which separates stars from brown dwarfs is about 7 or 8% of the mass of the Sun. Incapable of generating nuclear energy, the gravitational contraction of a brown dwarf takes place unavoidably until the pressure of the degenerated electrons in its interior interrupts the whole process. The nearby star cluster of the Pleiades, a group of stars which formed about a hundred million years ago at a distance of approximately 400 light years (3780 billion kilometers) from the Sun, is considered to be one of the most suitable astronomical sources for the detection, and the subsequent study of brown dwarfs. At such early ages, these objects should be undergoing gravitational contraction, radiating much more energy than in later stages of their evolution. More massive brown dwarfs in the Pleiades should be detectable in sufficiently deep surveys.

After only 0.3% of the cluster’s area had been explored using IAC80 telescope at Teide Observatory, a faint object was detected, whose extremely red colour possibly indicated a very low surface temperature. Firstly, its motion in space was confirmed to coincide with that of the stars of the cluster and, later, a precise photometric characterization was achieved. Several high resolution spectra between 600 and 900 nm were obtained with the WHT. These spectra confirmed the discovery of one of the coldest quasi-stellar objects known in the Universe. The spectral lines of neutral potassium between 767 and 770 nm indicated that it was an object with high surface gravity, as was expected for a brown dwarf, and the presence of prominent bands of titanium oxide and, especially, vanadium oxide at 750 nm allowed to derive its spectral classification and an estimate of its effective surface temperature, which turned out to be some 2350 K. The spectrum allowed to infere a velocity measurement of this object in regard to the Sun, which happened to be very similar to that of the stars in the cluster. All the entire set of observations suggested that it was a member of the cluster and, therefore, that its age was the same as the cluster’s: 100 million years approximately, with a margin of error below 30%. It was the first time that the age of a celestial object of this nature had been so accurately determined, overcoming one of the most important restrictions preventing the true substellar nature of brown dwarf candidates to be classified. From the cluster’s distance it was possible to determine that the luminosity of Teide 1 (this is how the discoverers decided to call the object) was one thousandth of the solar luminosity. The comparison of its principal features (luminosity, temperature and age) with all the evolutionary models available in the scientific literature led to the conclusion that Teide 1 had to be a brown dwarf.

In 1996 the International Time Project “Observational Properties of Brown Dwarfs” detected new brown dwarfs in the Pleiades cluster. Several have masses similar to Teide 1 (55 Jupiter masses approximately) or higher, but various present slightly lower masses. They were all first detected using the INT. Subsequent confirmation involved spectra from the WHT and infrared photometry from UKIRT and WHT. The Keck telescope was then used to detect the element lithium in the spectra of brown dwarfs. Lithium is an important test for brown dwarfs because it is destroyed by nuclear reactions in stars of low mass but not in brown dwarfs.

References:

R Rebolo et al, 1995, "Discovery of a brown dwarf in the Pleiades star cluster", *Nature*, **377**, 129

"Brown Dwarfs in the cluster of the Pleiades", *1995 CCI Annual Report*, 13

"New Brown Dwarfs in the Pleiades", *1996 CCI Annual Report*, 7

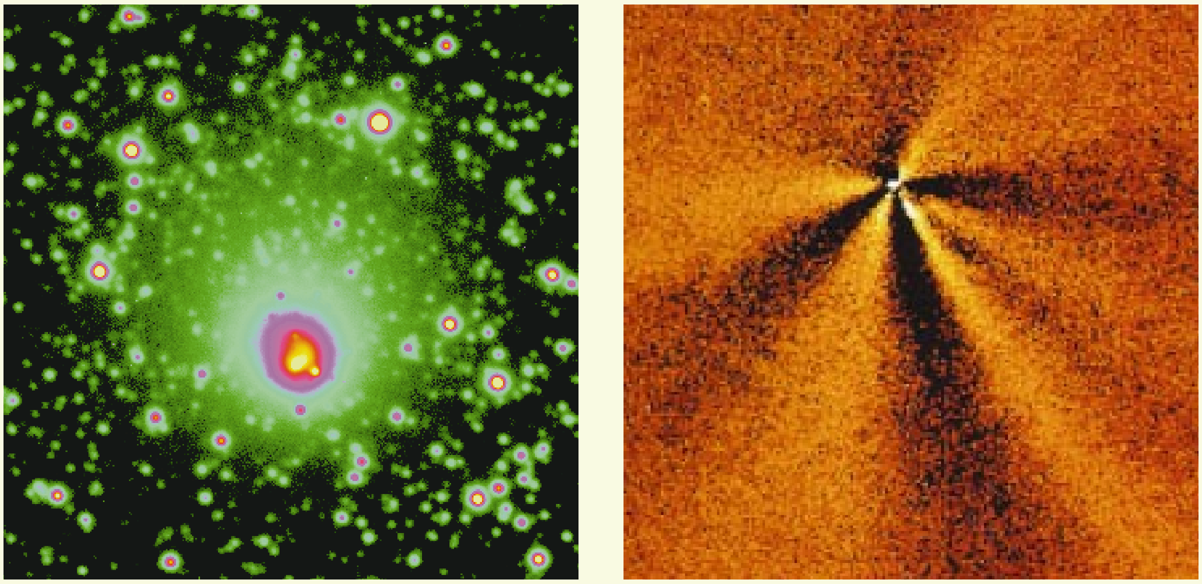
R Jameson, 1997, "The search for brown dwarfs", *1996/1997 PPARC Annual Report*, 28

"Another Brown Dwarf discerned", *S&T*, **12/95**, 10

ING OBSERVATIONS OF COMET HALE-BOPP

WHT+ISIS, INT+IDS, JKT+CCD imaging

Comet Hale-Bopp was discovered at a heliocentric distance of 7.2 AU in July 1995. What was significant about this discovery was both the large distance at which it was discovered, and that it was already at an integrated magnitude of ~10.5. To put this into context, at the same distance from the Sun Comet Halley was at V=22.8. This difference was mostly due to the fact that Hale-Bopp had generated an atmosphere, or coma, around itself, while Halley had not. At such large distances the optical coma of a comet is dominated by scatered sunlight from dust grains. These are released from the comet nucleus (generally 1–20 km in diameter) through sublimation of surface ices, at this distance primarily volatiles such as CO. Therefore the



The image on the left was obtained on 25 August 1995 when the comet was 6.9 AU from the Sun and 6.3 AU from the Earth. A large number of stars are visible, as at this time the comet was in the direction of the constellation of Sagittarius. On the right, dust jets observed in Comet Hale-Bopp with the JKT on 27 August 1996. The image spans 84 arcseconds, or roughly 170,000 km at the comet. Six jets can be seen emanating from the nucleus (courtesy of Alan Fitzsimmons).

presence of so much dust implied an extremely active nucleus, with either a large fraction of its surface undergoing outgassing, or perhaps just a very large nucleus.

Subsequent spectrophotometry with the WHT a month after discovery revealed the presence of the CN molecular band, formed from the HCN being released from the nucleus and then being photodissociated via solar UV photons. Monte-Carlo modelling of these data revealed an outgassing rate for the parent HCN molecule of 6×10^{25} mol/second. This confirmed the high activity of the nucleus, as Halley had an outgassing rate a factor of 10 lower when it was at 4.5 AU from the Sun. This meant that the discovery of Comet Hale-Bopp at an unusually large heliocentric distance provided an unprecedented opportunity to follow its evolution from beyond Jupiter into the inner Solar System. To take advantage of this, spectroscopic follow-up was carried out using variously the WHT with ISIS and the INT with the IDS. A spectrum of the comet was obtained on 3 September 1996. Even though the comet was still 3.2 AU from the Sun, where most comets show little activity, Hale-Bopp had a spectrum tremendously rich in molecular species.

While the gradual brightening of the comet is clear, any short-term variability in the dust production, and hence outgassing, rate is difficult to obtain from these observations. Therefore in August 1996 CCD imaging of Hale-Bopp was obtained with the JKT over 13 nights, with the primary goal being an investigation into the short-term (hours–days) variability of the comet. By fitting the comet images with a modelled isophote distribution and subtracted it to reveal more clearly the underlying structure, a similar process to that used in the study of shell galaxies, it is possible to study the morphology of the coma. On 27 August 1996 comet Hale-Bopp was imaged with an R-band filter in seeing of 0.6 arcseconds using the JKT. Six well defined jets were seen emanating from the nucleus. These were due to the outgassing from the nucleus being confined to several localised hotspots, where the insulating mantle was thin or non-existent thereby allowing heating of the nuclear ices.

References:

A Fitzsimmons and I M Cartwright, 1996, "Optical spectroscopy of comet C/1995 O1 Hale-Bopp", *MNRAS*, **278**, L37

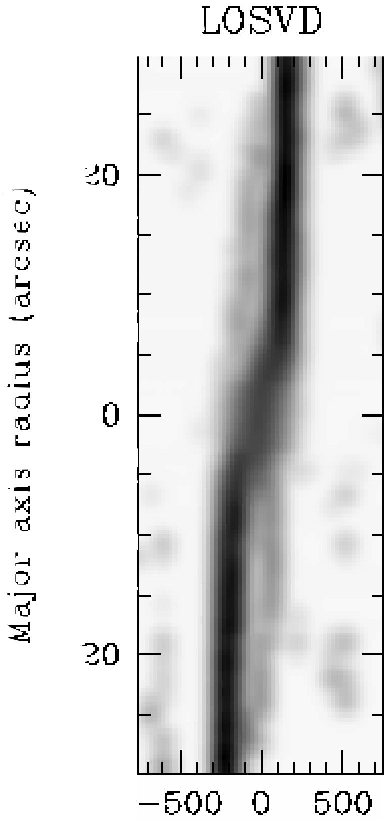
A Fitzsimmons et al, 1996, *IAU circular 6361*

A Fitzsimmons et al, "ING observations of Comet Hale-Bopp", *Spectrum Newsletter*, **12**, 4

DISCOVERY OF A NEW TYPE OF GALAXY: ONE IN WHICH THE BULGE ROTATES RETROGRADE TO THE DISK

WHT+ISIS, INT+Prime Focus

A team of astronomers found that the bulge of the large, nearby Sb galaxy NGC 7331 rotates retrograde to its disk. Analysis of spectra in the region of the near-IR Ca II triplet along the major axis shows that, in the radial range between 5 and 20 arcseconds, the line-of-sight velocity



Gray-scale plot of the stellar line-of-sight velocity distribution along the major axis of NGC 7331, where for representation purposes, the data in the spatial direction have been smoothed with a gaussian of FWHM 4 arcseconds. LOSVD stands for Line-Of-Sight Velocity Distribution (courtesy of Francisco Prada).

distribution of the absorption lines has two distinct peaks and can be decomposed into a fast-rotating component and a slower rotating, retrograde component. The radial surface brightness profile of the counterrotating component follows that of the bulge, obtained from a two-dimensional bulge-disk decomposition of a near-infrared K-band image, while the fast-rotating component follows the disk. At the radius at which the disk starts to dominate, the isophotes change from being considerably boxy to being very disky.

Although a number of spiral galaxies have been found that contain cold, counterrotating disks, this is the first galaxy known to have a boxy, probably triaxial, fairly warm, counterrotating component, which is dominating in the central regions. If it is a bar seen end-on, this bar has to be thicker than the disk. NGC 7331, even though it is a fairly early-type spiral, does not have a conventional, corotating bulge. The fact that the inner component is retrograde makes the astronomers believe that it was formed from infalling material in either stellar or gaseous form. Another possibility discused by the discoverers is that the structure has been there since the formation of the galaxy. In this case, it will be a challenge to explain the large change in orientation of the angular momentum when going outward radially.

References:

F Prada et al, 1996, "A counterrotating bulge in the Sb galaxy NGC 7331", *ApJ*, **463**, L9

C M Gutiérrez et al, 1996, "Un bulbo retrógado en la galaxia cercana NGC 7331", *IAC Noticias*, **1/1996**, 4

A GRAVITATIONALLY LENSED Z=2.515 STAR-FORMING GALAXY

WHT+LDSS-2

The origin and evolution of galaxies is one of the holy grails of modern astronomy. It is interesting that despite a huge effort over the last few decades, the nature of galaxy evolution is still much less well understood than that of the stars from which the galaxies themselves are largely made. In order to study how galaxies change with time, the astronomer must isolate populations at different look-back times and compare them with the well-studied objects we see around us today. The major problem of this work is that the farther away you look, the fainter the sources become, and consequently isolating such a population from bright, close-by objects becomes very difficult.

The most obvious and systematic method is to conduct large spectroscopic surveys to determine redshifts for as many faint galaxies as possible. The disadvantage of this approach is that even at the faint limits achievable with 10m telescopes, only a tiny fraction of galaxies lies beyond about a redshift of 1. Thus a huge number of redshifts must be accumulated before even one distant source is located. What is needed is a method of selection which would only be sensitive to very distant galaxies. One of these methods is based on gravitational lensing by clusters of galaxies, in which the selection is purely geometrical.

Giant arcs in clusters were first recognised in the mid-1980s and the great potential of lensing as a cosmological tool was realised soon afterwards. The magnification and distorsion induced by the lensing depends solely on the position and distance of the source with respect to the lensing cluster. Thus low-luminosity sources may be magnified just as often as high luminosity ones by virtue of their alignment with the lens. The magnification allows the astronomers to obtain spectra and redshifts for objects otherwise too faint for such study with today's telescopes. Moreover, in addition to the boosting of the apparent magnitude, the lensing spatially magnifies the objects, whose components may then be studied individually. A second advantage of this technique is its ability to amplify sources over a wide redshift range ($z > 0.5$).

Data from the HST enables the construction of very precise mass models for selected lensing clusters. A good example is the recent analysis of Abell 2218 ($z=0.175$), where the resolution of the HST allowed the construction of a detailed mass model constrained by as many as seven multiply-imaged sources. Based on these mass models, a number of the arclets were predicted to have redshifts $z > 1$.

As part of a major effort to verify the lensing inversion method for Abell 2218, astronomers secured spectra for a large sample of faint arclets. For this purpose, the Low Dispersion Survey Spectrograph (LDSS-2) at the WHT was used. As a result, a redshift of z=2.515 for a refracted galaxy was obtained and this was the first confirmation of a redshift predicted by a cluster lensing model.

The source responsible for the lensed images appeared to be a blue galaxy whose on-going star formation rate of 7–11 solar masses per year is similar to that of similar sources found at higher redshift using the Lyman limit cutoff as a high-z locator. Its brightness was magnified almost 3 magnitudes thanks to the lensing process.

References:

T M D Ebbels et al, 1996, “Identification of a gravitationally lensed z=2.515 star-forming galaxy”, *MNRAS*, **281**, L75

“The Universe through a gravitational lens”, *PPARC Bulletin*, **3**, 20

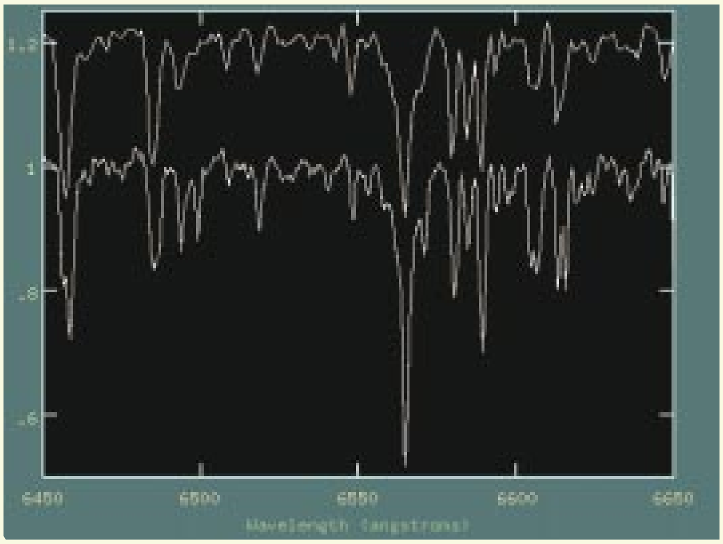
T Ebbels et al, 1996, “A gravitationally lensed z=2.515 star-forming galaxy”, *Spectrum Newsletter*, **9**, 4

A DYING STAR’S LAST GASP: SAKURAI OBJECT

WHT+ISIS

In February 1995 a Japanese amateur astronomer discovered a nova in the constellation of Sagittarius (now known as V4334 Sagittarii). Its pre-discovery light curve indicated that it was unusual in that it had apparently been evolving only very slowly compared to a normal nova. Spectroscopic observations post discovered with the WHT showed the star to have little resemblance to any previously observed nova and in fact looked more like a solar type object shrouded in dust and with some level of hydrogen deficiency. Further observations revealed the presence of a nebula shell some 45 arcseconds in diameter. Thanks to a PATT award the ING has been monitoring this event since discovery and has witnessed gross spectral changes as the star has cooled.

Spectral variations in the Sakurai object during a period of 14 day during april/may 1995. The cooling of the star is accompanied by a remarkable strengthening in H alpha as well as the appearance of other features (courtesy of Don Pollaco).



The discovery of a Planetary Nebula at the WHT is important in that it indicates we are dealing with an evolved star. Planetary Nebula occur when a star evolves from red supergiant to a white dwarf expelling material. During this evolution the star rapidly heats up in 10,000–20,000 years reaching a surface temperature of 100,000 K or more, and this causes the expelled material to become visible. When the star becomes a white dwarf nuclear reactions no longer occur and the star simply fades and cools.

More recent work has shown that this may not be the end of the story, for some or even most stars. Just as the star reaches the white dwarf phase instabilities within its interior can cause an explosive event called a shell flash. In some objects this event can be so intense that material around the core of the star violently starts undergoing nuclear reactions. This can cause the star to go through a second supergiant phase and Planetary Nebula ejection before settling down to become a white dwarf. The time scale for this evolution is rapid taking anywhere from a few months to a few years to evolve from a white dwarf - red supergiant - hot Planetary Nebula central star. It is this evolution that Sakurai's object is currently undergoing.

During this century there is only one other object that is known to have undergone a shell flash of this magnitude: the central star of the old Planetary Nebula Abell 58 or V605 Aql. This object was first spotted as an unusually slow nova in 1918 and reaching about 10th magnitude in 1920. During its slow fade the light curve underwent rapid and large fluctuations similar to those seen in R Corona Borealis stars. The star was finally lost to observers around 1923 and was essentially forgotten about. In 1989 the star was recovered again as a very hot Wolf-Rayet star shrouded in dust and gas and having a brightness of around the 22nd magnitude and its ejected nebula contains virtually no hydrogen. HST imaging shows this new nebula to be 0.5 arcsec in diameter and containing very non-uniformly distributed material.

References:

D Pollaco, 1996, *IAU circular 6328*

"A Dying Star's Last Gasp", *S&T*, **05/96**, 11

A RADIO GALAXY AT REDSHIFT 4.41

WHT+ISIS, +Cass Aux Camera

The most distant astronomical objects observed are quasars at redshifts of $z \approx 4.9$, corresponding to a time when the Universe was less than a billion years old. This leaves little time during which quasars and their host galaxies could form. In principle, the evolutionary state of the host galaxies can be probed by determining how many stars have formed, but this task is not straightforward because light from the quasar itself overwhelms any accompanying starlight. High-redshift radio galaxies – the likely progenitors of luminous elliptical galaxies – provide better targets for such studies, as optical emissions from their active nuclei are observed to be faint. The radio galaxy 6C0140+326, discovered in the optical following to observations by the WHT, shows no evidence for either a stellar continuum or an obscured quasar nucleus. The astronomers conclude that the galaxy associated with the radio source is neither fully formed nor obviously in the process of forming stars. This implies that at least some giant elliptical galaxies are still immature at $z \approx 4.5$ and that if the intense bursts of star formation thought to produce the bulk of their stellar populations occur during the radio-bright phase, these star-forming regions are obscured by dust and gas.

6C 0140+326 has a redshift of 4.41, exceeding that of the previous record-setting radio galaxy, 8C 1435+635 at z=4.25, also discovered by the WHT.

References:

S Rawlings et al, 1995, "A radio galaxy at redshift 4.41", *Nature*, **383**, 502

"Redshift records renewed", *S&T*, **01/97**, 12

THE WENSS SURVEY

WHT, INT, and JKT

The night-time CCI International Time Programme (ITP) observations for the period February 1995 to January 1996 were carried out by a consortium of astronomers following up various aspects of the Westerbork Northern Sky Survey (WENSS). This is a radio survey of the northern sky at the relatively low frequency of 327 MHz. Much of the work in the spring/summer concentrated on the mini-survey region, a 500 square degree area centred on the north ecliptic pole. The radio sources in the survey were split into several subgroups and a high success rate was achieved in following up each one: nearby galaxies, flat (quasars), peaked and ultra-steep (high-redshift galaxies) spectrum radio sources, and gravitational lenses.

The observations were carried out with CCI telescopes, among them, WHT, INT and JKT, both imaging and spectroscopy. These observations have improved the understanding of low-flux radio sources at both low and high redshift. The work at low redshift has allowed the construction of luminosity functions in the optical and in the radio, for nearby weak radio sources. It is clear from the work on flat-spectrum and ultra-steep spectrum radio sources that the WENSS survey allow the study and selection of objects to consistently higher redshifts than have generally been possible with higher flux radio surveys, and is therefore extremely well suited to the study of the high-redshift universe.

During the survey, a good candidate for a giant radio galaxy was found: Mrk 1498 (B1626+5153). These kinds of extragalactic radio sources with dimensions greater than 1.5 Mpc are rare in the cosmos, but provide in principle a good laboratory for studying both the physics of the radio galaxy phenomenon and the nature of the intergalactic medium. It is uncertain whether these sources attain such large sizes because the ratio of jet power to the density of the surrounding medium is unusually large, or because the sources are simply much older than the average radio source of the type and so have had time to expand to unusually large dimensions.

Mrk 1498 is a classical double source which has a maximum dimension of at least 1.6 Mpc, a flux density at 325 MHz of 1.9 Jy and spectral index of –0.66. Optical spectra with the WHT show a narrow line emission spectrum typical of many radio galaxies and yield a redshift of z=0.056. The H-alpha line clearly has a broad line component, making Mrk 1498 the third known giant radio galaxy exhibiting broad permitted lines.

Most available evidence supports the view that the main differences among radio galaxies and radio quasars may be understood as an orientation effect. At some orientations one can see the central source directly, including the broad permitted lines, while at others the center is hidden and only the larger scale narrow emission line gas and large scale radio emission is visible. Of the dozen or so giant radio sources known, three, including Mrk 1498, show broad optical permitted lines, broadly consistent with the predictions of this orientation unification model.

References:

H J A Röttgering et al, 1996, “WN 1626+5153: a giant radio galaxy from the WENSS survey”, *MNRAS*, **282**, 1033

A P Schoenmakers et al, “Giant Radio Galaxies from the WENSS”, *1995/1996 Annual Report of the Utrecht Astronomical Institute*, 19

“WENNS”, *1996 CCI Annual Report*, 12

“Giant Radio Galaxies”, *1995 NFRA Annual Report*, 35

GALAXY’S HEART IS HEAVY

WHT+FAST

An extensive new study of the Galactic center stellar cluster was carried out thanks to observations with the WHT and other ground-based telescopes. One of the conclusions of such study is that the central parsec is powered by a cluster of about two dozen luminous and helium-rich blue supergiants/Wolf Rayet stars ($T_{eff} \approx 20{,}000–30{,}000$ K) with ZAMS masses up to 100 solar masses approximately. The most likely scenario for the formation of the massive stars is a small star formation burst between 3×10^6 and 7×10^6 years ago. In this scenario the Galactic center is presently in a short-lived, post-main-sequence “wind phase”. In addition, there is evidence for another star formation event about 10^8 years ago, as well as for recently formed massive stars that may have been transported into the central core along with orbiting gas streamers. The radial velocity dispersion of 35 early- and late-type stars with distances of 1–12 arcseconds from Sgr A*, a luminous radio-source near the Galactic center, is 154±19 km/s. These new results strongly favor the existence of a central dark mass of 3×10^6 solar masses approximately (with density $\geq 10^{8.5}$ solar masses/pc^3, and $M/L \geq 10$ solar masses/solar luminosities) within 0.14 pc of the dynamic center.

References:

A Krabbe et al, 1995, “The Nuclear Cluster of the Milky Way: star formation and velocity dispersion in the central 0.5 parsec”, *ApJ*, **447**, L95

A Krabbe et al, 1993, “FAST: a near-infrared imaging Fabry-Perot spectrometer”, *PASP*, **105**, 1472

“Our Galaxy’s Heavy Heart”, *S&T*, **02/96**, 14

THE CURIOUS M100’S CORE

WHT+TAURUS

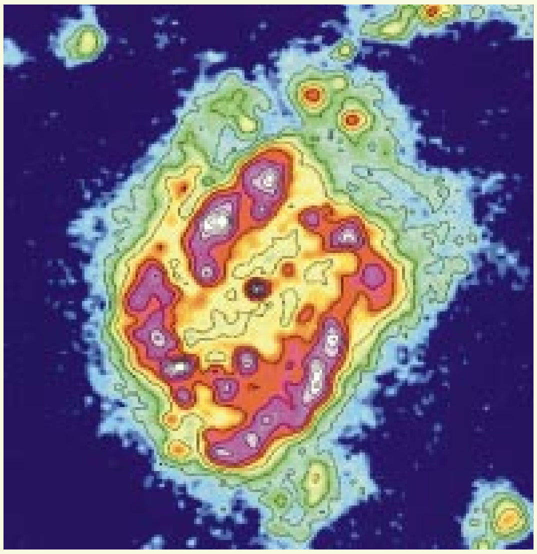
The inner region of the barred spiral NGC 4321 (M100) shows remarkably different morphology in the optical and the near-infrared. Whereas in the optical it is dominated by two spiral arms lying in an ovally shaped region of enhanced star formation, a K-band image reveals an inner bar aligned with the 5 kpc stellar bar and a pair of leading arms emerging from its ends. Neither feature is observed directly in the optical.

NGC 4321 is a nuclear starburst induced and maintained by a global bar-driven density wave. The location of the starburst in the circumnuclear “ring” is related to the slowing down of the radial gas inflow in the presence of inner Lindblad resonances. Understanding the details of such radial flows in barred galaxies may well shed light on the origin and fueling of active galactic nuclei.

References:

J H Knapen et al, 1995, “The striking near-infrared morphology of the inner region in M100”, *ApJ*, **443**, L73

“M100’s Curious Core”, *S&T*, **10/95**, 13



H-alpha continuum subtracted image of the central region of M100, as obtained using the TAURUS instrument on the WHT, with sub-arcsecond resolution. The H-alpha emission shows where massive stars are presently1y forming, represented by white in this false colour image. Note that the spiral arms visible in this image connect directly to the spiral arms in the disc of the galaxy (courtesy of J. H. Knapen).

DEFICIT OF DISTANT X-RAY-EMITTING GALAXY CLUSTERS AND IMPLICATIONS FOR CLUSTER EVOLUTION

WHT, INT, and JKT

The ROSAT International X-ray Optical Survey (RIXOS) was aimed at the optical identification of a complete sample of ~400 serendipitous X-ray sources found in 81 northern ROSAT fields, achieved using an International Time award on the Canarian Telescopes. Fields at high Galactic latitude ($b>+28°$) were selected with exposure times longer than 8000 seconds achieving a limiting flux optimized for wide-area optical follow-up. In total, 385 X-ray sources were catalogued over 20.4 deg^2 to a limiting flux of $f_X \geq 3.0\times10^{-14}$ erg/s/cm^2 in the 0.5–2.0 keV energy band.

An overview of the various stages of data preparation and acquisition for RIXOS included: source searching and positional calibration of the X-ray images, the construction of finding charts around each of the sources using digitised sky-survey plates, a search for previously-known catalogued sources from on-line services, deep imaging of the optically empty fields using the Nordic Optical Telescope and the INT, spectroscopic observation of the brighter sources with the INT and of the fainter ones with the WHT, and, finally, multicolour imaging photometry of extended or interesting objects using the JKT. The results of the RIXOS survey provided a sample which is complete over 15 deg^2 of sky, including 319 X-ray sources of which the largest population is of Active Galactic Nuclei (AGN), followed by stars, clusters of galaxies, Emission Line Galaxies (ELG), and finally, just one “normal” galaxy.

The most significant scientific result from the survey was the deficit of distant X-ray-emitting galaxy clusters found. Clusters of galaxies are the largest gravitationally bound systems in the Universe and therefore provide important constraints on the formation and evolution of large-scale structure. Cluster evolution can be inferred from observations of the X-ray emission of the gas in distant clusters, but interpreting these data is not straightforward. In a simplified view, clusters grow from perturbations in the matter distribution, and the intracluster gas is compressed and shock-heated by the gravitational collapse. If the gas is in hydrostatic equilibrium the resulting X-ray emission is related in a simple way to the evolving gravitational potential. But if processes such as radiative cooling or pre-collapse heating of the gas are also important, the X-ray evolution will be strongly influenced by the thermal history of the gas. In the RIXOS project very few distant clusters were identified, and their redshift distribution seems to be inconsistent with simple models based on the evolution of the gravitational potential. These results thus suggest that radiative cooling or non-gravitational heating of intracluster gas must be important in the evolution of clusters.

References:

F J Castander et al, 1995, “Deficit in distant X-ray-emitting galaxy clusters and implications for cluster evolution”, *Nature*, **377**, 39

“The ROSAT International X-ray/Optical Survey (RIXOS)”, *1995 CCI Annual Report*, 6

AND FINALLY SOME CURIOSITIES

The maximum redshift for quasar fuzz seen from Earth has grown to z=2.3 thanks to observations obtained with the WHT (I Aretxaga et al, 1995, *MNRAS*, **275**, L27).

WHT also discovered the most distant giant double radio source: 4C 39.24 at z=1.887 (J D B Law-Green et al, 1995, *MNRAS*, **277**, 995), and showed that active galaxies with large double radio lobes are not enormously less common at redshifts above unity than they are closer (G Cotter et al, 1996, *MNRAS*, **281**,1081).

Chapter 2

NEW INSTRUMENTATION AND ENHANCEMENTS

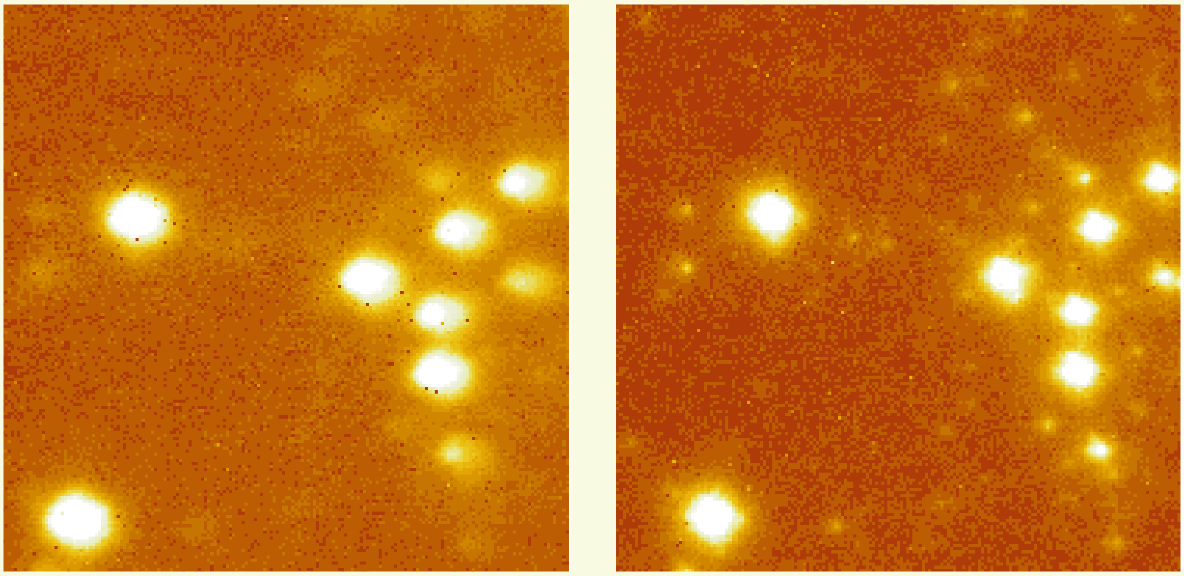
WILLIAM HERSCHEL TELESCOPE

THE CAPABILITY OF INSTRUMENTS OFFERED TO OBSERVERS AT ING was augmented in 1995 through the commissioning of the WHIRCAM infrared imaging camera, based on a 256 x 256 element InSb array. It was subsequently used for many observing runs. WHIRCAM also served as the science detector for the Durham prototype adaptive-optics system MARTINI. To provide optimal throughput in the infrared a new derotator was commissioned for the Nasmyth focus. First steps were taken for subsequent commissioning of WHIRCAM in the cassegrain focus, where the instrument was anticipated to be mounted permanently on the standard acquisition and guiding unit. Unfortunately, in December 1996 the detector failed and had to be sent back to the manufacturer for repair.

The MARTINI-3 adaptive-optics system was successfully commissioned in co-phased mode, which achieved images with 0.2-arcsec FWHM over the full 13-arcsec field of view. These encouraging results demonstrated the successful application of adaptive-optics techniques to relatively faint targets, including extra-galactic objects. These trials also provided essential input for the development of the common-user NAOMI adaptive-optics system, which is a key element of ING’s development programme.

The wide field available at the prime focus of WHT is very effectively exploited through the development of the prime focus fiber positioning unit, AUTOFIB, feeding the intermediate resolution fiber spectrograph, WYFFOS. This system is capable of measuring up to 120 objects over a field of 40 arcminutes wide. The individual fibers are positioned automatically in the focal plane by a robotic gripper unit working to an overall accuracy of better than 10 microns. Light captured by the fibers is run along the telescope structure to the Nasmyth platform and then fed into the WYFFOS spectrograph. This spectrograph has different modes of operation, yielding resolutions ranging from 1 to 10 Å.

The commissioning of this complex fiber system was carried out in various stages during 1995 and 1996. A number of problems, both with the AUTOFIB positioning unit and with the WYFFOS spectrograph plagued the commissioning. Some fundamental problems with the robotic fiber positioning unit persisted and required a major redesign. In spite of these difficulties, the system was used successfully for various observing runs and produced spectra of many hundreds of galaxies and stellar objects.



Observations of the globular cluster M15 using the MARTINI adaptive-optics system. Shown on the left is the K-band uncorrected image and on the right the corrected image.

Another instrument specifically exploiting the wide field of the WHT prime focus was the mosaic CCD camera (totaling 5000 x 8000 pixels) built at NAO Japan, which was first deployed on the WHT in 1996. The (unfilled) mosaic CCD covers 30' x 50' in four exposures, i.e. most of the prime-focus field, and provides a superb complement to the AUTOFIB/WYFFOS fibre-fed spectrograph. This instrument, a prototype for the Subaru telescope, is a visiting instrument at ING.

The ISIS intermediate resolution spectrograph in the cassegrain focus of the WHT saw an upgrade of its polarisation unit in 1996. Although the optical capabilities remained the same, the operational accuracy was substantially improved and made more reliable.

INTEGRAL, the integral field fiber feed for the WYFFOS spectrograph, was being built by a collaborative team from the IAC, RGO, and ING. Design and manufacture progressed well. This instrument will be deployed at the nasmyth focus of the WHT with a variety of integral field fiber bundels for optimized sampling, depending on the science requirements and the seeing conditions.

ISAAC NEWTON TELESCOPE

The prime-focus Wide Field Camera approached completion in 1996. The camera contains a mosaic of four 2048 x 2048 pixel thinned Loral CCDs. The delivery of these devices was substantially delayed which resulted in much later commissioning of the instrument than originally anticipated. The camera started to be used for scheduled common-user observations in 1996.

MUSICOS, a fibre fed echelle spectrograph, constructed by an ESA/Leiden group, was successfully commissioned for use on the INT in 1996. Much useful science was obtained from the scheduled programmes. MUSICOS was located in the old photographic developing room on the INT observing floor. This instrument fills a niche for high resolution spectroscopy (R ~ 40,000) for objects of intermediate brightness during bright time. The possibility of retaining this instrument on a long-term basis was under investigation.

DETECTOR ENHANCEMENTS

A large-format unthinned 2220x1280 EEV CCD was commissioned for use with UES in 1995. In 1996 a 2048 x 2048 thinned Loral CCD was commissioned as a general-purpose detector for the WHT. This device had an excellent UV and blue response, but suffered from cosmetic defects and operational complexities. Furthermore, the relatively poor point-spread function and relatively high read noise limited the use of this detector. The 1024 x 1024 thinned TEK devices remained the work horse detectors at ING.

The IPCS detector was used for the last time in February 1996. Its chief advantage over CCDs was its zero readout noise which gave it an advantage for very faint sources and high-resolution spectroscopy. But since CCDs became available with very low readout noise, combined with their high quantum efficiency, these detector reduced the advantage of the IPCS detector, which was subsequently decommissioned.

A fast and continuous readout mode was developed for detectors on the WHT. This new mode of operation allows very short exposure times, as short as 0.2 seconds, with similar low dead times. This readout mode is particularly suited for high-speed spectroscopy of rapidly varying sources such as X-ray binaries and flare stars. This readout mode was achieved by only adapting the CCD controller software and the high-level data acquisition software.

Chapter 3

TELESCOPE PERFORMANCE

USE OF TELESCOPE TIME

THE FOLLOWING TABLES SHOW FOR EACH TELESCOPE HOW THE nights in Semesters A and B were allocated between PATT, CAT, the international collaborative scheme, scheduled stand-downs, and service and discretionary nights. Stand-downs are periods of major maintenance or instrumental commissioning. Discretionary nights are used partly for minor enhancements and calibration and partly for astronomy (for example, as compensation for breakdowns or for observations of targets of opportunity). The aim of the ING Service Programme is to provide astronomers with a way to obtain small sets of observations, which would not justify a whole night or more of telescope time. For each telescope and instrument several nights per month are set aside especially for this purpose. During those nights, La Palma support astronomers perform observations for several service requests per nights.

The British and Dutch time is allocated by PATT, and CAT is responsible for the Spanish time. The ratio of PATT : CAT : international time is nominally 75 : 20 : 5. This ratio is monitored and small differences in these proportions in any one year are corrected over a number of observing seasons.

The way the available observing time on the ING telescopes has been shared in 1995 and 1996 is summarised in the following tables.

Semesters 95A+95B

	WHT		INT		JKT	
	nights	**%**	**nights**	**%**	**nights**	**%**
PATT	201	55.1	224	61.4	248	68.0
CAT	60	16.4	67	18.4	69	18.9
ITP	15	4.1	16	4.4	16	4.4
Service	24	6.6	21	5.7	8	2.2
Stand-down	43	11.8	18	4.9	10	2.7
Discretionary	22	6.0	19	5.2	14	3.8
Total	365	100.0	365	100.0	365	100.0

Semesters 96A+96B

	WHT		INT		JKT	
	nights	**%**	**nights**	**%**	**nights**	**%**
PATT	200.5	54.8	224	61.2	242	66.1
CAT	65	17.7	70	19.1	71	19.5
ITP	16	4.4	16	4.4	16	4.4
Service	27.5	7.5	19	5.2	11	3.0
Stand-down	35.5	9.7	24	6.6	13	3.5
Discretionary	21.5	5.9	13	3.5	13	3.5
Total	366	100.0	366	100.0	366	100.0

USE OF INSTRUMENTATION

The tables below show for each telescope the number of nights for which the different instruments were used. Stand-down periods are excluded. The abbreviations are explained in Appendix B and the Glossary. "Other" includes all instrumentation which is not common-user.

ISIS and UES were again the most popular instruments on the WHT. On the INT the most used instruments were, as in previous years, the prime focus CCD camera and the IDS spectrograph. On the JKT, the dominant instrument remains the CCD camera.

Semesters 95A+95B

WHT

	ISIS	LDSS	Taur	UES	WYF	PF	Mart	Fib	GHR	WCAM	Other	Total
nights	147	28	14	70	22	18	12	6	11	16	14	358
%	41.0	7.8	3.9	19.6	6.1	5.0	3.3	1.8	3.1	4.5	3.9	100.0

INT

	PFC	IDS	Other	Total
nights	131	209	7	347
%	37.8	60.2	2.0	100.0

JKT

	CCD	RBS	Other	Total
nights	299	35	21	355
%	84.2	9.9	5.9	100.0

Semesters 96A+96B

WHT

	ISIS	LDSS	Taur	UES	WYF	PF	Mart	Fib	GHR	WCAM	Other	Total
nights	105	28	31	69	40	22	9	3	14	26	15	362
%	29.0	7.7	8.5	19.1	11.0	6.1	2.5	0.9	3.9	7.2	4.1	100.0

INT

	PFC	IDS	Other	Total
nights	114	209	33	356
%	32.0	58.7	9.3	100.0

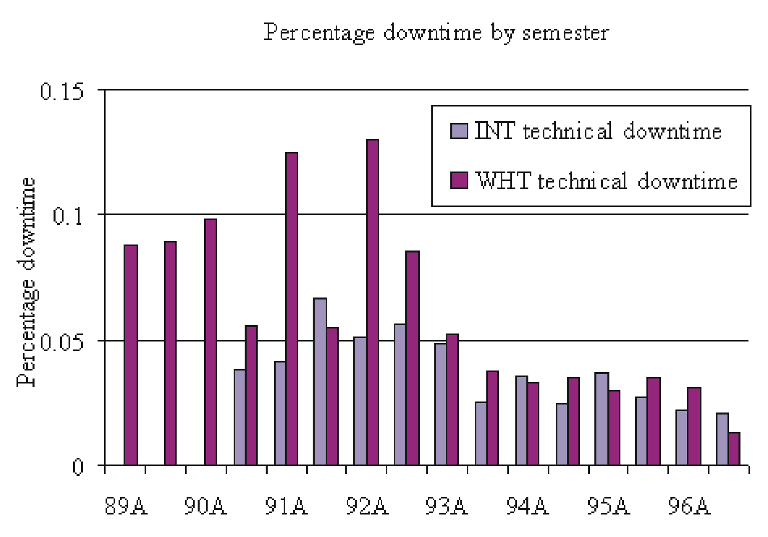
JKT

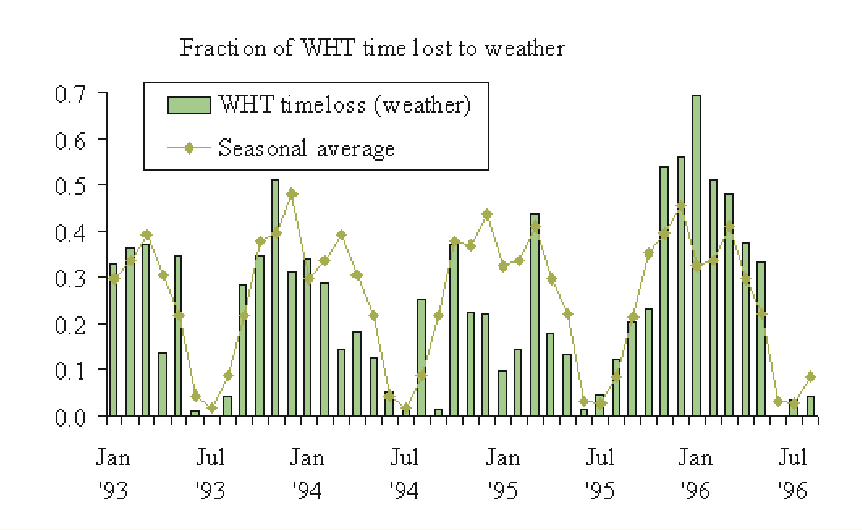
	CCD	RBS	WFC	PP	Other	Total
nights	273	36	8	8	28	353
%	77.3	10.2	2.3	2.3	7.9	100.0

TELESCOPE RELIABILITY

During 1995 and 1996 operation of telescopes at ING continued to be very satisfactory with time lost due to technical faults at low levels averaging 2.8% for the William Herschel Telescope, 2.7% for the Isaac Newton Telescope, and 2.4% for the Jacobus Kapteyn Telescope. No single particular problem was responsible for the remaining technical down time.

The following plots show for each telescope the proportion of scheduled observing time lost to technical failures and bad weather. All PATT, CAT and international collaborative nights are included when common-user instrumentation was mounted; stand-downs and discretionary time are excluded. Percentages of technical downtime for JKT were: 2.9% (95A), 1.5% (95B), 3.4% (96A), and 2.7% (96B).





Chapter 4

TELESCOPE OPERATION

TELESCOPE OPERATIONS

IN 1995 A NEW TECHNIQUE FOR CLEANING THE PRIMARY MIRROR optics was tested, using CO_2 snow which is gently sprayed over the mirror surface, carrying the dust particles with it. Since 1996, besides the annual re-aluminising, the primary mirrors of the three telescopes were cleaned once every two months in-situ using CO_2 snow. The results looked promising, with much reduced dust buildup throughout the year. From visual inspection and measurements of the mirror reflectivity it is anticipated that with regular in-situ mirror cleaning snow the periods between aluminising can be extended to two years or more.

The control rooms of each of the telescopes were substantial modified. In particular a new control desk was installed for the WHT. This desk is much more spacious, provides a better work environment, and improved protection for the electronics and cabling. Furthermore, partitioning walls within the control room now provide a better layed out and more quiet general computing area. The control rooms of the INT and JKT underwent similar face lifts to keep pace with the upgraded equipment and changing work requirements.

A key area of attention at ING was the evaluation of seeing quality. The assessment of seeing at the focus of the WHT, and a comparison with the undisturbed site seeing outside the telescope building provides fundamental input to the design of adaptive-optics systems, and serves the general aim of improving the image quality of the telescope. Two new diagnostic tool were installed and taken into operation in 1995: the Differential Image Motion Monitor (DIMM) which was installed on its own observing tower, some 50 meters away from the WHT building, and a Shack-Hartmann fast optical wavefront sensor (JOSE), which was operated from the Nasmyth focus on the WHT. Both diagnostic tools were used on a regular basis throughout the years, through half-hour overrides of the scheduled observations. Visiting scientists were very cooperative and understood the need for these disruptions of their observations. Good sampling throughout the various seasons and different parts of the night were obtained. Besides these regular measurements also targeted site characterization campaigns took place. Once a large database of observations has been obtained, it will become clear how the quality of La Palma as an observing site compares to other sites, and how the dome and telescope structure affect seeing quality.

The tower with the DIMM on the top at a height of 5 m above ground. The DIMM is based on a 20 cm Celestron telescope. The WHT in the background is 50 m away and about 15 m above the level of the DIMM.

Substantial progress was made on remedial work to reduce heat input into the dome environment with the aim to achieve improved seeing conditions. A new services building, external to, and downwind from the WHT was completed. An improved oil cooling system for the WHT hydrostatic bearings was installed in this building. The new oil cooling plant keeps the oil at a pre-set level corresponding roughly to the night-time air temperature. Eventually also the cooling plant required for instrument and mirror cooling will be installed here.

Towards the end of 1995 the original airbag mirror-support system on the INT was replaced by a bellowphragm three-sector mirror support system similar to that of the WHT. This new system has proven to be much more robust in operation.

In 1996 major advances were made on the re-engineering programme on the INT. Through intermediate steps, gradually fasing out obsolete computers and electronics, the new data acquisition system was installed. These improvements dramatically reduced the CCD readout overheads and allowed observers to immediately access their data on a workstation. A similar upgrade took place on the JKT.

The sea-level office in Santa Cruz de La Palma (green building) came into use during 1996.

Optical tests of the JKT primary mirror and its support were undertaken in 1995. These tests indicated that the mirror support system is inadequate and limits the best achievable image quality. Telescope pointing and image quality would benefit from an improved mirror support system. An upgrade to the support system is being considered.

In recognition of the potential dangers of working alone, in an isolated environment, the JKT was fitted out with a lone worker alarm system which automatically alerts other workers on-site, should the individual become motionless, or press the manual alarm on the unit.

Following a continuing decline in the use of the Peoples Photometer on the JKT, this instrument was decommissioned in 1996.

OBSERVATORY INFRASTRUCTURE

The temporary office accommodation outside the main WHT telescope building, known as the Casa Blanca, was demolished. To compensate the associated loss of office space, additional offices were constructed in the INT building. However, it became clear that only a sea-level base could adequately meet the long-term accommodation requirements.

In 1996 the Mayantigo building in Santa Cruz was identified as the most suitable location to establish a sea-level base. Agreement was reached with the Galileo telescope and with the Nordic Optical Telescope to collaborate with ING to establish a joint astronomy centre in Santa Cruz de La Palma. Offices were planned and constructed, library, communications and computing infrastructure was installed, and staff commenced to occupy their new offices during the fall of 1996. These new facilities at sea level substantially reduced the need to travel up to site for many staff.

Chapter 5

ORGANISATION AND STAFF

OPERATIONS STAFF

DR S W UNGER, WHO HAD BEEN ACTING HEAD OF ING, WAS substantively promoted into the post in April 1995. Subsequently, following interviews in September 1995, Dr R G M Rutten was promoted to the role of Head of Astronomy. The post of Head of Engineering was left vacant for the whole of the period covered by this report, following the unsuccessful exercise to fill it in 1994.

For 1996, the telescope managers were: for the WHT, Dr C R Benn; for the INT, Dr N A Walton; and for the JKT, Mr P J Rudd.

The total UK approved annual staff effort for La Palma operations for financial year 1995/96 was 42. This comprised 32 staff on-island and 10 staff at the RGO in Cambridge. The total approved staff effort for the Netherlands was 8 on-island and 1 in Cambridge.

During the period covered by this report, astronomical support provided by the RGO on behalf of the ING was the responsibility of the La Palma Support Group of the RGO's Astronomy Division. The Support Group, headed during this period by Dr D Carter, supplemented the work of the ING Astronomy Group.

The list of staff in post on La Palma during 1995 and 1996 is set out below.

MANAGEMENT

S W Unger, *Director ING*

R L Miles, *Bilingual Secretary*

M Lorenzo, *Site Receptionist* (to 31.3.95)

ADMINISTRATION

M R Acosta

E Arzola

E C Barreto

L I Edwins (from 15.5.95)

C J Felipe

S Figueroa (to 16.4.96)

S S Hunter (from 1.11.95)

M Lorenzo (from 1.4.95)

J Martínez (from 1.11.96)

K Maunders (to 31.3.95)

C Osgood (to 20.6.95)

ASTRONOMY

P Arenaz (to 31.8.96)

M W Azif

M Azzaro

C R Benn

M Breare (to 31.8.96)

H O Castañeda (*IAC* - to 30.5.95)

M Centurión (*IAC* - 1.10.95 to 30.9.96)

V S Dhillon (to 30.8.96)

J A Fernández (7.11.95 to 6.11.96)

J N González

M Guerrero (*IAC* - 1.10.95 to 30.9.96)

C Martín

J Méndez (from 24.10.96)

C Moreno

N O'Mahoney

R Peletier (to 31.7.95)

D Pollacco (from 13.6.95)

F Prada (*IAC* - 1.10.95 to 30.9.96)

J C Rey

P J Rudd

R G M Rutten

P Sorensen (from 4.9.96)

D Sprayberry (from 31.8.95)

J Telting (from 1.8.96)

N A Walton

COMPUTING

Software

J M Burch

S M Crosby

R J Edwards (from 16.4.96)

P M Fishwick

F Gribbin

P C T Rees

Computing Facilities

V Borraz

B M Hassan

G F Mitchell

A G Povoas (from 1.7.96)

P G Symonds

P v d Velde

ELECTRONICS

S Barker

C Benneker

S J Crump (from 1.11.95)

A Guillén

C Jackman

K Kolle

R Martínez

D Matthews

E J Mills

R Michel (25.8.95 to 30.9.96)

P Moore (from 29.11.96)

R J Pit

A Ridings

P Whiteley (to 30.9.95)

MECHANICAL ENGINEERING

F Concepción

K M Dee

J Haan (to 5.7.95)

C Hankinson (from 1.3.95)

P S Morrall

S Rodríguez

J C Pérez

B van Venrooy (from 1.8.95)

SITE SERVICES

C Alvarez

D J Bonnick (to 30.9.95)

A K Chopping

J R Concepción

N Dean (from 29.8.95)

J M Díaz

D Gray

M V Hernández (from 1 .4.95)

R Hernández (11.2.95 to 7.2.96)

A C Osborne

C Ramón

C Riverol

M Simpson

C Ventura (to 31.3.95)

Paul Langford

Appendix A

The Isaac Newton Group of Telescopes

THE ISAAC NEWTON GROUP OF TELESCOPES (ING) CONSISTS OF THE WILLIAM HERSCHEL Telescope (WHT), the Isaac Newton Telescope (INT) and the Jacobus Kapteyn Telescope (JKT). The three telescopes have complementary roles. The WHT, with its 4.2m diameter primary mirror, is the largest in Western Europe. It was first operational in August 1987. It is a general purpose telescope equipped with instruments for a wide range of astronomical observations. The INT was originally used at Herstmonceux in the UK, but was moved to La Palma in 1979 and rebuilt with a new mirror and new instrumentation. It has a 2.5m diameter primary mirror and is mostly used for wide-field imaging and spectroscopy. The JKT has a primary mirror of 1m diameter. It is mainly used for observing relatively bright objects. Both INT and JKT were first operational in May 1984.

The ING is located at the Observatorio del Roque de Los Muchachos (ORM), on the island of La Palma. The observatory also includes the Carlsberg Meridian Circle, the 3.6m Italian Galileo National Telescope, the 2.5m Nordic Optical Telescope, the 60cm telescope of the Swedish Royal Academy of Sciences, the 50cm Swedish Solar Telescope, the 45cm Dutch Open Solar Telescope, and the German High Energy Gamma-Ray Array (HEGRA).

The Isaac Newton Group is operated on behalf of the British Particle Physics and Astronomy Research Council (PPARC) and the Nederlandse Organisatie voor Wetenschappelijk Onderzoek (NWO).

The observatory occupies an area of 1.89 square kilometres approximately 2350m above sea level on the highest peak of the Caldera de Taburiente National Park, in the Palmeran district of Garafía. La Palma is one of the westerly islands of the Canary Archipiélago and the Canary Islands are an autonomous region of Spain.

The site was chosen after an extensive search for a location with clear, dark skies all the year around. All tests proved that the Roque de Los Muchachos is one of the best astronomical sites in the world. The remoteness of the island and its lack of urban development ensure that the night sky at the observatory is free from artificial light pollution. The continued quality of the night sky is protected by law. The mountain-top site has a remarkably stable atmosphere, owing to the local topography. The mountain has a smooth convex contour facing the prevailing northerly wind and the air-flow is comparatively undisturbed, allowing sharp and stable images of the night sky. The site is clear of cloud for 90 per cent of the time in the summer months.

The following table shows each telescope’s location:

	Latitude	Longitude	Ground Floor Height (m)
WHT	28° 45’ 38.3” N	17° 52’ 53.9” W	2332
INT	28° 45’ 43.4” N	17° 52’ 39.5” W	2336
JKT	28° 45’ 40.1” N	17° 52’ 41.2” W	2364

The Roque de Los Muchachos Observatory, which is the principal European northern hemisphere observatory, belongs to the Instituto de Astrofísica de Canarias (IAC), as does the Teide Observatory on Tenerife. The operation of the site is overseen by an International Scientific Committee (CCI). Financial and operational matters of common interest are dealt with by appropriate subcommittees.

The construction, operation, and development of the ING telescopes is the result of a collaboration between the UK, 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. A further 75 per cent is shared by the UK, Netherlands and Eire. 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.

Many of the state-of-art telescope and instrument components are custom-built. New instruments are designed and built by technology groups in the UK and the Netherlands, with which the ING maintains close links. Of particular importance is the historical link with the Royal Greenwich Observatory (RGO), originally responsible for the creation of the ING.

THE INTERNATIONAL AGREEMENTS

The international agreements by which the Roque de Los Muchachos and Teide Observatories were brought into existence were signed on La Palma on 26 May 1979 (BOE, **161**, 6 July 1979). The participant nations at that time were Spain, The United Kingdom, Sweden and Denmark. Other European countries later also signed the agreements. Infrastructural services including roads, communications, power supplies and meals and accommodation facilities have been provided by the Spanish side. In return for the use of the observatory and its facilities all foreign user institutions make 20 per cent of time on their telescopes available to Spanish observers. Representatives of the participant institutions meet together as the International Scientific Committee, or Comité Científico Internacional (CCI).

The inauguration of the Canary Islands observatories took place on 29 June 1985 in the presence of the monarchs and members of the Royal Families of five European countries, and the Presidents of another two.

THE PPARC-NWO JOINT STEERING COMMITTEE

The PPARC and the NWO have entered into collaborative agreements for the operation of and the sharing of observing time on the ING telescopes. The Joint Steering Committee (JSC) has been set up to oversee the operation of this agreement, to foster and develop collaboration between astronomers of the UK and the Netherlands and to ensure that the telescope installations are maintained in the forefront of world astronomy. In particular, the JSC oversees the construction programme of the telescopes and instrumentation, determines the programme of operation, maintenance and development of the installations, approves annual budgets and forward estimates and determines the arrangements for the allocation of observing time.

TELESCOPE TIME AND DATA OWNERSHIP

Spain has at its disposal 20 per cent of the observing time on each of the three telescopes. It is the responsibility of the IAC to make this time available to Spanish institutions and others, via the Comité para la Asignación de Tiempos (CAT).

A further 5 per cent of the observing time is for international collaborative programmes between institutions of the CCI member countries. It is intended that this time be used for the study of one, or a few, broad topics each year by several telescopes. This time is allocated by the CCI.

The remaining 75 per cent of the time is distributed as follows. The PPARC and NWO share the time on all three telescopes in the proportions 80 per cent PPARC : 20 per cent NWO. The PPARC-NWO Joint Steering Committee has delegated the task of time allocation to astronomers to the PPARC Panel for the Allocation of Telescope Time (PATT), which has set up procedures for achieving the 80 : 20 ratio whilst respecting the separate priorities of the UK and Dutch communities. The PPARC has made 27 nights per year of its share on the JKT available to the National Board of Science and Technology of Ireland (NBST) and the Dublin Institute for Advanced Studies (DIAS). The Irish Advisory Committee for La Palma set up by the two Irish Institutions has decided that JKT proposals by Irish Astronomers should also be submitted to PATT. Irish astronomers are not however discouraged from applying for use of the other telescopes of the ING. PATT includes representatives from the Netherlands and the Republic of Ireland.

All the above agreements envisage that observing time shall be distributed equitably over the different seasons of the year and phases of the Moon.

Notwithstanding the above, any astronomer, irrespective of nationality or affiliation, may apply for observing time on the ING. Astronomers who are working at an institute in one of the partner countries should apply through the route appropriate to their nationality or the nationality of their institute.

PATT allocates time on all PPARC supported telescopes in two semesters, from 1 February to 31 July (semester A) and from 1 August to 31 January (semester B). The corresponding closing dates are the end of September and March respectively. Decisions on time allocations are made on the basis of scientific merit and technical feasibility of the proposed observations.

The PPARC-NWO JSC and the CCI have decided that ING policy is that data belongs exclusively to those who collected it for a period of one year, after which it is available in a common archive for all astronomers. It may be used at any time for engineering or instrumental investigations in approved programmes carried out to improve facilities provided at the observatory.

Service observations which are made by support astronomers at the request of others are similarly treated. However, calibration data may well be used for more than one observation and may therefore be available in common several groups. It may happen that identical or similar service observations are requested by two or more groups. Requests which are approved before the data are taken may be satisfied by requiring the data to be held in common by the several groups. It is up to them how they organise themselves to process it, analyse it, relate it to other work, and eventually publish it.

Requests for observations from programmes already executed on the telescopes should be referred to the original owners of the data, and/or to the data archive. This is the policy whether or not the data were obtained by PATT or CAT scheduled astronomers, or by service requests.

NEWSLETTERS

Announcements of the status and availability of the ING telescopes and instruments are made in the *PATT Newsletter*. *Spectrum*, the newsletter of the Royal Observatories and ING, contains up-to-date information about the telescopes and instruments, as well as highlights of recent results and other topical items. *Spectrum* is published quarterly and is available free of charge from the RGO at Cambridge. Up-to-date information is also available electronically. The most recent information is kept on the web pages at http://www.ing.iac.es/ or in the UK mirror at http://www.ast.cam.ac.uk/ING/.

Appendix B

Telescope Instrumentation

THE INT AND JKT ARE EQUIPPED WITH A RESTRICTED SET OF INSTRUMENTS THAT MATCH the capabilities of the telescopes whilst satisfying the requirements of a large fraction of users. The number of instrument changes on these telescopes is kept to a minimum to reduce costs and increase reliability. The design of the WHT allows much greater flexibility, since it is straightforward to switch between the Cassegrain and the two Nasmyth focal stations, and a much greater variety of instruments may be left on the telescope. A broad functional division between the WHT, INT and JKT is as follows:

WHT	Spectroscopy and spectropolarimetry over a wide range of resolving powers
	Multi-object spectroscopy
	CCD imaging (faint objects, high spatial resolution)
	Infrared imaging
	High-resolution imaging and other projects in a laboratory environment
	Fabry-Perot imaging spectroscopy
INT	Intermediate- and low-dispersion spectroscopy
	CCD imaging
JKT	Spectroscopy of bright stars
	CCD imaging

The table below summarises the common-user instruments which were available during the period 1995-1996.

Focus	**Instrument**	**Detector**
WHT		
Cassegrain	ISIS double spectrograph	Tektronix and EEV CCDs
	Faint Object Spectrograph (FOS-2)	Coated GEC CCD
	TAURUS-2 (imaging Fabry-Perot)	Tektronix and EEV CCDs
	Low Dispersion Survey Spectrograph (LDSS-2)	Tektronix and EEV CCDs
	CCD Imaging (Acquisition and Guidance Unit auxiliary port)	Tektronix and EEV CCDs
	TAURUS CCD Imaging (f/2 or f/4)	Tektronix and EEV CCDs
Nasmyth	Ground Based High Resolution Imaging Laboratory (GHRIL)	Tektronix and EEV CCDs
	William Herschel Infrared Camera (WHIRCAM)	InSb array
	Utrecht Echelle Spectrograph (UES)	Tektronix and EEV CCDs
Prime	CCD Imaging (f/2.8)	Tektronix and EEV CCDs
	Autofib Fibre Positioner (AUTOFIB-2)	Tektronix CCD (WYFFOS at GHRIL)
INT		
Cassegrain	Intermediate Dispersion Spectrograph (IDS)	Tektronix and EEV CCDs
	Faint Object Spectrograph (FOS-1)	Coated GEC CCD
Prime	CCD imaging	Tektronix and EEV CCDs
JKT		
Cassegrain	Richardson-Brealey Spectrograph	Tektronix and EEV CCDs
	CCD imaging	Tektronix and EEV CCDs

Appendix C

Telescope Time Awards

THE PANEL FOR THE ALLOCATION OF TELESCOPE TIME (PATT) AND THE COMITÉ PARA LA Asignación de Tiempos (CAT) made time awards to the following ING proposals. Only the PATT or CAT reference, the principal applicant, his or her institute, and the title of the proposal are given in each case. Semester A is from February to July and Semester B is from August to January.

BRITISH SUCCESSFUL PROPOSALS - SEMESTER 95A

WHT

W/95A/1	*Howarth*	UCL	The search for newborn massive stars
W/95A/6	*Axon*	NRAL	The double peaked BRL of Apr 102B
W/95A/7	*Schild*	ZURICH	Spectropolarimetry of the Raman-scattered emission lines in Symbiotic stars
W/95A/9	*Keenan*	QUB	Distance to the high-velocity cloud complex M
W/95A/10	*Jeffery*	ST.ANDREWS	Atmospheric parameters for helium-rich subdwarf B-stars
W/95A/14	*Marsh*	SOUTHAMPTON	HS1804+6753 and the dwarf nova/nova-like connection
W/95A/16	*Storey*	UCL	Magnesium isotope ratios in Planetary Nebulae
W/95A/23	*Tadhunter*	SHEFFIELD	Scattered quasars in powerful radio galaxies
W/95A/36	*Shearer*	GALWAY	A search for binaries in M92 and M13
W/95A/37	*Ringwald*	KEELE	Time-resolved spectroscopy of a cataclysmic variable wind: BZ Cam (0623+71)
W/95A/38	*Welsh*	KEELE	Spectrophometry of dwarf nova oscillations and flickering
W/95A/41	*Meikle*	IC	Late-time optical spectroscopy of SNe 1993J, 1994D and 1994I
W/95A/44	*Jones*	SOUTHAMPTON	The origin of the X-ray background: what are the faintest X-ray galaxies?

W/95A/45	*Maddox*	RGO	The velocity dispersion of lensing galaxy clusters
W/95A/46	*Carter*	RGO	Two-dimensional velocity fields of elliptical cores
W/95A/47	*Carter*	RGO	Cool interstellar matter of M87
W/95A/50	*Walton*	LPO/ING	Modelling the internal dynamics of planetary nebulae using Taurus-II
W/95A/64	*Ellis*	IoA	A redshift survey of HST-selected lensed galaxies through the cluster A2218
W/95A/65	*Kneib*	IoA	The velocity dispersion of cD galaxies in lensing clusters
W/95A/70	*Santiago*	IoA	Spectroscopy of a complete sample of faint galaxies resolved with HST
W/95A/75	*Webb*	NSW	Extended galaxy halos and the origin of QSO absorption systems
W/95A/77	*Thomson*	IoA	The dark matter content of the early type galaxies in the Leo-I group
W/95A/78	*Charles*	Oxford	Does GS2000+25 contain a black hole?
W/95A/82	*Ward*	Oxford	Imaging polarimetry of AGN with ISIS
W/95A/89	*Dunlop*	Liverpool	The stellar ages of mJy radio galaxies
W/95A/90	*Tadhunter*	Sheffield	The nature of the blue component in the host galaxies of AGN+
W/94B/45	*Rawlings*	Oxford	Distant radio galaxies and the red-shift cutoff ***Long term***

INT

I/95A/1	*Hilditch*	St.Andrews	A study of the variable stars in the galaxies Leo I and Leo II
I/95A/5	*Fitzsimmons*	QUB	The determination of orbits of Kuiper-belt objects ***Long Term***
I/95A/6	*Barstow*	Leicester	Observations of stellar structure and evolution through pulsating white dwarfs
I/95A/7	*Marsh*	Southampton	Binaries among white dwarfs
I/95A/8	*Davies*	Cardiff	Determining the opacity of nearby spiral galaxies
I/95A/9	*Miller*	ROE	A complete sample of AGN from the ROSAT XRT survey
I/95A/10	*Roche*	Southampton	A radial velocity study of HZ Her/Her X-1 an undermassive neutron star?
I/95A/13	*Hughes*	RGO	Calibration of extragalactic distance scale key project
I/95A/15	*Efstathiou*	Oxford	Galaxy clustering and large-scale structure
I/95A/18	*Crawford*	IoA	Optical properties of central galaxies in the ROSAT brightest cluster sample
I/95A/20	*McMahon*	IoA	The evolution of radio loud quasars between z=2 and z=6
I/95A/25	*Smith*	Sussex	Emission line mapping in two nova-like variables
I/95A/28	*Davies*	Durham	Streaming motions in Abell clusters
J/95A/22	*Mason*	MSSL	Determination of orbital periods of faint high galactic latitude cataclysmic variables

W/95A/2	*Howarth*	UCL O/R	The mass of an ON supergiant

JKT

J/95A/1	*Hilditch*	St.Andrews	Photometric survey for binaries in the old open cluster NGC 6791
J/95A/9	*Jeffries*	Birmingham	Identification and photometry of low mass stars in NGC 6633
J/95A/12	*Coe*	Southhampton	Long-term spectroscopic monitoring of northern hemisphere X-ray binaries
J/95A/13	*Bryce*	Manchester	A search for scattered light in the faint haloes of planetary nebulae
J/95A/16	*Bridges*	RGO	Deep B,R surface photometry of poor cluster cD galaxies
J/95A/17	*Bell*	RGO	Photometric variability and the existence of PN in PG composite spectrum objects
J/95A/18	*Pollacco*	Liverpool	Time resolved narrow-band photometry of planetary nebula central stars
J/95A/19	*Hewett*	IoA	Quasars at redshifts z > 5
J/95A/25	*Mobasher*	IC	An unbiased, all-sky study of the local velocity field ***Long Term***
J/95A/28	*Davies*	Durham	Streaming motions in Abell clusters
I/95A/2	*Tadhunter*	Sheffield	Deep continuum imaging: a new look at nearby active galaxies+
J/94B/29	*Boyle*	RGO	Photometric standards for wide field surveys ***Long term***

SPANISH SUCCESSFUL PROPOSALS - SEMESTER 95A

WHT

CAT W1	*Martín*	IAC	2D correlation for spectroscopic binaries
CAT W6	*Prada*	IAC	Starburst in blue dwarf galaxies
CAT W8	*García*	IAC	Be abundances in Lithium-rich stars
CAT W11	*R-Lapuente*	Barcelona	H_0 from supernovae
CAT W17	*Corradi*	IAC	Structure of the planetary nebula IC 4593
CAT W18	Cuesta	IAC	Expansion velocity in planetary nebulae
CAT W19	*Beckman*	IAC	Velocity field of the disc of N4321
CAT W20	*Guerrero*	IAC	Kinematics of planetary nebulae
CAT W24	*Colina*	STScI	Radio sources in starbursts
CAT W28	*de la Fuente*	VILSPA	Abundances toward the QSO HS 1700+6416
CAT W34	*Mas-Hesse*	Madrid	Loss of metals in dwarf galaxies
CAT W35	*Sanahuja*	Barcelona	The cluster of galaxies Abell 2218
CAT W36	*Casares*	Oxford	Does GS2000+25 have a black hole?

CAT W37	*Barcons*	Santander	Kinematics of haloes of QSO galaxies
CAT W38	*Barcons*	Santander	The ROSAT medium sensitivity survey

INT

CAT I1	*Cepa*	IAC	Stellar formation in spiral galaxies
CAT I2	*Campos*	IAA	BO-effect in the outer regions of clusters
CAT I4	*Rebolo*	IAC	Metal-poor stars in the Galaxy
CAT I5	*Rebolo*	IAC	Star clusters near gamma-ray regions
CAT I7	*de Diego*	IAC	Reddening in quasars
CAT I9	*Lázaro*	IAC	Eclipsing cataclysmics
CAT I10	*Cuesta*	IAC	Dynamics of PMS bipolar nebulosity
CAT I14	*García-Lario*	VILSPA	Post-AGB stars and planetary nebulae
CAT I15	*Aragón*	IAC	Galaxy clustering in the field of 2 QSOs
CAT I20	*Gorgas*	UCM	Stellar population in elliptical galaxies
CAT I23	*Pérez*	IAA	Collimated ejection from planetary nebulae
CAT W7	*Garzón*	IAC	Search for red supergiants
CAT J2	*Zapatero*	IAC	Proper motions in halo stars

JKT

CAT J1	*Kidger*	IAC	Quasars of low polarization
CAT J2	*Zapatero*	IAC	Proper motions of Halo stars
CAT J3	*Lahulla*	OAN	The group of Hilda asteroids
CAT J4	*Martín*	IAC	The eclipsing binary CM Dra
CAT J6	*Gorgas*	UCM	Calibration of the break at 4000Å
CAT J8	*González*	Santander	Radio galaxies of low luminosity
CAT W13	*Aparicio*	IAC	Stellar formation in the Local Group

DUTCH SUCCESSFUL PROPOSALS - SEMESTER 95A

WHT

W/95A/N2	*Smette*	Groningen	UV of brightest known high redshift QSOs
W/95A/N3	*Miley*	Leiden	Ultra steep spectrum sources from WENSS; the highest red-shift galaxies?
W/95A/N4	*Katgert*	Leiden	Structure of the magnetic field in the hot ISM on PC scales
W/95A/N5	*Butcher*	Dwingeloo	Spectroscopy of Butcher-Oemler cluster galaxies
W/95A/N11	*Balcells*	Groningen	Two-dimensional velocity fields of elliptical cores

W/95A/N12	*Smette*	Groningen	Probing the halo of quasars
W/95A/N14	*Oudmaijer*	Groningen	Spectroscopy of two mass-losing carbon stars at high galactic latitudes
W/95A/N16	*v Woerden*	Groningen	The composition of HVC complex C
W/95A/N17	*Telting*	Amsterdam	*v sin i* of early-type stars

INT

I/95A/N1	*v d Kruit*	Groningen	Optical surface photometry of spiral galaxies in the Westerbork H1 survey
I/95A/N2	v d Hulst	Groningen	Diffuse, ionized gas in nearby, edge-on spiral galaxies
I/95A/N5	*v Paradijs*	Amsterdam	Spatially-resolved spectroscopy of accretion disks in cataclysmic variables
I/95A/N6	*Spruit*	Amsterdam	A spectroscopic study of the enigmatic dwarf nova WZ Sge
W/95A/N10	*Martin*	CHEAF	Beryllium and Lithium in Her X-1 and Cyg X-2
J/95A/N2	*Dieters*	Amsterdam	A search for black hole candidates amongst the old novae

JKT

J/95A/N1	*Stil*	Leiden	The stellar populations of dwarf galaxies
J/95A/N3	*Augusteijn*	Amsterdam	A comparative study of disk and halo cataclysmic variables
J/95A/N4	*de Blok*	Groningen	H alpha surface photometry of low surface brightness galaxies
J/95A/N5	*Gunawan*	Utrecht	Search for short time-scale photometric variations of Wolf-Rayets

BRITISH SUCCESSFUL PROPOSALS - SEMESTER 95B

WHT

W/95B/6	*Marsh*	Southampton	A detached cataclysmic variable caught crossing the period gap
W/95B/8	*Shanks*	Durham	The host galaxies of luminous QSOs
W/95B/12	*Dufton*	QUB	IOS observations of HII regions: comparison with B-type stellar chemical compositions
W/95B/14	*Hilditch*	St.Andrews	Accurate masses for WR star + O star binaries
W/95B/15	*Jackson*	NRAL	A systematic polarization imaging survey of 3C objects
W/95B/21	*Doyle*	Armagh	Understanding the lower chromospheric regions of M dwarfs via the Na 5890 doublet
W/95B/22	*Murray*	QMW	Saturn’s E ring and faint satellites
W/95B/25	*Bowen*	STScI	Mapping interstellar gas around M31

W/95B/26	*Bowen*	STScI	Ly alpha absorption lines from low-redshift galaxies
W/95B/28	*Metcalfe*	Durham	U and R band imaging of the deepest B field
W/95B/36	*Horne*	St.Andrews	Mapping the magnetic accretion in RX J0558+53
W/95B/41	*Hughes*	RGO	IR imaging of Andromeda (M31)
W/95B/42	*Aretxaga*	RGO	Colours of host galaxies of z=2 QSOs
W/95B/43	*Pettini*	RGO	Chemical evolution of high-redshift galaxies ***Long Term***
W/95B/50	*Ray*	DIAS	How do young stellar jets drive molecular outflows
W/95B/53	*Terlevich*	IoA	Spectrophotometric studies of high redshift HII galaxies
W/95B/56	*Bridges*	RGO	Spectrophotometry of globular clusters at the centre of M31
W/95B/67	*Perlmuter*	California	High-redshift supernovae spectroscopy
W/95B/69	*Rolleston*	Armagh	The magnetic activity of late-type stars in the open cluster NGC 7092
W/95B/77	*B-Hawthorn*	AAO	Rotation curves beyond the HI cutoff in spirals
W/95B/78	*Eales*	Cardiff	Kinematics and structure of the nebulae around high redshift radio galaxies
W/95B/82	*Irwin*	RGO	A deep optical survey for z > 4 QSOs
W/95B/85	*Krabbe*	MPE	Strong optical FeII emitting galaxies; is there ongoing star formation?
W/95B/91	*Howarth*	UCL	Atmospheres of O supergiants
W/95B/95	*Lacy*	Oxford	Ly-limit imaging of z > 3.4 radiogalaxy fields
W/95B/97	*Dunlop*	ROE	The nature of the blue component of in the host galaxies of AGN
W/95B/99	*McMahon*	IoA	A search for primeval galaxies around high redshift radio-loud QSOs
W/95B/100	*Barlow*	UCL	Optical spectroscopy of ISO target of opportunity novae ***O/R***

INT

I/95B/1	*Marsh*	Southampton	Spectroscopic survey of white dwarfs
I/95B/3	*Still*	St.Andrews	Orbitally-resolved spectrophotometry GK Per
I/95B/6	*Jameson*	Leicester	CCD survey of Pleiades for Brown Dwarfs
I/95B/10	*Metcalfe*	Durham	Clustering of field galaxies to B = 27
I/95B/12	*Axon*	Jodrell	Collimated ejection in planetary nebulae
I/95B/13	*Naylor*	Keele	Gravity darkening in Roche-lobe filling stars
I/95B/14	*Boyle*	RGO	Do QSO’s trace galaxies?
I/95B/16	*Bunclark*	RGO	Spectral variability of T Tauri stars
I/95B/17	*Irwin*	RGO	Faint high galactic latitude stars in galactic halo
I/95B/18	*Irwin*	RGO	Spectroscopy of RBQS quasar candidates ***Long Term***
I/95B/20	*Reid*	UCL	Multiwavelength time-series spectroscopy of the classical

			Be star, gamma Cas
I/95B/22	*Thomson*	IoA	Multicolour imaging of shell galaxies
I/95B/23	*Davies*	JAC	Physical properties of very distant asteroids

JKT

J/95B/1	*Coe*	Southampton	Long-term spectroscopic monitoring of northern hemisphere X-ray binaries
J/95B/2	*Kemp*	QUB	The structure and colours of the envelopes of cD galaxies
J/95B/3	*Hewett*	IoA	Quasars at redshifts z>5
J/95B/4	*Horne*	St. Andrews	Mapping the Magnetic Accretion in RX~J0558+53
J/95B/5	*Dainty*	IC	SCIDAR and Wavefront Sensing for Seeing Characterisation at the JKT ***Long Term***
J/95B/6	*Naylor*	Keele	Understanding gravity darkening in Roche-lobe filling stars
J/95B/8	*Williams*	QMW	The orbits of the major satellites of Saturn
J/95B/9	*Fitzsimmons*	QUB	A CCD photometric survey of cometary nuclei
J/95B/10	*Rolleston*	Armagh	BVRI CCD photometry of 3 nearby, northern open clusters
J/95B/14	*Bell*	RGO	Photometric variability and the existence of PN in PG composite spectrum objects
J/95B/16	*James*	LJMU	Observational tests of spiral density wave theories
J/95B/17	*Collins*	LJMU	Peculiar velocities of X-ray clusters

SPANISH SUCCESSFUL PROPOSALS - SEMESTER 95B

WHT

CAT W3	*Castander*	IoA	Dynamical study of galaxy clusters
CAT W5	*Peletier*	IAC	Properties of Seyfert galaxies
CAT W14	*González*	IAC	IRAS galaxies with FeII emission
CAT W20	*Gorgas*	UCM	Stellar formation in galaxy clusters
CAT W25	*Mediavilla*	IAC	2D spectral atlas of NGC 4151
CAT W26	*Arribas*	IAC	The BLR of NGC 3227
CAT W30	*Martín*	IAC	The major candidate in the Pleiades
CAT W32	*Díaz*	UAM	The gigantic HII region NGC 604
CAT W33	*Herrero*	IAC	Analysis of stars in M31 and M33
CAT W35	*Beckman*	IAC	Interstellar medium near the sun
CAT W36	*Cuesta*	IAC	Expansion velocity of planetary nebulae
CAT W37	*Guerrero*	IAC	Kinematics of planetary nebulae

INT

CAT I1	*Garzón*	IAC	Search for red supergiants
CAT I3	*Martín*	IAC	Accretion columns in T-Tauri stars
CAT I4	*Rebolo*	IAC	Deep photometry in the Pleiades
CAT I5	*Herrero*	IAC	Helium abundances in Cygnus OB 2
CAT I7	*Rebolo*	IAC	Metal poor stars in the Galaxy
CAT I11	*F-Figueroa*	UCM	H alpha and HeI D3 of active stars
CAT I18	*Magazzu*	CATANIA	Spectroscopy of ROSAT T Tauri stars
CAT W28	*Sánchez*	IAC	Spectroscopy of supernovae

JKT

CAT J5	*Alfaro*	IAA	Type c RR Lyrae
CAT I7	*Gaztanaga*	OXFORD	The Galaxy luminosity function
CAT J8	*González*	IAC	Photometry of miniblazars
CAT I3	*Martín*	IAC	Accretion columns in T Tauri stars
CAT N1	*Zapatero*	IAC	Rotation periods for M6 to M9.5 stars

DUTCH SUCCESSFUL PROPOSALS - SEMESTER 95B

WHT

W/95B/N1	*Franx*	GRONINGEN	Mapping the matter distribution from distorted galaxies
W/95B/N2	*Bremer*	LEIDEN	Spectral evolution of the most distant cluster galaxies
W/95B/N3	*Kuijken*	GRONINGEN	A kinematic survey of bars in peanut-shaped bulges
W/95B/N7	*Prins*	AMSTERDAM	Spectroscopy of supernovae remnants in M31
W/95B/N8	*Kuijken*	GRONINGEN	Core kinematic substructure in the bulges of disk galaxies
W/95B/N9	*Voors*	UTRECHT	Verification of the LBV-candidate G79.29+0.46
W/95B/N10	*Favata*	ESA/ESTEC	Lithium abundance, activity and rotation in the Stock 2 open cluster
W/95B/N11	*van Winkel*	LEUVEN	Photospheric abundance and circumstellar physics and chemistry of post-AGB stars
W/95B/N12	*v d Werf*	LEIDEN	Near-IR imaging spectroscopy of dusty high redshift radio galaxies
W/95B/N13	*Telting*	AMSTERDAM	Accurate determination of *v sin i* of early type stars
W/95B/N15	*v d Werf*	LEIDEN	Interstellar medium and low-mass stars in cooling flow galaxies

INT

I/95B/N1	*Sackett*	GRONINGEN	Galaxy structure at LSB levels

I/95B/N2	*Sprayberry*	Groningen	Optical imaging of An HI selected galaxy sample
I/95B/N5	*v Paradijs*	Amsterdam	Spatially-resolved spectroscopy of accretion disks in cataclysmic variable stars
I/95B/N6	*De Bruyn*	Dwingeloo	Spectroscopy of a unique sample of low redshift Giant Radio Galaxies
I/95B/N8	*v d Kruit*	Groningen	Optical surface photometry in WHISP survey
I/95B/N10	*v Hoof*	Groningen	Accurate abundance determination of CNO in planetary nebulae

JKT

J/95B/N1	*Augusteijn*	AIAP	Comparative study of disk and halo CVs
J/95B/N2	*Stil*	Leiden	The stellar population of dwarf galaxies
J/95B/N3	*Jaffe*	Leiden	High quality digital images for Education and Publicity
J/95B/N4	*Zaal*	AIAP	H alpha spectrosopy of OB stars

INTERNATIONAL TIME PROJECTS FOR 1995

ITP95	*Miley*	Leiden	Optical identification and spectroscopic follow-up of Flat and Ultra Steep spectrum radio sources

BRITISH SUCCESSFUL PROPOSALS - SEMESTER 96A

WHT

W/96A/2	*Keenan*	QUB	Early-type stars in the galactic halo
W/96A/4	*Keenan*	QUB	Search for star formation around the galactic halo B-type star BD -2 3766
W/96A/6	*B-Hawthorn*	AAO	Rotation curves beyond the HI cutoff in spirals
W/96A/8	*Bryce*	Manchester	Kinematical and radiative structure of young planetary nebulae
W/96A/9	*Heisler*	AAO	Spectropolarimetry of warm IRAS Seyfert 2 galaxies
W/96A/15	*Marsh*	Southampton	Mass ratios of double degenerate binary stars
W/96A/19	*Horne*	St.Andrews	Echo tomography of reprocessing sites in X-ray binaries
W/96A/20	*Hilditch*	St.Andrews	Spectroscopy of newly discovered binaries in the old open cluster N6791
W/96A/24	*Glazebrook*	AAO	HDF-redshifts via AAO tuneable filter
W/96A/34	*Byrne*	Armagh	Prominences on rapidly rotating late-type stars
W/96A/35	*Barlow*	UCL	Target of opportunity for 150 novae *** O/R plus Long Term***

W/96A/37	*McHardy*	Southampton	IR imaging of optically violent variable Quasar host galaxies
W/96A/43	*Lawrence*	ROE	Nuclear activity in very nearby galaxies
W/96A/44	*Lacy*	Oxford	Companions to the two z > 4 radio galaxies ***Long Term***
W/96A/47	*Gardner*	Durham	The K-band galaxy luminosity function
W/96A/54	*McMahon*	IoA	Evolution of radio loud quasars, z=2 to z=6
W/96A/55	*McMahon*	IoA	Deep ultra-red survey for QSOs with z > 5
W/96A/70	*Vine*	IoA	Dynamics of planetary nebulae and the distribution of dark matter in M84, M86, M87
W/96A/77	*Carter*	RGO	Deep imaging survey of the Coma cluster
W/96A/82	*Jeffery*	St.Andrews	Atmospheric parameters for helium-rich subdwarf B stars
W/96A/83	*Tadhunter*	Sheffield	Jets, shocks and the alignment effect in high-z radio galaxies
W/96A/87	*Boyle*	RGO	Relationship between active and normal galaxies
W/96A/88	*Ellis*	IoA	Redshift survey of HST-selected lensed galaxies
W/96A/94	*Russell*	Dublin	Abundances of neutron-capture elements in extremely metal poor stars
W/96A/96	*Saunders*	MRAO	A gas-rich cluster at z > 3?
W/96A/98	*Shahbaz*	Oxford	New method for determining the inclination in cataclysmic variables

INT

I/96A/3	*Irwin*	RGO	Faint high latitude carbon stars in the Galactic Halo
I/96A/8	*Carter*	RGO	The origin and dynamic of cD galaxies
I/96A/9	*Still*	St.Andrews	Eclipse spectrophotometry of the SW Sex cataclysmic variables: mass accretion or ejection
I/96A/11	*Smith*	Cardiff	Determination of the field galaxy luminosity function
I/96A/14	*Dalton*	UCL	Time-resolved near-infrared spectroscopy of galactic WR stars
I/96A/15	*Welsh*	Keele	The nature of accretion disc flickering
I/96A/16	*Boyle*	RGO	The cluster environment of z ~ 0.5 QSOs
I/96A/22	*Pollacco*	RGO	The period distribution of binary central stars of planetary nebula ***Long Term***
I/96A/24	*Oliver*	ICSTM	A CCD survey of one ELAIS raster
I/96A/30	*Jeffries*	Keele	Lithium depletion and chromospheric activity in low mass members of NGC 6633
I/96A/37	*De Marco*	UCL	Spectroscopy of Hydrogen-deficient central stars of planetary nebulae
I/96A/38	*Watson*	Leicester	Spectroscopy of EUV transient RE J1255+266
I/96A/40	*Barlow*	UCL	Optical spectroscopy of ISO Target of Opportunity novae ***O/R***

JKT

J/96A/1	*Collins*	Liverpool	Peculiar velocities of x-ray clusters
J/96A/2	*Mason*	MSSL	Optical Continuum Variability of Narrow Line Seyfert 1 galaxies
J/96A/3	*Coe*	Southampton	Emission from the circumstellar disk and neutron star in HMXRB
J/96A/4	*Hilditch*	St.Andrews	Eclipsing binary stars in the turnoff region of M3 (NGC 5272)
J/96A/5	*Scarrott*	Durham	Magnetic fields in spiral galaxies
J/96A/6	*Hewett*	IoA	Quasars at Redshifts z > 5 ***Long Term***
J/96A/9	*Argyle*	RGO	Optical astrometry of QSOs
J/96A/10	*Jones*	RGO	Calibration of the orbits of the major satellites of Saturn
J/96A/11	*Coates*	MSSL	Comets, observations near the time of the Sakigake Encounter
J/96A/13	*Smith*	Cork	Rapid optical variability in radio-quiet quasars with extended radio features
J/96A/15	*Boyce*	Cardiff	Deep CCD imaging of low-redshift quasars
J/96A/17	*O'Brien*	Oxford	Variability of high and very low luminosity AGN
J/96A/19	*Mobasher*	IC	An unbiased, all sky study of the local velocity field

SPANISH SUCCESSFUL PROPOSALS - SEMESTER 96A

WHT

CAT W1	*Gutiérrez*	IAC	Fine structure in QSO 2048+196
CAT W2	*González*	Santander	Enrichment in quasars
CAT W3	*Carballo*	Santander	UKMS ROSAT survey
CAT W6	*Sanahuja*	Barcelona	Clusters of galaxies
CAT W10	*Castañeda*	IAC	IZW 18 and its companions
CAT W11	*Peletier*	Groningen	Understanding Seyfert galaxies
CAT W12	*González*	STScI	NIR emission in Seyfert galaxies
CAT W13	*Battaner*	Granada	Discs of spiral galaxies
CAT W15	*Mas-Hesse*	Madrid	Search for gas in dwarf galaxies
CAT W17	*Gorgas*	UCM	Populations in elliptical galaxies
CAT W19	*Castañeda*	IAC	HII regions and the distance scale
CAT W21	*Esteban*	IAC	Global kinematics of W-R stars
CAT W22	*Aparicio*	IAC	Stellar formation in the local group
CAT W26	*Zapatero*	IAC	Brown Dwarfs candidates in two clusters

INT

CAT I2	*Fernández*	Santander	Identification of pairs of quasars
CAT I4	*Campos*	Durham	Faint galaxy number counts
CAT I5	*de Diego*	México	Reddening in quasars
CAT I7	*Iglesias*	IAC	H alpha observation of compact groups of galaxies
CAT I11	*Bertola*	Padova	Bulge's components in disk galaxies
CAT I20	*Garzón*	IAC	Search for red supergiants
CAT I22	*Rebolo*	IAC	Metal-poor stars in the galaxy
CAT I25	*Deeg*	IAC	Extrasolar planets around CM Dra
CAT I26	*Riera*	Barcelona	Processed ejecta in planetary nebulae

JKT

CAT J2	*Barcons*	Santander	Faint X-ray emitting galaxies
CAT J3	*Iglesias*	IAC	Compact groups of galaxies
CAT J4	*Castañeda*	IAC	Temperatures in HII regions
CAT J5	*Génova*	IAC	Identification of sources detected in EUV
CAT J6	*Ortiz*	UAM	Photometry of PMS objects
CAT J7	*Torrá*	Barcelona	AV stars in the solar surround
CAT W22	*Aparicio*	IAC	Stellar formation in the local group

DUTCH SUCCESSFUL PROPOSALS - SEMESTER 96A

WHT

W/96A/N1	*v d Weygaert*	Groningen	Infall into the Coma cluster as constraint on cluster formation scenarios
W/96A/N2	*Franx*	Groningen	Galaxy evolution, and morphology density relation at z = 0.3
W/96A/N3	*Smette*	Groningen	Spectroscopy of the UV brightest known high redshift Quasars
W/96A/N4	*Röttgering*	Leiden	Search for z > 3.5 galaxies
W/96A/N10	*Briggs*	Groningen	Hydrogen kinematics and DI and H2 abundances in damped Ly alpha system at z = 2.8
W/96A/N12	*v Woerden*	Groningen	Composition of HVC complex C
W/96A/N13	*Oudmaijer*	IC	Long term monitoring of IRC+10420
W/96A/N14	*Jaffe*	Leiden	Warm molecular hydrogen in cooling flows and AGNs
W/96A/N15	*Verbunt*	Utrecht	Test theory of circularization of giant binaries
W/96A/N16	*v Paradijs*	Amsterdam	High time resolution spectroscopy of dwarf novae in quiescence

W/96A/N17	*Rutten*	LPO	Secondary star in AM CVn

INT

I/96A/N2	*Balcells*	Groningen	Optical surface photometry in WHISP survey
I/96A/N6	*Sprayberry*	LPO	Optical imaging of An HI selected galaxy sample - part 2
I/96A/N9	*Groot*	Amsterdam	Spatially resolved spectroscopy of accretion disks in cataclysmic variable stars
I/96A/N11	*Schoenmakers*	Utrecht	Spectroscopy of a unique sample of low redshift giant radio galaxies
I/96A/N12	*Le Poole*	Leiden	Nonradial pulsations in early-type stars

JKT

I/96A/N1	*v Paradijs*	Amsterdam	Disk and halo cataclysmic variables
I/96A/N2	*Schoenmakers*	Utrecht	R-band imaging of a sample of high redshift giant radio galaxy candidates
I/96A/N3	*Dieters*	MPI	Black hole candidates amongst the old novae
I/96A/N4	*Jaffe*	Leiden	High quality images for education/publicity
I/96A/N5	*Le Poole*	Leiden	Hipparcos binary stars

BRITISH SUCCESSFUL PROPOSALS FOR 96B

WHT

W/96B/1	*Doyle*	Armagh	Understanding the lower chromospheric regions of M dwarfs via the Na 5890Å doublet
W/96B/6	*Liu*	UCL	The He3/He4 isotope ratio in planetary nebulae
W/96B/7	*Harlaftis*	St.Andrews	Structure in quiescent accretion discs
W/96B/8	*Pollacco*	ING	A modern shell flash: when the dust clears
W/96B/10	*Marsh*	Southampton	The magnetic fields of White Dwarfs
W/96B/13	*Fabian*	IoA	The Blue Loop of NGC 1275 - Star formation in a disturbed cooling flow
W/96B/16	*Hoare*	Leeds	The Velocity Structure of Evolved HII Regions
W/96B/19	*García*	Harvard	Is the X-ray Transient 4U2129+47 a Triple System?
W/96B/24	*Merrifield*	Sot'on	Measuring the transparency of spiral galaxies: stellar kinematic opacity mapping
W/96B/25	*Merrifield*	Sot'on	An infrared imaging survey of edge-on galactic bulges
W/96B/27	*Robinson*	Herts	Broad emission lines and thermal continuum emission in BL Lacertae objects
W/96B/29	*Rawlings*	Oxford	Radiogalaxies at z greater than 5 ***Long Term***
W/96B/31	*Baldwin*	MRAO	Combined synthesis imaging of cool stars with the WHT and COAST

W/96B/34	*Bridges*	RGO	A spectroscopic survey of globular clusters in M31
W/96B/35	*Bridges*	RGO	Mass and velocity dispersion profile of the cluster-lens Cl0024+17
W/96B/38	*Ellis*	IoA	A systematic redshift survey of normal galaxies with $1 < z < 3$ ***Long Term***
W/96B/40	*Pettini*	RGO	Galaxies at $z > 3$: clustering and luminosity function ***Long Term***
W/96B/41	*B-Hawthorn*	AAO	Optical rotation curves beyond the HI edge in spirals
W/96B/43	*Horne*	St.Andrews	Quasi-simultaneous WHT-HST-EUVE observations of the unique eclipsing polar HU Aqr
W/96B/44	*Jameson*	Leicester	Occultation study of Neptune's atmosphere and rings
W/96B/46	*Rolleston*	QUB	The magnetic activity of late-type stars in the open clusters NGC 7092 and Stock 2
W/96B/50	*Lawrence*	ROE	Nuclear activity in very nearby galaxies
W/96B/51	*Lacy*	Oxford	The star-forming galaxy population at $4.25<z<5$
W/96B/57	*O'Brien*	Liverpool	Kinematics of old nova shells
W/96B/59	*Terlevich*	IoA	Spectrophotometric studies of high redshift HII galaxies
W/96B/60	*Cameron*	St.Andrews	A search for high latitude starspot activity in rapidly rotating G dwarfs
W/96B/61	*Olling*	Southampton	Measuring the mass-to-light ratios of stellar discs
W/96B/62	*Mobasher*	IC	Near-infrared luminosity function of field galaxies
W/96B/70	*Shanks*	Durham	Natural Guide Star Cosmology: Deep K galaxy counts with MARTINI-2
W/96B/76	*Wilson*	RGO	High resolution imaging of Betelgeuse
W/96B/80	*Fitzsimmons*	QUB	Molecular abundances in Hale-Bopp as a function of heliocentric distance ***O/R plus Long Term***

INT

I/96B/1	*Davies*	JAC	Physical properties of distant planetesimals ***Long Term***
I/96B/6	*Dufton*	QUB	Nuclear processed material at the surface of main-sequence B-type stars
I/96B/7	*Pollacco*	ING	A modern shell flash: when the dust clears
I/96B/8	*Davies*	Cardiff	The colours of background galaxies close to the plane of edge-on spiral galaxies
I/96B/9	*Crawford*	IoA	Optical properties of central cluster galaxies in the ROSAT brightest cluster sample
I/96B/11	*Naylor*	Keele	The mass of the white dwarf in the recurrent nova T CrB ***Long Term***
I/96B/13	*Adamson*	Preston	Characteristics of the Stephenson Catalogue: interstellar fine structure and luminosity classes
I/96B/14	*Thomson*	Herts	Multicolour imaging of shell galaxies
I/96B/15	*A-Salamanca*	IoA	Evolution of the star formation rate density of the Universe

I/96B/19	*Hewett*	IoA	Spectroscopy of candidate very late > M7 M-dwarfs
I/96B/24	*Hodgkin*	Leicester	A CCD survey of the Pleiades for Brown Dwarfs
I/96B/26	*O'Brien*	Leicester	Emission-line constraints on the ultra-soft X-ray continuum of AGN
I/96B/30	*Marsh*	Southampton	A spectroscopic survey of white dwarfs ***Long Term***
I/96B/32	*O'Brien*	Liverpool	The kinematics of the common-envelope phase during nova outbursts ***O/R***
I/96B/33	*Lucey*	Durham	Streaming motions of Abell clusters
I/96B/38	*Crotts*	Columbia	Contribution of sub-stellar masses to the haloes of M31 and the Galaxy
I/96B/42	*Fitzsimmons*	QUB	Astrometry and colours of Kuiper-Belt objects ***Long Term***

JKT

J/96B/2	*Collins*	LJMU	Peculiar velocities of X-ray clusters
J/96B/3	*Keenan*	QUB	Four-colour photometry of stars from the Palomar-Green Survey
J/96B/4	*Rolleston*	QUB	A search for late-type members of the young, open cluster NGC 2232
J/96B/5	*Barstow*	Leicester	Observing stellar structure and evolution through a new class of pulsating subdwarfs
J/96B/8	*Naylor*	Keele	The nature of star formation in the Cep OB3b region
J/96B/10	*Watson*	Leicester	Photometry of ultra-soft polar candidates
J/96B/11	*Naylor*	Keele	Are hot sources efficient at irradiating late type stars in close binaries?
J/96B/12	*Adamson*	Preston	Photometric properties of the Stephenson Survey - the optical broadband extinction curve
J/96B/15	*Lucey*	Durham	Streaming motions of Abell clusters
J/96B/16	*Terlevich*	IoA	Improved determination of Luminosity - Line width relation for giant extragalactic HII regions
J/96B/17	*Mobasher*	IC	Unbiased, all sky study of the local velocity field
J/96B/18	*Fitzsimmons*	QUB	Rotation and outgassing of Hale-Bopp from broad and narrow-band imaging

SPANISH SUCCESSFUL PROPOSALS - SEMESTER 96B

WHT

CAT W2	*Campos*	Durham	U and R images of galaxies, z > 3
CAT W6	*Castander*	Chicago	Dynamics of galaxy clusters
CAT W7	*Centurión*	IAC	N_2 in Ly alpha absorption systems
CAT W14	*Pérez*	STScI	Activity in the nuclei of galaxies

CAT W16	*García*	IAC	Circumnuclear regions in AGNs
CAT W21	*Vílchez*	IAC	Irregular galaxies
CAT W22	*Vílchez*	IAC	Abundances of primordial helium
CAT W30	*Guerrero*	IAC	Kinematics of planetary nebulae
CAT W35	*Díaz*	MADRID	Velocity dispersion in giant HII regions
CAT W39	*García*	IAC	O2 Be in very metal poor stars
CAT W41	*Manchado*	IAC	Mass loss from stars in galaxies
CAT W44	*García*	LEIDEN	Lithium abundances in O2 rich AGB stars
CAT W45	*R-Lapuente*	BARCELONA	H_0 from type Ia supernovae
CAT W49	*Martín*	IAC	Giant planets and low mass stars
CAT I23	*Zapatero*	IAC	Mass function in alpha Per and Hyades

INT

CAT I1	*Gallego*	UCM	SFR indicators for the local universe
CAT I5	*Iglesias*	IAC	WR galaxies in groups
CAT I7	*Gorgas*	UCM	Stellar population of bulges in spirals
CAT I14	*Corradi*	IAC	Chemical structure in bipolar planetary nebulae
CAT I19	*Rosenberg*	IAC	Metallicity of the globular Pal 1
CAT I21	*F-Figueroa*	UCM	Chromospheres in PMS stars
CAT I22	*Martín*	IAC	Stellar formation in Taurus and Orion
CAT I23	*Zapatero*	IAC	Brown dwarfs in alpha Per and Hyades

JKT

CAT J1	*Iglesias*	IAC	Compact groups of galaxies
CAT J2	*Gorgas*	UCM	Calibration of the CaII triplet
CAT J3	*Alfaro*	IAA	Photometry of young clusters
CAT J4	*Génova*	IAC	Identification of EUV sources
CAT I22	*Martín*	IAC	Stellar formation in Taurus and Orion

DUTCH SUCCESSFUL PROPOSALS - SEMESTER 96B

WHT

W/96B/N1	*Franx*	GRONINGEN	Galaxy evolution and morphology at z=0.58
W/96B/N3	*Röttgering*	LEIDEN	A search for z > 3.5 galaxies
W/96B/N5	*Kuijken*	GRONINGEN	3-D kinematics of disc galaxies
W/96B/N7	*Magnier*	AMSTERDAM	Finding the ages of young SNRs in M31
W/96B/N8	*Groot*	AMSTERDAM	Spectropolarimetry of Holoea, a YSO in M36 field

W/96B/N12	*Prins*	AMSTERDAM	Spectroscopy of SN remnants in M31
W/96B/N15	*Braun*	DWINGELOO	Fabry-Perot spectroscopy of expanding, ionized shells in nearby spirals
W/96B/N16	*v Woerden*	GRONINGEN	Distance of HVC complex A
W/96B/N17	*Rutten*	LPO	Ellipsoidal variations and irradiation of the secondary stars in eclipsing CVs
W/96B/N18	*Waters*	AMSTERDAM	The lambda Boo phenomenon in Herbig Ae/Be and Vega type stars
W/96B/N21	*Waters*	AMSTERDAM	Long term monitoring of IRC+10420

INT

I/96B/N3	*Röttgering*	LEIDEN	X-ray identified WENSS halo sources in rich, high redshift clusters
I/96B/N4	*Zwaan*	GRONINGEN	Optical imaging of an HI selected galaxy sample - part 3
I/96B/N5	*Sackett*	GRONINGEN	Contribution of sub-stellar masses to the haloes of M31 and the Galaxy
I/96B/N6	*Schoenmakers*		Spectroscopy of a sample of low redshift giant radio galaxy candidates
I/96B/N7	*Ehrenfreund*	LEIDEN	Diffuse interstellar bands: environment dependence in Orion, Taurus and nearby clouds
I/96B/N8	*Henrichs*	AMSTERDAM	Photospheric and wind variability in O stars (MUSICOS 96 campaign)
I/96B/N10	*v Hoof*	GRONINGEN	Accurate abundance determination of CNO in planetary nebulae

JKT

J/96B/N1	*de Vries*	GRONINGEN	Host environment of compact radio sources
J/96B/N2	*v Paradijs*	AMSTERDAM	Comparative study of disk and halo CVs
J/96B/N3	*Zaal*	AMSTERDAM	High-resolution H alpha spectroscopy of OB stars
J/96B/N4	*Reynolds*	UTRECHT	Reddening-distances for Be/X-ray binaries

INTERNATIONAL TIME PROJECTS FOR 1996

ITP 96(1)	*Rebolo*	IAC	Brown dwarfs
ITP 96(2)	*Beckman*	IAC	Barred and Ringed Spiral galaxies

Appendix D

ING Bibliography and Analysis

BELOW IS THE LIST OF RESEARCH PAPERS PUBLISHED IN 1995 AND 1996 THAT RESULTED from observations made at the Isaac Newton Group of Telescopes. Only papers appearing in refereed journals have been included, although many useful data have also appeared elsewhere, notably in workshop and conference proceedings.

Papers marked (INT) or (JKT) at the end of the reference indicate those papers also include results from the INT or JKT. For each telescope, papers corresponding to 1995 are shown before those for 1996.

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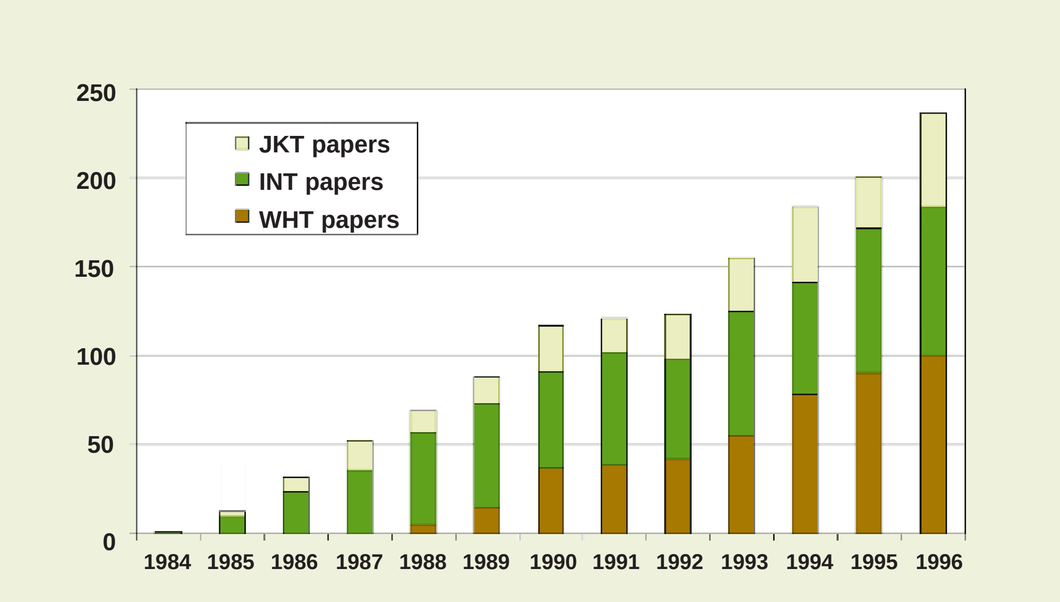
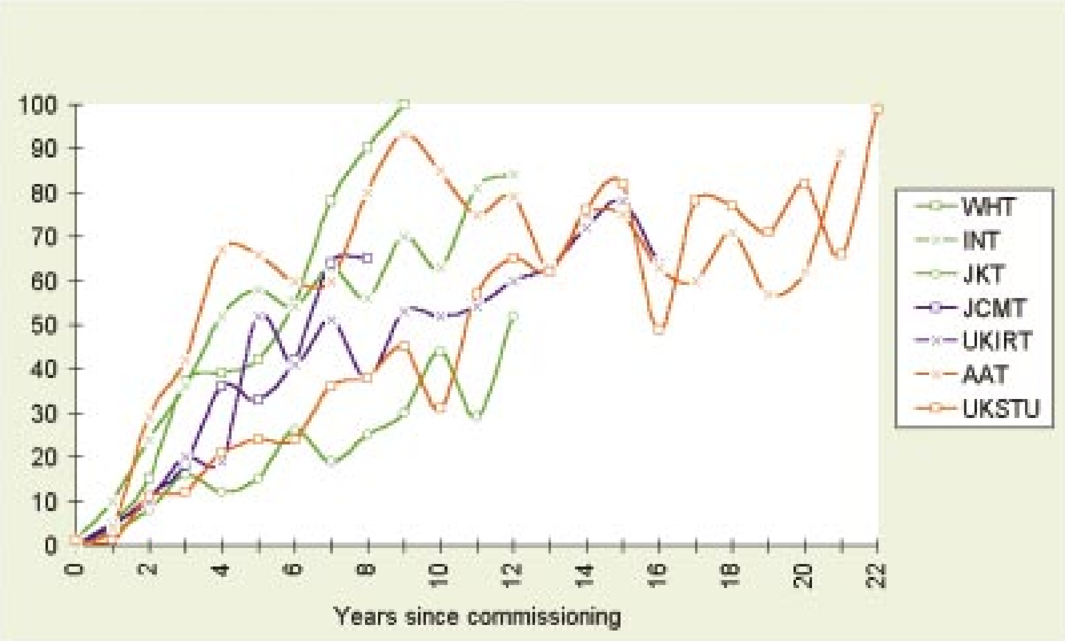
ANALYSIS

This list contains 348 publications, 162 in 1995 and 186 in 1996, some of which include results from more than one telescope. 90 papers contain results from the WHT, 81 contain results from the INT and 29 contain results from the JKT in 1995. The corresponding figures for 1996 are 100 from the WHT, 84 from the INT and 52 from the JKT. As can be seen from the tables and figure below, the combined publication rate has increased again by 36 publications compared with 1995 and 51 compared with 1994. In addition the number of papers published from all three telescopes is the highest to date and hence the overall publication rate has still not yet reached a steady state. Note that papers containing results from more than one telescope have been credited to each telescope used.



The number of papers based on data from ING was 200 in 1995. The total in 1996 continued to climb, at 236. There is no evidence as yet for the scientific output from ING levelling off.

	WHT	INT	JKT	Total
1984	-	1	-	1
1985	-	10	3	13
1986	-	24	8	32
1987	-	36	16	52
1988	5	52	12	69
1989	15	58	15	88
1990	37	54	26	117
1991	39	63	19	221
1992	42	56	25	123
1993	55	70	30	155
1994	78	63	44	185
1995	90	81	29	200
1996	100	84	52	236



The publication rates can be compared with those of other UK-funded telescopes. Of particular interest is the rapid increase of publications from the WHT, INT and AAT in the first 10 years. The older telescopes tend to reach a plateau after about 10 years – note however that there is as yet no evidence for the productivity of the ING telescopes reaching such a plateau.

Appendix E

ING staff research papers

THE FOLLOWING LIST INCLUDES RESEARCH PAPERS PUBLISHED BY ING STAFF FROM 1995 to 1996. It is organised by subjects and sorted in alphabetical order. ING authors appear in bold and italic.

SOLAR SYSTEM

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A Fitzsimmons, P J Andrews, R Catchpole, J E Little, ***N A Walton***, I P Williams, 1996, “Re-entry and ablation of cometary dust in the impact plumes of Shoemaker-Levy 9”, *Nature*, **379**, 801

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I P Williams, A Fitzsimmons, J E Little, P J Andrews, R M Catchpole, E Harlaftis, ***P J Rudd***, ***N A Walton***, 1995, “Optical imaging and spectroscopy of the interaction with Jupiter of Comet Shoemaker-Levy 9”, *Highlights of Astronomy*, **10**, 644

STARS

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S Bell, ***D Pollaco***, 1995, “Absolute dimensions and masses of the eclipsing planetary nebulae central stars UU Sagittae and V477 Lyrae", in Proc. of University of Haifa Conference on Asymmetrical Planetary Nebulae, *Ann. Isr. Phys. Soc.*, **11**, A Harpaz, N Soker (eds.), 71

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V S Dhillon, ***R G M Rutten***, 1995, "Spectropolarimetry of the nova-like variable V1315 Aql", *MNRAS*, **277**, 777

V S Dhillon, ***R G M Rutten***, 1995, "Spectropolarimetry of V1315 Aql: an attempt to explain the SW SEX phenomenon", in *Proc. of the Abano-Padova Conference on CVs*, Della Valle (ed.)

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V S Dhillon, ***R G M Rutten***, 1995, "Spectropolarimetry of V1315 Aql: an attempt to explain the SW Sex phenomenon", in *Cataclysmic Variables*, A Bianchini et al (eds.), Kluwer, Dordrecht, 125

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V S Dhillon, 1996, "Book review on cataclysmic variable stars by Brian Warner", *The Observatory*, **116**, 321

H F Henrichs, L Kaper, J S Nichols, D Bohlender, H Cao, K Gordon, G Hill, Y Jiang, I Kolka, J Neff, ***J H Telting***, 1995, "Surface magnetic fields and stellar wind variability in O-type stars", in *Stellar Surface Structure*, Poster Proceedings of IAU Symposium 176, Strassmeier K. G. (ed.), 229

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C R Moreno, ***R G M Rutten***, ***V S Dhillon***, 1996, "Temperature structure of the disk in V1315 Aql", in *Proc. of IAU Colloquium 158 on cataclysmic variables and related objects*, A Evans and J H Wood (eds.), Kluwer, Dordrecht, 15

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R G M Rutten, 1996, “Eclipse mapping and related techniques”, in *Proc. of IAU Symposium 176 on Stellar Surface Structure*, Strassmeier K (ed.), Kluwer, Dordrecht, 69

M J Sarna, ***V S Dhillon***, T R Marsh, P Marks, 1995, “An observational test of common-envelope evolution”, *MNRAS*, **272**, L41

M D Still, ***V S Dhillon***, D H P Jones, 1995, “Spectrophotometry of the nova-like variable RW Trianguli in a high state”, *MNRAS*, **273**, 849

M D Still, ***V S Dhillon***, D H P Jones, 1995, “Emission-line variations of the nova-like variable PX Andromedae (=PG0027+260)”, *MNRAS*, **273**, 863

M D Still, ***V S Dhillon***, D H P Jones, 1996, “Evidence for Curtain Accretion in the SW Sextantis Stars”, in Cape Workshop on Magnetic Cataclysmic Variables, D A H Buckley, B Warner (eds.), *ASP Conference Series*, **85**, 213

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M G Watson, ***V S Dhillon*** et al, 1996, “The EUV transient RE J1255+266”, *MNRAS*, **281**, 1016

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C G Mundell, A Pedlar, D L Shone, D J Axon, J Meaburn, ***S W Unger***, 1996, “NGC 3227 - an interacting barred spiral with an active nucleus”, *Astron. Soc. Pac. Conf. Ser.*, **91**, 473

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C R Benn, *1995, “*The 5C13 deep radio survey”, *MNRAS*, **272**, 699

C R Benn, J V Wall, 1995, “The largest structures: limits from the radio-source background”, in *Proc. of the STScI Symp 7 on Extragalactic Background Radiation*, D Calzetti et al (ed.), 265

C R Benn, J V Wall, 1995, “Large-scale structure from radio surveys”, in *Proc. of the 35th Herstmonceux Conference on Wide-field Spectroscopy and the Distant Universe*, S J Maddox et al (eds.), World Scientific, 184

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Appendix F

Financial Statement

ANNEX 1 SETS OUT THE FINANCIAL OUTTURNS FOR ING OPERATIONS IN financial years 1994/95 and 1995/96. The baseline budget for the first of these two years was originally approved at the level of £422k and 286,446 kptas. However, additional revenue, from repayment work plus an additional receipt against the technology programme, increased the total budget to £1,996.8k at the exchange rate for the year of 198.469 ptas/£. These figures also included compensation for the shortfall in staff effort from the partner countries, and an adjustment for the overspend carried forward from financial year 1993/94. The main features of expenditure during the year was an overspend of £31.5k against Common Services, resulting from an operating loss at the Residencia, being offset by an underspend of £31.2k for Local Staff costs as social security payments were lower than expected. Overall the Joint Operations budget was £4.3k underspent against allocation, and this sum was carried forward to the following financial year.

For 1995/96, the approved budgets comprised £429.3k plus 311,800 kptas, which at the exchange rate for the year, 202.882 ptas/£ provided a total of £1,966.2k for operations. In addition, however, PPARC provided a loan of a further £100k as partial funding for the start up of the new sea-level base in the edificio Mayantigo in Santa Cruz de La Palma. Although requiring an initial injection of capital funds, it is anticipated that the sea level base will lead to increases in efficiency and economy for the ING, particularly through the reduction of time and costs associated with staff travelling each day to the mountain top. Slippage of expenditure on the Enhancements lines also provided some additional funds for the equipping of the sea-level base. The year concluded with an overall underspend of £17k against the Joint budgets, due to slippage of expenditure on the Enhancements lines.

Outturns of expenditure for ING Joint Operations

Cost centres	Expenditure 1994/95 kPtas	Expenditure 1994/95 £k	Expenditure 1995/96 kPtas	Expenditure 1995/96 £k
Local staff costs	123,103	0.7	152,100	0.0
UK/NL shared staff costs	3,405	4.2	3,100	6.9
Common Services	16,591	0.0	11,000	0.0
Site Services	41,500	2.7	30,100	4.9
Site works	4,487	40.0	4,600	35.6
Sea level office services	15,364	10.2	10,700	10.9
Communications	27,614	16.4	16,100	13.6
Residencia costs	29,599	0.0	26,200	0.0
Transport fleet maintenance	16,025	0.5	11,600	0.0
Transport fleet replacement	7,145	0	-	0.0
Safety	2,958	22.2	1,000	21.0
Electrical services	3,135	70.2	6,800	49.0
Mechanical engineering	2,455	57.5	3,300	63.4
Electronics	5,630	71.1	4,500	106
Computing	4,226	92.4	6,400	87.9
Astronomy support	3,498	10.9	3,400	21.7
Library	1,349	24.3	700	28.1
UK/NL support	223	15.6	200	24.0
SLB start up costs	-	0	10,400	176.3
Totals	**308,307**	**438.9**	**302,200**	**649.3**

ANNEX 1. JOINT UK-NL BUDGET: ENHANCEMENTS AND MAINTENANCE

FINANCIAL YEAR 1994 / 95

The following table shows the expenditure on the Joint UK-NL enhancements and maintenance programme for 1994/95. At its May 1994 meeting, the Joint Steering Committee approved an overall allocation of £454k to the joint technology programme, consisting of the on-going new instrumentation projects and the enhancement and maintenance programme. This budget was derived from a baseline budget of £400k plus a carry forward from the previous year of £54k. A shortfall in the NL contribution of £20k was then subsequently agreed by the funding agencies, reducing the overall budget to £434. PPARC also provided funding to the level of £179k for other enhancement work, as detailed in the tables.

The underspend on the INT dome resulted from delayed completion of this work, whilst the underspend in the “Pulse” programme was aided by actual costs being lower than estimated for the INT prime focus filter wheel improvements and the TV tube replacement. To cope with the overall underspend under the budget, £15.9k of expenditure was brought forward from the following year against the computer enhancements budget in the form of a SparcStation for an improved data acquisition system for the JKT. Similarly, expenditure for the INT and JKT CCD controllers was brought forward from the following year.

Enhancements and Maintenance Programme - Expenditure Outturn 1994/95

Description	Approved Allocations £k	Financial Outturn £k
NEW INSTRUMENTS		
Autofib	33.0	25.6
WHT PF Instrument Platform	2.0	3.0
WYFFOS	37.0	39.9
Holographic Spectrometer (HHS)	2.0	2.5
INT PF Camera	60.0	22.7
Seeing Sources Design Study	12.0	-
Seeing Measurement Design Study	2.0	3.0
SUB TOTAL	**148.0**	**96.7**
INSTRUMENT ENHANCEMENTS		
ISIS Enhancements	6.0	0.00
Optical components	10.0	7.40
DMS and Instrument Control	15.0	16.00
UES Enhancements	20.0	15.40
WHT software	8.0	5.80
INT/JKT CCD controllers	0.0	22.00
SUB TOTAL	**59.0**	**66.60**
TELESCOPE ENHANCEMENTS		
WHT PF Infrastructure	5.0	6.2
WHT Performance	5.0	11.5
INT/JKT Performance	5.0	8.3
SUB TOTAL	**15.0**	**26.0**
COMPUTER ENHANCEMENTS		
Computers	35.0	50.9
SUB TOTAL	**35.0**	**50.9**
MAJOR MAINTENANCE		
Domes	85.0	60.0
‘Pulse’	112.0	95.5
SUB TOTAL	**197.0**	**155.5**
ENHANCEMENT AND MAINTENANCE TOTAL	**306.0**	**299.0**
OVERALL PROGRAMME TOTAL	**454.0**	**395.7**

Note: the following projects were funded solely by the UK PPARC in 1994/95, in accordance with the agreement between the UK and NL funding agencies.

	Expenditure £k
Detector enhancements	123.7
Half Arcsecond programme	37.1
Other enhancements	30.2
Total	**191.0**

FINANCIAL YEAR 1995 / 96

Set out below, are the allocations and outturn for the enhancements and maintenance budget for 1995/96. The JSC approved a budget of £387k for this programme in 1995/96, derived from a baseline of £400k less a £20k shortfall in the NL contribution and a carry forward of a £7k underspend from the previous financial year. PPARC also made available an additional £179k for the procurement of CCDs and other enhancement items for the ING.

In the event, the budget underspent by £51.1k in 1995/96 as a result of late delivery of major capital items, insufficient staff effort to carry out all parts of the programme and non-payment of bills at the end of the financial year. This underspend was therefore re-allocated to La Palma to help equip the new sea level base in Santa Cruz de La Palma.

Major items to note were:

- Telescope Enhancements underspent by £20.4k because the INT primary mirror supports cost less than expected;

- Delays in purchasing equipment for the WYFFOS enhancement and hardware for INTEGRAL, resulted in an underspend of £14.9k;

- Computer enhancements overspent by £10.8k due to unexpected but necessary expenditure on improvements to the WHT control systems, including development of the real-time system and maintenance charges on the development Micro-Vax;

Capital spend on the Re-engineering programme was £31.9k under allocation due to a delay in placing a contract to provide a replacement for the utility network, and due to the decision made at the June 1995 JSC meeting to delay any investment in a stand-alone IPCS/DMS until its future had been clearly defined. Despite this low capital expenditure on Re-engineering, the programme did make a significant advance during the year in question.

Enhancements and Maintenance Programme - Expenditure Outturn 1995/96

Description	Approved Allocations £k	Financial Outturn £k
INSTRUMENT ENHANCEMENTS		
CCDs and Cryostats	45.0	43.8
INT/JKT CCD controllers	38.0	34.4
Optical components	10.0	6.4
ISIS Polarisation Unit	14.0	17.1
INTEGRAL	8.0	2.2
WYFFOS Enhancements	8.0	1.7
UES Derotator	0.0	2.5
SUB TOTAL	**123.0**	**108.1**
HALF ARCSECOND PROGRAMME	**46.0**	**54.6**
TELESCOPE ENHANCEMENTS		
WHT Performance	28.0	23.2
INT Performance	53.0	44.8
JKT Performance	28.0	20.6
SUB TOTAL	**109.0**	**88.6**
COMPUTER ENHANCEMENTS		
INT/JKT Data Acquisition Systems	10.0	2.1
WHT Control Systems	6.0	24.7
SUB TOTAL	**16.0**	**26.8**
SYSTEM RE-ENGINEERING		
INT/JKT Telescope Control Systems	4.0	6.7
Autoguider/TV systems	9.0	1.4
Utility network	20.0	0
Stand-alone IPCS/DMS	10.0	0
JKT Design Study	2.0	2.2
Other design studies/management	4.0	1.1
EPICS systems	0.0	5.7
SUB TOTAL	49.0	17.1
MAJOR MAINTENANCE		
INT Dome	10.0	4.5
‘Pulse’	25.0	24.4
ISIS/IDS Overhaul	5.0	7.2
SUB TOTAL	**40.0**	**36.1**
PROGRAMME MANAGEMENT	**4.0**	**4.6**
OVERALL PROGRAMME TOTAL	**387.0**	**335.9**

Note: the following projects were funded solely by the UK PPARC during1995/96

	Allocation £k	Outturn £k
EEV and Loral Detectors	176.0	48.0
Half Arcsecond programme	13.0	3.0
Total	**189.0**	**51.0**

Appendix G

Committee Membership

DURING 1995 AND 1996 THE MEMBERSHIP OF THE JOINT STEERING COMMITTEE AND associated bodies was as follows.

JOINT STEERING COMMITTEE

Professor M. F. Bode – **Chairman**	*Liverpool John Moores University*
Professor P. C. van der Kruit – **Vice Chairman**	*University of Groningen*
Professor H. R. Butcher (until August 1996)	*NFRA Dwingeloo*
Dr. W. Boland (from August 1996)	*NFRA Dwingeloo*
Dr. P. G. Murdin	*PPARC Swindon*
Professor C. Frenk	*University of Durham*
Dr. G. F. Gilmore (until August 1995)	*University of Cambridge*
Professor P. A. Charles (from September 1995)	*University of Oxford*
Miss R. L. Sirey – **Secretary** (until October 1996)	*PPARC Swindon*
Dr. C. Vincent minutes – **Secretary** (from October 1996)	*PPARC Swindon*

INSTRUMENTATION WORKING GROUP

Dr. G. F. Gilmore – **Chairman** (until December 1996)	*University of Cambridge*
Professor P. A. Charles – **Chairman** (from December 1996)	*University of Oxford*
Dr. M. Cropper (from August 1996)	*University College London*
Dr. C. R. Jenkins	*RGO*
Mr. M. R. Johnson	*RGO*
Dr. R. M. Meyers (from August 1996)	*University of Durham*
Dr. J. W. Pel	*KSW Roden*
Dr. P. F. Roche	*University of Oxford*
Dr. R. G. M. Rutten	*ING*

PATT ING TIME ALLOCATION GROUP

Dr. B. J. Boyle – **Chairman**	*RGO*
Dr. P. B. Byrne	*Armagh Observatory*
Dr. J. I. Davies	*University College Cardiff*
Dr. H. Henrichs	*University of Amsterdam*
Dr. T. P. Ray (until October 1995)	*Dublin Institute for Advanced Studies*
Dr. M. Redfern (from October 1995)	*University of Galway*
Dr. C. N. Tadhunter	*University of Sheffield*

Dr. W. L. Martin – **Technical Secretary**	*RGO*

Appendix H

Addresses

Isaac Newton Group of Telescopes

Apartado de correos, 321
38780 Santa Cruz de La Palma
Canary Islands
SPAIN
E-mail: username@ing.iac.es
URL: http://www.ing.iac.es/
http://www.ast.cam.ac.uk/ING/ (UK mirror)

Sea-level base:

Edificio Mayantigo
c/ Alvarez de Abreu, 68, piso 2
38780 Santa Cruz de La Palma
Canary Islands
SPAIN
Tel: +34 922 425400
Fax: +34 922 425401
Open from 08:30 to 17:00 Monday to Thursday and from 08:30 to 16:30 on Friday, closed for lunch from 13:00 to 14:00

Mountain Top:

Tel: +34 922 405655 (reception)
+34 922 405559 (WHT control room)
+34 922 405640 (INT control room)
+34 922 405585 (JKT control room)
+34 922 405500 (residencia)
Fax: +34 922 405646

Director: Dr René G. M. Rutten
Tel: +34 922 425420 (*secretary*); fax: +34 922 425408; e-mail: rgmr@ing.iac.es, miles@ing.iac.es (*secretary*)

Particle Physics and Astronomy Research Council

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SN2 1SZ
UK
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Fax: +44 (0)1793 442002
URL: http://www.pparc.ac.uk/

Stichting Astronomisch Onderzoek in Nederland

Netherlands Foundation for Research in Astronomy

P.O. Box 2
7990 AA Dwingeloo
The Netherlands
Tel: +31 (0)521 595 100
Fax: +31 (0)521 597 332
URL: http://www.nfra.nl/

Enquiries about the operation of the Roque de Los Muchachos Observatory can be made to:

Instituto de Astrofísica de Canarias

c/ Vía Láctea s/n
38200 La Laguna
Canary Islands
SPAIN
Tel: +34 922 605200
Fax: +34 922 605210
URL: http://www.iac.es/

IAC at Roque de los Muchachos Observatory:
Tel: +34 922 405500 (Residencia/Switchboard)
Fax: +34 922 405501
E-mail: adminorm@orm.iac.es

Enquiries about observing time on the ING telescopes allocated by the Panel for the Allocation of Telescope Time (PATT) should be made to the Executive Secretary, PATT, at the PPARC address given above.

Enquiries about the share of time at the disposal of Spain should be made to the Comité para la Asignación de Tiempos (CAT), at the address of the Instituto de Astrofísica de Canarias (IAC) given above.

Enquiries about the International Time Scheme should be made to the Secretary, Comité Científico Internacional (CCI), at the address of the Instituto de Astrofísica de Canarias given above.

Acronyms and Abbreviations

AU	*Astronomical Unit* (1.496×10^8 *km*)
Cass	*Cassegrain Focus*
CAT	*Comité para la Asignación de Tiempos*
CCD	*Charge-Coupled Device*
CCI	*Comité Científico Internacional (International Scientific Committee)*
DIAS	*Dublin Institute for Advanced Studies*
Fib	*AUTOFIB Fibre Positioner*
GHR	*Ground Based High Resolution Imaging Laboratory (GHRIL)*
HST	*Hubble Space Telescope*
IAC	*Instituto de Astrofísica de Canarias*
IDS	*Intermediate Dispersion Spectrograph*
ING	*Isaac Newton Group*
INT	*Isaac Newton Telescope*
IR	*Infrared*
ISIS	*ISIS Double Spectrograph*
ITP	*International Time Programme*
JKT	*Jacobus Kapteyn Telescope*
JSC	*Joint Steering Committee*
LDSS	*Low Dispersion Survey Spectrograph*
Mart	*MARTINI Adaptive Optics System*
NBST	*National Board of Science and Technology of Ireland*
NWO	*Nederlandse Organisatie voor Wetenschappelijk Onderzoek*
ORM	*Observatorio del Roque de Los Muchachos (Roque de los Muchachos Observatory)*
PATT	*Panel for the Allocation of Telescope Time*
PF	*Prime Focus*
PFC	*Prime Focus Camera*
PP	*Peoples Photometer*
PPARC	*Particle Physics and Astronomy Research Council*
RBS	*Richardson-Brealy Spectrograph*
RGO	*Royal Greenwich Observatory*
Taur	*TAURUS Imaging System*
UES	*Utrecht Echelle Spectrograph*
UKIRT	*United Kingdom Infrared Telescope*
WCAM	*William Herschel Infrared Camera (WHIRCAM)*
WFC	*Wide Field Camera*
WHT	*William Herschel Telescope*
WYF	*Wide Field Fibre Optics Spectrograph (WYFFOS)*
ZAMS	*Zero-Age Main Sequence*

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