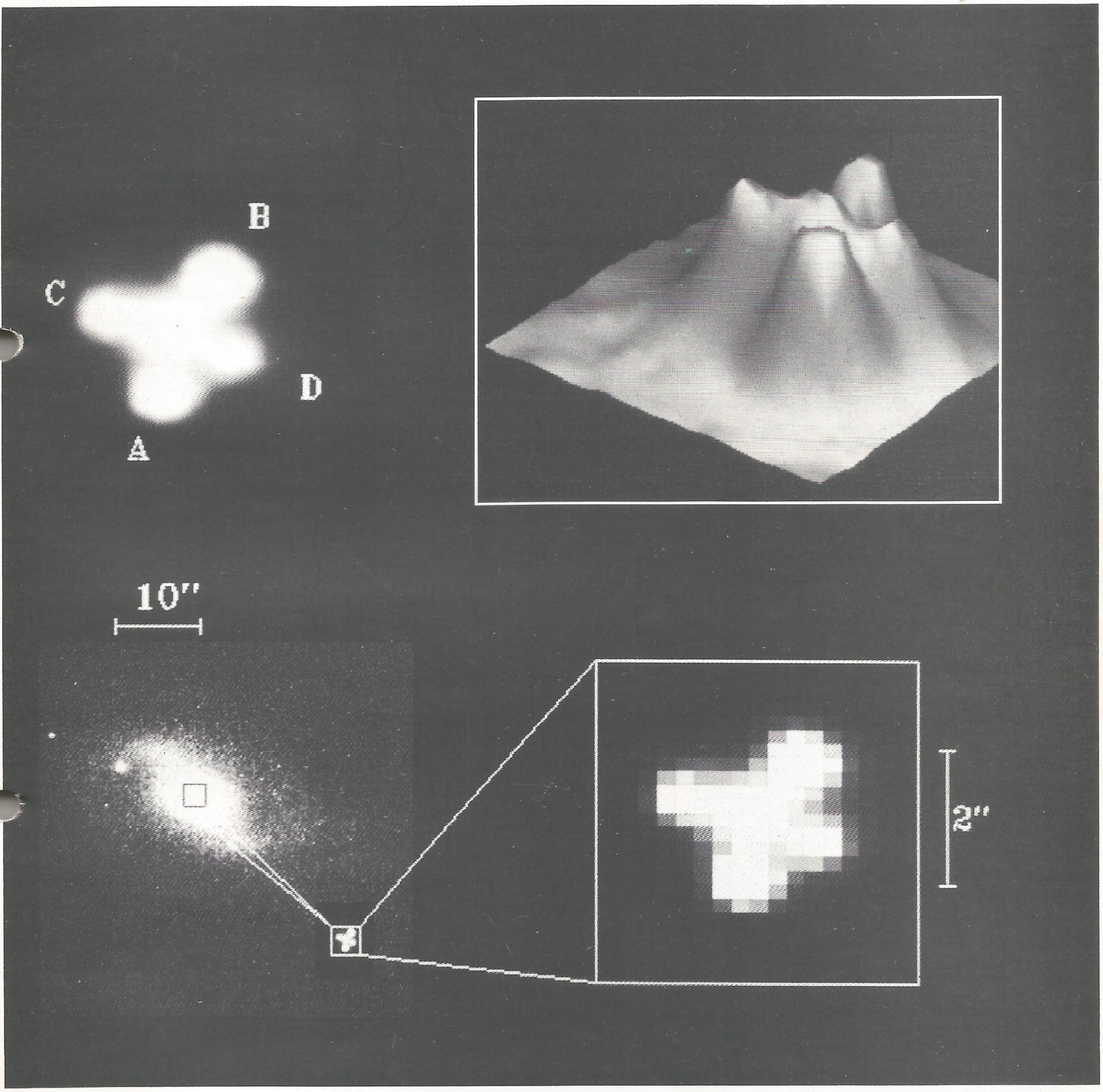
NOT NEWS

No. 5 *** February 1992

Nordic Optical Telescope Scientific Association



Gravitational Lenses

The Nordic Optical Telescope monitors gravitational lenses with high resolution. The figure shows one such example, the gravitational lens QSO 2237+0305 (the Einstein Cross) as observed by T. Korhonen and B.R. Pettersen. Seeing was 0.4 arcsec and exposure time 4 minutes.

Full report by Rolf Stabell on page 5.

Coordination of Instrumentation for the NOT

In its original version, the Nordic Optical Telescope was completed in 1989. Already before, much work at Nordic institutes had been devoted to construction of auxiliary instrumentation for the telescope. These efforts have continued. As a result, there are today at Cruz del Fraile a number of instruments available for the community of observers.

In total, ten instruments have either passed or are about to pass the commissioning phase. Three instruments are entering this phase. Another few are under construction and approaching commissioning, at the same time as plans for future instruments are developing.

Scientific coordination of auxiliary instrumentation was conducted by the Scientific Technical Committee (STC) already long before the telescope was assembled at Cruz del Fraile. In fact, STC formulated a plan for NOT instrumentation as early as 1986.

As the amount, sophistication and complexity of auxiliary instrumentation increases, so does the need for technical coordination. Instruments must be reliable, produce the data required, interface well to the telescope and be easy to maintain and modify. To safeguard these qualities, NOT Council decided in its meeting at Roque de los Muchachos in October 1991 to place the responsibility for technical coordination of auxiliary instrumentation with the Nordic Telescope Group.

Accordingly, if you are planning, working on or finishing some instrument intended for the NOT, you are strongly encouraged to contact the Nordic Telescope Group. A telephone call to the group could easily save you a lot of problems and money. In addition, it could give you a better result. Finally, do not forget that the group has solid experience in high technology equipment and can be convinced to participate in projects in a number of ways.

Editorial

Astronomy maintains its role as a science of high activity and high production of new knowledge. This is a worldwide phenomenon, in which Europe has an important part. Frontiers are moved at remarkable pace. Among other things, new problems call for more powerful tools. Such tools, much in demand, are telescopes and auxiliary instruments but also, and very much so, devices enlarging the capacity of telescopes.

The first Keck 10 m telescope approaches completion, The European Southern Observatory (ESO) 16 m VLT makes good progress. The Japanese 8 m telescope advances rapidly. In addition, development work is abundant for other large telescopes. This includes the Large Earth-based Solar Telescope (LEST).

As compared to telescopes now in operation, the new ones are larger but also more sophisticated. To a considerable extent, the novel features under development are fully applicable also to telescopes already completed, at least those constructed around modern concepts. Active and adaptive optical systems are striking examples.

In parallel to the construction of new telescopes and new telescope features, development of novel auxiliary instruments is an important part of present efforts. Instruments much in demand respond to needs for improved imaging at higher spatial resolution, of larger fields and with wider spectral coverage but also for spectroscopy of both fainter objects at reasonable resolution and of brighter targets at very high resolution.

Naturally, our project takes part in this development. Evidently, we like to see our role as an active one. And activity is certainly there. In this issue, evidence is provided. New science programmes open up. Some of them have already produced smashing data, others are emerging. New projects in progress aim at further improvement of facilities. Plans for the near future are abundant. Not withstanding, present gadgets continue producing data of ever higher quality. A small article some pages ahead bears witness on new record image quality.

Another, and most positive, sign of our activities, is the continued pressure of applications for observing time with the NOT. The number of applications arriving in early January this year is higher than ever. And so is the quality of applications. After all, this is what it is all about.

The Nordic Optical Telescope (NOT) Scientific Association was founded in 1984 to construct and operate a Nordic telescope for observations at optical and infrared wavelengths. Associates are Statens naturvidenskabelige forskningsråd, Denmark, Suomen Akatemia, Finland, Norges almenvitenskaplige forskningsråd, Norway, and Naturvetenskapliga forskningsrådet, Sweden. Executive bodies are the Council and the Directorate. Advice and assistance is provided by an Observing Programmes Committee and Scientific-Technical Committee.

The Nordic Optical Telescope is a 2.56 m telescope with altazimuth mounting and Cassegrain focus. The primary mirror has a focal ratio of f/2.0, the combined optical system a corresponding focal ratio of f/11.0. The telescope is installed at Cruz del Fraile, Observatorio del Roque de los Muchachos, La Palma, Islas Canarias. Geographical longitude is 17° 52' 59.7'' West, geographical latitude 28° 45' 20.5'' North, and altitude 2382 metres above sea level.

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The Nucleus of the Cygnus A Galaxy

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First Investigations
Since its identification in the early fifties, the powerful radio galaxy Cygnus A has served for many investigations, both in radio and optical wavebands. The double morphology of the very powerful radio source in the Cygnus constellation was discovered by Jennison and Das Gupta (1953), and an accurate radio position by Smith led to the identification with a moderately faint (V = 16.2) galaxy by Baade and Minkowski (1954). Using several bright narrow emission lines, these authors also determined the redshift of the galaxy (cz = 16830 km/sec, or z = 0.056), and they furthermore noted the double optical appearance of its central region.

More Recent Studies
Among subsequent important radio studies are the observations with the Cambridge 5 km array (Hargrave and Ryle 1974), in which a weak radio core coincident with the optical galaxy was discovered, and the VLA observations by Perley et al. (1984), revealing a faint jet feeding the Northwestern lobe.

A recent report on VLBI observations of the milliarcsec scale jet in the Cygnus A radio core is given by Carilli et al. (1991). On the basis of these radio studies, Cygnus A can be classified as a prototypical Fanaroff and Riley Class 2 (FR2 - powerful, edge-brightened) radio galaxy, its radio axis oriented at a substantial angle with the line of sight. As for important studies in the optical, Van den Bergh (1976) obtained line-free continuum plates, again drawing attention to the double optical nucleus. The analogy to the famous Cen A galaxy NGC5128 with its prominent dust lane, was pointed out by Kronberg et al. (1976) and Osterbrock (1983).

Nature of the Cygnus A Galaxy
In spite of these various investigations, there is still considerable debate about the nature of the Cygnus A galaxy. The earliest interpretation was to identify the galaxy with a merger remnant. This „colliding nebulae" (Baade and Minkowski 1954) hypothesis, based on the double appearance of the central regions of the galaxy, was succeeded by the dust-lane (cf NGC5128) hypothesis.

Recent results from polarization imaging studies (Tadhunter et al., 1990), as well as the notion that the galaxy center displays extended regions of nonstellar continuum radiation (Pierce and Stockton, 1986) suggest identification of the galaxy nucleus with a bipolar reflection nebula. This model is particularly interesting as Barthel (1989) has proposed that indeed all luminous FR2 radio galaxies may harbour quasars in their nuclei, obscured by anisotropically distributed dust. Such unification theories are currently of great interest.

We have obtained NOT images in V, R, I, and Z of the Cygnus A galaxy under good seeing conditions. These results allow us to shed more light on the nature of this intriguing object.

Improved Imaging with the NOT
The best images made so far of the Cygnus A galaxy were produced with the 2.2 m telescope at Mauna Kea, Hawaii. Using a computer-controlled active mirror autoguider, Thompson (1984) was able to squeeze the image

Figure 1: 15 minute R-band image of the Cygnus A field. The galaxy is located more or less between the two brightest stars. Note the hexagon of stars around the central regions of the galaxy. Only these central regions are shown (choice of gray scale transfer function).

resolution to 0."65 FWHM. These V-band images gave a hint of a compact component coincident with the radio core.

The NOT is capable of producing better image quality (for an extended period) without computer monitoring of the seeing. The images shown are from one 15 minute R band exposure of the Cygnus A galaxy at 0."5 seeing taken on August 15, 1991. These images clearly show the two optical „lobes" of the double morphology, with the northwestern lobe containing a fair amount of H-alpha line emission. On the western side of the southeastern lobe a faint peak is seen. The Cygnus A „dust lane" is also clearly seen.

Astrometry
Using standard stars from Griffin (1963) we performed astrometry on this R-band image, in order to locate the radio core for which we received an accurate (0."1) VLA position (Perley and Carilli, priv. comm.). This radio core position is marked by a + sign in our second figure, and it is found to coincide exactly with the peak in the SE lobe. We believe this is the true nucleus viewed through thick obscuring matter which has been postulated by Djorgovski et al. (1991).

These authors obtained optical and near-IR images at 0."9 and 0."6 resolution, respectively. They found the very interesting result that the emission becomes centrally peaked going toward longer wavelengths. At 3.7 micron (L'-band) the nuclear emission comes solely from a compact point source. Already at 2.2 micron (K-band) the center is unresolved. These near-IR observations suggest the presence of an obscured quasi-stellar nucleus suffering severe extinction.

Our NOT images show this presumed obscured quasar nucleus in higher spatial resolution. A more detailed analysis, including photometry of the nuclear components, is in progress.

Figure 2: Blow-up of the Cygnus A galaxy center. The + sign marks the position of the radio core, which falls exactly on the faint central point source. The pixel size is 0."197, which implies that we were close to undersampling the seeing.

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Good things can be free

We all hope to have a perfect telescope with plenty of high ranking instrumentation. However, budgets are tight. That's where our friends come in.

Astronomical institutes are presently giving workshop assistance free of charge to the NOT. The Institute of Theoretical Astrophysics in Oslo fabricates mechanics for the Velux spectrograph and telescope adapter. Tromsø University manufactures filter holders for the new filter exchange mechanism in the adapter. Finally, Uppsala Observatory contributes fabrication of a lens mechanism for the wavefront sensor of the active optics.

Unpaid workshop assistance from other institutes seems on the way. We shall keep you posted on this favourable development and we urge new workshop sponsors to line up.

Gravitational Lenses

Rolf Stabell

Nordic Collaboration
In 1988 a small Nordic research group was formed to work on gravitational lenses and in particular to monitor well-known systems with the NOT. Since then the group has grown and thanks to the kind support and effort from many members of the Nordic astronomical community, our monitoring programme has been a success so far. In particular we want to thank J. Egonsson and P. Lilje who also volunteered to bring home from La Palma several of those heavy tapes.

Local staff astronomers H. Kjeldsen, Ø. Olsen and P.-I. Emanuelsen have tirelessly coordinated and participated in the observing efforts. We appreciate the positive attitude we have experienced and hope to be able to return favours one day. Participating observers will, of course, be co-authors of eventual publications.

Our Monitoring Programme
In order to get good coverage, we include only a few of the more interesting gravitational lens systems in our monitoring programme. Some of these systems are mentioned below.

The scientific impact of the gravitational lens phenomenon is its ability to determine fundamental astronomical parameters such as the distance to galaxies and quasars and thereby the Hubble parameter, the structure and mass of galaxies, the structure of quasars, the distribution of mass in the universe and the candidates for dark matter.

Distance to Lensing Galaxies
The distance to a lensing galaxy (and the background quasar) can be determined by measuring the difference in light travel time for the different mirages of the quasar. A well determined value of this time delay together with the redshifts and the angles between the lens and the mirages is sufficient, just using simple geometrical relations.

„Double Quasar" QSO 0957+561 A,B
In the case of the „Double Quasar" (QSO 0957+561 A,B), several values for the time delay have been published, ranging from 1.1 to 1.6 years. The quasar has, however, been too well-behaved recently to give a more reliable value for the time delay. The correlation analysis also suffers from large gaps in the two lightcurves. It is therefore of utmost importance that the monitoring of this system is being continued with the NOT.

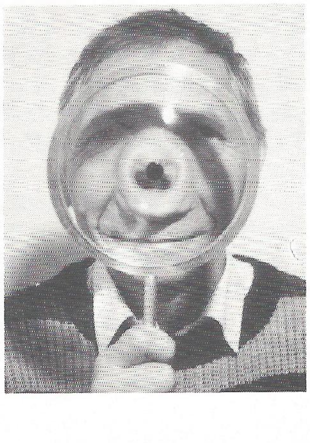
ESO GL 1 (QSO 0142-100)
A particularly promising lens system for measuring time delay is the ESO GL 1 (QSO 0142-100). This is a „clean" system where the lensing galaxy has few disturbing neighbouring galaxies. It is also a „double" and the time delay is expected to be of the order of 50 days. Hence, if a variation is detected in one image, a similar variation may be expected to occur in the other image even in the same season. Maybe the monitoring at the NOT of this gravitational lens will give the first reliable value of the Hubble parameter?

The Einstein Cross (QSO 2237+0305)
One of the systems in our programme, the Einstein Cross (QSO 2237+0305), is truly unique. The quasar has a redshift of z=1.695 and is lensed by a galaxy relatively close to us at z=0.039. The quasar is split into four mirages lying roughly on a circle around and very close to the nucleus of the foreground galaxy.

In addition to this (macro) lens effect of the deflecting galaxy, theory predicts that individual stars in the galaxy along the line of sight to the different images may give observable lens effects of their own. This system is ideal for observing such micro-lens effects. The expected time delay is only about a day, so it is easy to separate intrinsic variability from microlensing. In fact, observations with the NOT by T. Korhonen and B.R. Pettersen with excellent seeing has revealed a clear case of microlensing in this system, a result that was later confirmed by observations made at the same time with the Hubble Space Telescope. Two other cases of such effects has recently been reported.

„Clover Leaf" (H 1413+117)
Another interesting quadruple lens system is the quasar H1413+117, the „Clover Leaf". It was discovered in 1988 and was actually the first object to be observed with the NOT when P.O. Lindblad and M. Hjelm started the regular observing in April 1990 (see NOT NEWS No. 2). Observations made at ESO on February the 18th 1991 indicated that one of the four images (image B) had increased its luminosity by a factor of about 1.8. Observations made by P.O. Lindblad and M. Hjelm at the NOT only a week earlier showed that image B then had its „normal" luminosity. Observations made again at the NOT the 11th of May by M. Sodemann, J. Hjorth and B. Thomsen showed that image B now was back to „normal". If this was a real event (opinions differ), it could either be an intrinsic variation in the quasar that would show up successively in the other images due to the different time delays which are of the order of months, or it could be a micro-lensing effect, a so-called High Amplification Event which is a rarely occurring phenomenon.

NOT Size and Resolution Excellently Suited
The NOT with its size and resolution is excellently suited for observing gravitationally lensed quasars since the separation between the images is typically of the order of arcseconds. It is our hope that the NOT will play an important role for our understanding of gravitational lenses and in using this phenomenon as an astrophysical tool to improve our view and physical understanding of the Universe and its major constituents.



Rolf Stabell (lensed)

Polarimetric Imaging

Vilppu Piirola, Vatican Observatory (present address)
Franco Scaltriti, Osservatorio Astronomico di Torino
George V. Coyne, S.J., Vatican Observatory

Polarized Light

Polarization of starlight carries information which is not accessible by the conventional observing techniques: the direction of the plane of maximum vibration of the electromagnetic radiation. Mechanisms such as scattering by small dust particles or free electrons, or various absorption and emission processes in a magnetic field, produce polarized light. Studies of the amount and the direction of the polarization as a function of wavelength and time may help to establish a physical and geometrical model which can reproduce the observed polarization behaviour.

There are also extended objects, galaxies, stars surrounded by reflection nebulae, or bipolar outflows, which can show appreciable polarization. It is clear that the spatial dependence of the polarization of the light emerging from the extended source can tell us more about the object than observations of the light integrated over the whole visible surface.

First Targets

As a part of a study on star forming regions we made a proposal for multicolour (UBVRI) polarimetry of Herbig Ae/Be stars. These objects are relatively massive (up to 10 Solar masses) young stars embedded in reflection nebulae, composed of gas and dust remaining from the cloud which gave the birth to the star. Multiwaveband polarimetry of the central object allows us to separate the polarization components arising from electron scattering in the extended Ae/Be star envelope and scattering due to the aligned dust particles in the cloud between the star and us.

CCD Polarimetry

Since the Stockholm standby CCD has an experimental device for inserting a rotatable Polaroid filter into the beam, we proposed to complement the aperture polarimetry of the central stars with imaging CCD polarimetry of the surrounding nebulae. The light scattered by the dust cloud (no alignment of particles needed) is a source of information of the particle size distribution, density and the geometry of the cloud. In the optically thick inner parts, multiple scattering decreases the amount of polarization, but in the thinner outer parts, the scattering geometry favours larger degrees of polarization for the emerging light.

Without experience on earlier performance, we preferred to start with a combined program of aperture and surface polarimetry. We also noted that the innermost portions of some Herbig Ae/Be nebulae are relatively bright, which makes the job easier. The fainter outer parts give also opportunities to look for the limits which can be reached with the technique.

We were happy to receive three observing nights, two of which were used for the aperture (UBVRI) polarimetry and the last one for surface polarimetry with the CCD mounted in the Cassegrain instrument position, to avoid the strong instrumental polarization (>4 %) produced by the 45^0 reflection in the standby position.

How to Measure Polarization with the CCD ?

If a Polaroid sheet is rotated in a light beam, the transmitted intensity is sinusoidally modulated with an amplitude proportional to the degree of linear polarization of the incoming

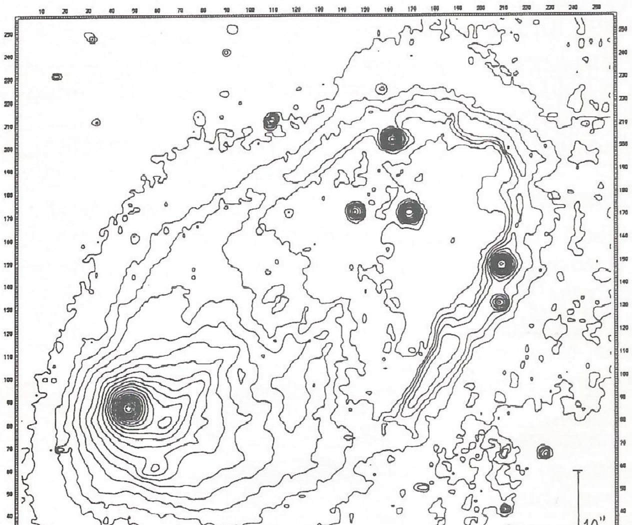


Figure 1: Log contour map of part of back page image. 8 polarization angles are summed of V633 Cas. Seeing of individual 5 min. exposures was between 0.4 and 0.6 arcsec.

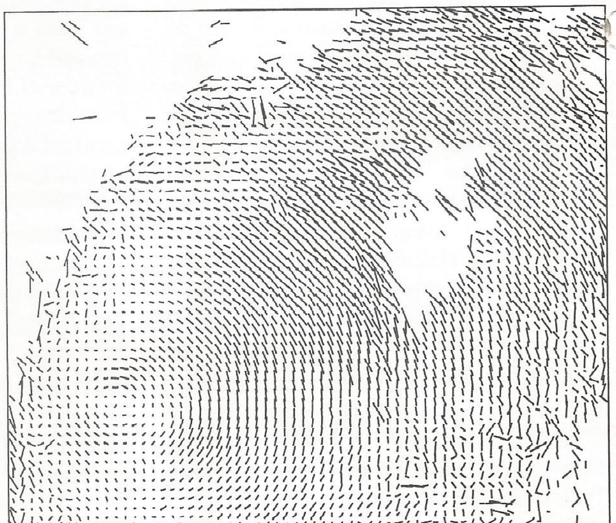


Figure 2: Polarization map of area in Fig. 1. Pixels were averaged in blocks of 4 x 4. Pixels are 0.2 arcsec square.

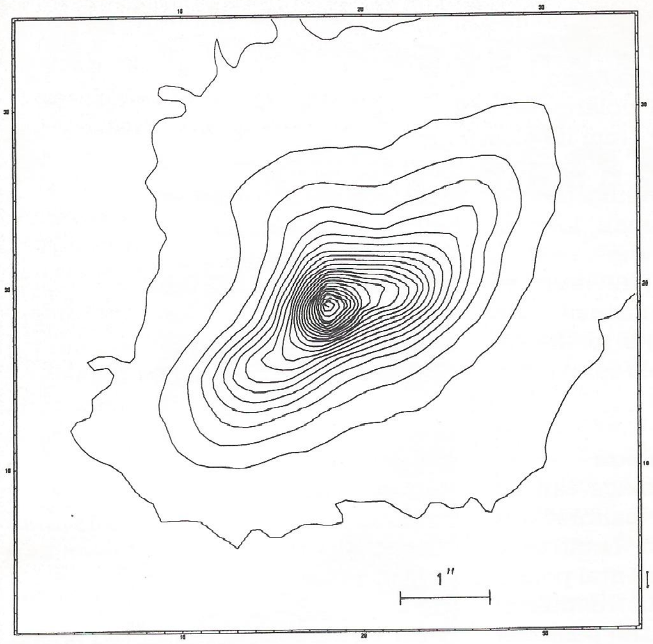


Figure 3: 5 min I band exposure of V376 Cas linearly contoured to individual pixels. Field is seven arcsec square. Seeing was 0.50 arcsec.

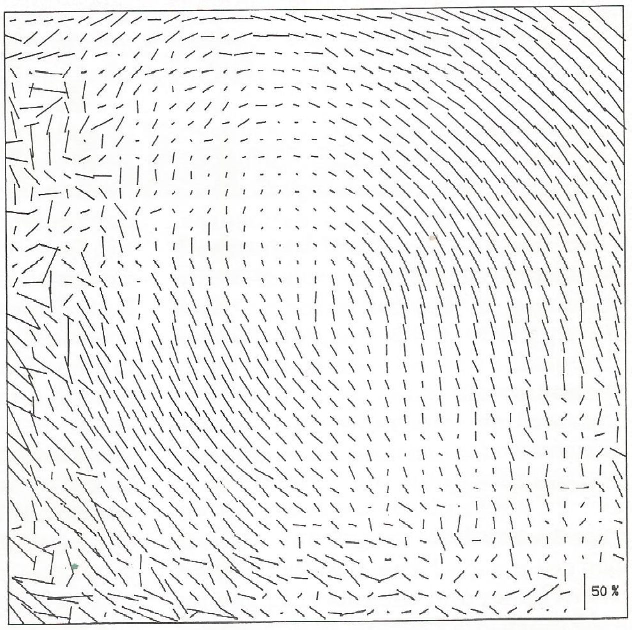


Figure 4: Polarization map of area in Fig. 3. Independent polarization bars were derived for each 0.2 arcsec square pixel.

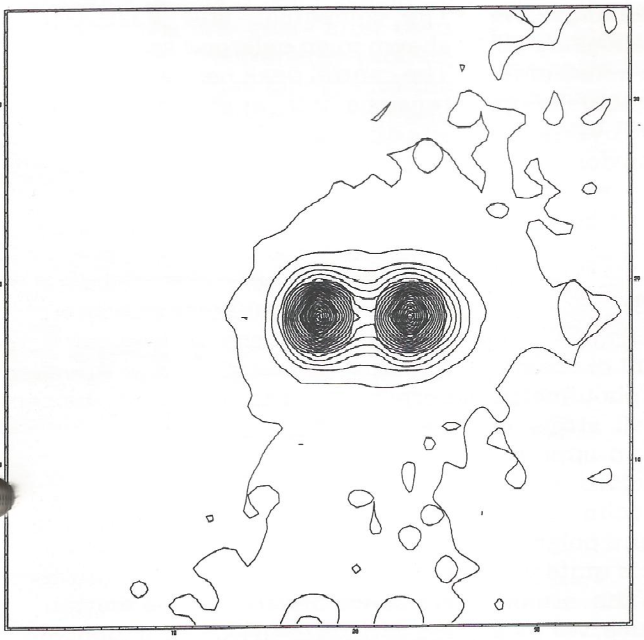


Figure 5: Image of field star from same frame as Fig. 3. Image has been doubled and shifted one arcsec.

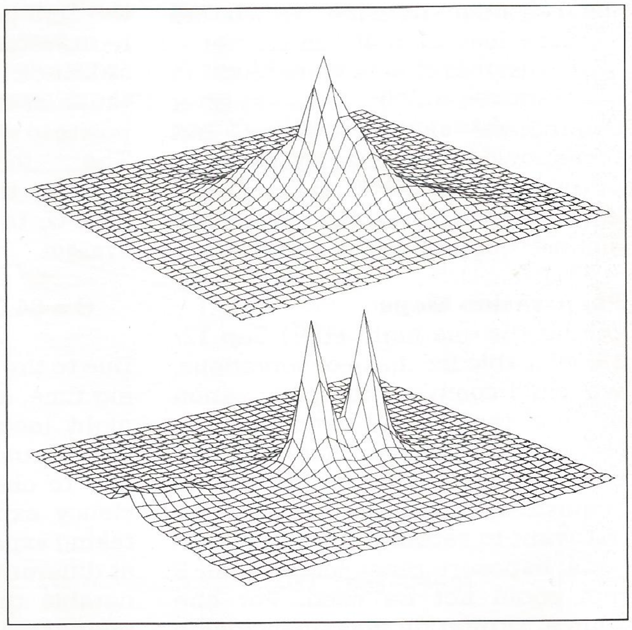


Figure 6: Intensity plots of V376 Cas (upper) and doubled image from Fig. 5 with one arcsec separation. No deconvolution has been made.

beam. A double wave is produced for each full rotation of the polarizer. At least three points are needed to fit a sine curve with known period. However, the reductions are much simplified and the accuracy improved, if measurements are taken at four orientations of the polarizer at 45° intervals, e.g. 0°, 45°, 90°, and 135°. Denoting the transmitted intensities I_1, I_2, I_3, and I_4, respectively, the polarization vector components $P_X = P \cos 2\Theta$ and $P_Y = P \sin 2\Theta$ can then be computed simply from

$$P_X = (I_1 - I_3)/(I_1 + I_3)$$
$$P_Y = (I_2 - I_4)/(I_2 + I_4) \qquad (1)$$

and the degree of polarization P and the position angle Θ will be

$$P = \sqrt{P_X^2 + P_Y^2}$$
$$\Theta = 0.5 \arctan (P_Y/P_X) \qquad (2)$$

Accordingly, if four images are taken with the above orientations of the Polaroid, the P_X image is obtained by dividing the difference of the first and third images by their sum, and the P_Y image correspondingly from the second and fourth images (see Eqs. (1)). The degree of polarization and the position angle can then be calculated for each pixel, or averaged block of pixels, by the Eqs. (2).

Reductions

The reductions for the present observations were carried out by V.P. using the IRAF image processing facilities at the VAXstation 3100 of the Vatican Observatory in Castel Gandolfo. The normal steps of CCD reductions, such as bias and dark subtraction and flat fielding, are, of course, necessary before the Eqs. (1)&(2) can be applied. We also noticed some image shifts (up to a couple of arcsec) between the exposures, although the tracking with the autoguider was good during the 5 min exposures. With the efficient IRAF algorithms for determining the positions of the centroids of the surrounding field stars in the CCD images, it was straightforward to shift all the eight images to the same coordinate system. Writing some new software was necessary for plotting the polarization bars.

Flat Fields

We determined the flat fields from the evening and the morning sky for each position angle of the polarizer and for each filter used. Since accurate sky flats are crucial for observations of the faint nebulosity, we checked the results very carefully from the areas of blank sky around the reflection nebulae, which are typically less than 40" in diameter. Small residual effects were found in the polarized flux from the sky after the normal sky subtraction, but these could be removed by linear fits to the sky areas for each line (or column if appropriate) in the difference images (I_1-I_3 and I_2-I_4, see Eqs (1)).

Polarization Maps

During the one night (1991 Sep 12/13) available for these observations, we could complete the polarization maps in the V and I bands for four Herbig Ae/Be objects. This was sufficient to fill the hard disk of the data acquisition computer. Since we did not want to saturate the central objects, exposure times longer than 5 min could not be used. For one source, saturation was unavoidable even with 150 s exposure and this resulted in image smearing of a few columns for the rest of the night.

Polarization Filter

It should be mentioned that the experimental polarization filter unit built at Stockholm Observatory has only three remotely controlled position angles of the Polaroid, namely 0^0, 45^0, and 90^0. Since this would have complicated the reductions and given lower accuracy for the P_Y polarization vector component, we took the liberty of opening the module and disconnected the rubber belt of the rotation mechanism (which nobody should do without consulting the observatory staff). This enabled us to turn the Polaroid wheel manually to the necessary positions, including the fourth (135^0). To do this we had to remove the polarization module by sliding it out from its slot between the exposures, every five minutes or so. Disregarding the inconvenience, and a small loss of time, the observations went well. A message has been sent, however, to Saltsjöbaden, asking them to provide the fourth position angle to the remotely (from the control room) operated system, if possible.

Instrumental Polarization

Since no mechanical device can be perfect, there are some calibrations to be made. Basically we should take into account the instrumental polarization, the zero-point correction of the position angle, and the polarizer efficiency. Instrumental polarization produced by the telescope has been found to be very small from the measurements made with the UBVRI Photopolarimeter. When checking the zero-point of position angle, we found after some strange looking polarization maps that the sense of rotation of the Polaroid is actually opposite to what is assumed by Eqs. (1). The following transformation brought the observed position angles Θ_0 to the standard Equatorial system:

$$\Theta = 84.0 - \Theta_0. \qquad (3)$$

Due to the limited amount of observing time, and not quite photometric night (occasionally small strips of thin cirrus), there was no opportunity to check for the polarizer efficiency explicitly. The technique of taking exposures through a polarizer at different orientations is quite vulnerable to changes in the atmospheric transparency. Hence, we took always eight exposures to obtain two independent polarization measurements for each filter passband and object. Also, since we had measured the polarizations of the central sources accurately by the UBVRI Polarimeter with a 7" diaphragm on the two previous nights, we could use these observations as calibration sources for the CCD polarimetry, with most satisfactory results.

Polarization Maps with Sub-Arcsecond Resolution

As an example, we give some results for the double Herbig emission source V376 & V633 Cas. See back page. The two sources are 37" apart on the sky and surrounded by dense circumstellar cloud, producing an estimated extinction A_V of about 5 and 7 mag for the central objects, having apparent visual magnitudes of about 16 and 15, respectively. The complex is part of a larger dark cloud with a total estimated mass of 400-800 Solar masses and a diameter of 2-3 pc at a distance of 0.6-1 kpc.

Our program needed a good seeing and we got it: the values measured from single exposures ranged from 0".4 to 0".6. Fig. 1 gives an intensity map of V633 Cas and the associated nebula. The broader profile of the central source (0".8 FWHM) indicates that the object is not seen as a point-like star. The polarization map in Fig. 2 shows a beautiful pattern of centrosymmetrically oriented polarization bars. The degree of polarization increases towards S-E with the decreasing optical thickness of the cloud.

The companion star V376 Cas is shown in an enlarged scale in Fig. 3. The central peak has two jet-like extensions into approximately opposite directions. The „jets" may in fact be two cones of light which escape from the central source to directions roughly perpendicular to an optically thick equatorial disk obscuring most of the direct light. The polarization map in Fig. 4 supports this interpretation, since the extensions are strongly polarized in the direction perpendicular to the line to the central star. This shows that the light we observe from the cones originates from the central object and is scattered towards us by the dust particles in the circumstellar medium. In the plane of the disk, the polarization is smaller, due to multiple scattering.

Superb Seeing

To illustrate the superb seeing conditions, we give in Fig. 5 an image of a field star from the same frame as Fig. 3, artificially doubled and shifted 1".0 in order to produce a binary image. Comparison of the surface plots in Fig. 6 shows the broader profile of V376 Cas with the jet-like extensions.

The first results on imaging polarimetry at the NOT are really encouraging, even spectacular. While many of the interesting objects may be less polarized than those shown here, there are all reasons to expect that more applications of the technique will be found at the NOT.

Wavelength Dependent Polarization in Blazars

Leena Valtaoja

Quasars and Models

Quasars were discovered nearly 30 years ago. What do we know about these objects today? Not much more than we did a few years after their discovery: The basic energy-producing mechanism (gas falling into the central black hole) was proposed three years later. The so-called unified schemes, which claim that the differences in the observed properties of quasars are results of different viewing angles, were also introduced soon...

Of course, the models have developed, but there still exist many uncertainties, even in the basics. For instance, are the different-looking quasars physically different or not...

Magnetic Fields and Polarization

Because of the importance of the magnetic fields in quasar models, polarization measurements, which give information about the geometry of the magnetic field in the source, are essential. Polarization is just about the only way to get direct knowledge about the structure of an unresolved object. This is why it has become a popular tool in many kinds of quasar studies.

Dedicated Work

Polarization observations are made together with the flux measurements over a wide wavelength region from X-rays to radio. Huge efforts are devoted to simultaneous measurements to get as complete spectra as possible. Spectroscopic observations are abundant. All together, these investigations are going to make quasar models more and more reliable.

Wavelength Dependent Polarization in Blazars

The quasar research group in Tuorla Observatory (Turku, Finland) investigates quasars theoretically and observationally. Observations include both radio and optical monitoring.

From 1984, we (L. Valtaoja, E. Valtaoja, C.-I. Björnsson, N. Shakhovskoi and Yu. Efimov) have made simulta-

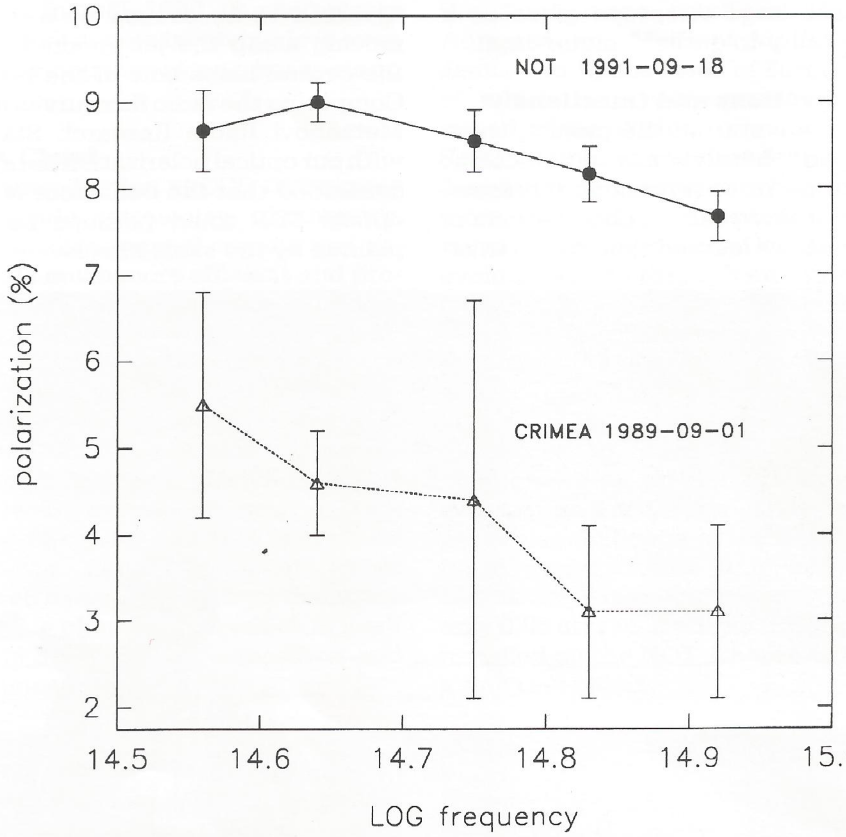


Figure 1: To investigate the behaviour of the frequency dependent polarization (FDP) in a faint source like 0109+224, we need to have the small error bars provided by the NOT. This particular blazar is extremely interesting. For example, during our last observing run at the NOT, its polarization decreased 50% in one night, just to return back to the previous level the following night. The character of the FDP also changed, but the flux and the position angle stayed almost constant. Let's see how this fits to anything.

Malcolm Beats the Record

During a recent run with the NOT, ESA astronomer Malcolm Fridlund hit it off. Inspecting one of his CCD frames, he felt like looking twice. Or even more times... These images did appear very small indeed. He had a close look.

- I have always been deeply impressed by the image quality of the NOT, says Malcolm, but this one was a real show. I had a careful look at my CCD frame. The Full Width at Half Maximum intensity of the stellar images was 0.2 arc seconds. It was really exciting. So exciting that I forgot to save the frame. I have difficulties forgiving myself for that. But then, sometimes you get shocked, even at the NOT.

We do forgive Malcolm, even though it takes an effort. But we do not forget his record.

neous UBVRI photopolarimetric observations of blazars (which are the most active quasars). Our investigations have been made in cooperation with the Crimean Astrophysical Observatory using their 1.25-meter telescope.

Use of the NOT a Great Improvement

Because many of the interesting blazars are very weak, a larger telescope improves the quality of the data. See figure 1. At the same time, it increases the number of objects which can be observed. Thus, our project benefited considerably from the availability of the NOT, which is equipped with a similar photopolarimeter as the 1.25-meter telescope in Crimea.

Photopolarimeter

Vilppu Piirola's photopolarimeter is one of the three devices in the world which allows the measurements to be done simultaneously in different colours. Simultaneity is extremely important when observing blazars where both the flux and the polarization may change very rapidly. The combination of this instrument with a quite large telescope gives us a possibility to gather unique data.

Observations and Questions

When we started the project, there existed hardly any multicolour polarimetric observations of blazars. After a few years of observations in Crimea, we learned that the polarization in these objects often shows various kinds of wavelength dependence, with the polarization decreasing or increasing towards the red. In addition, the character of the frequency dependence (FDP) of an object could change in different time scales. Wavelength dependent position angles were also observed, but not as often.

Because of the rapid variability and relatively high degree of polarization, it is assumed that the polarization in blazars is due to the synchrotron radiation, which in itself produces frequency independent polarization. Dilution by the surrounding galaxy can explain part of the decrease of the polarization to the red, but it cannot explain the other kinds of observed FDP and the frequency dependence of the position angle. So, what is the cause the FDP and the seemingly unsystematic and uncorrelated changes in it, in the flux and in the position angle?

Optical Polarization and Radio Flux

The flux variations in radio bands are assumed to be caused by a shock moving along the jet injected from the central black hole of the blazar. Comparing the radio flux curves from Metsähovi Radio Research Station with our optical polarization data, we concluded that the behaviour of the optical FDP could perhaps be explained by the same shocks. From the data already obtained with the NOT, it becomes obvious that the same shock might also be the origin of the radio polarization. To plan the optical observation programs for developing and testing our ideas about the shock model it is important to know the radio behaviour of an object. For this purpose, we have used the Metsähovi radio data base.

Monitoring Polarization at the NOT

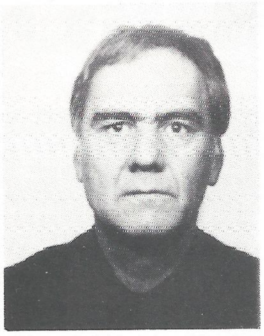
At the moment, we are trying to cover the initial growth phase of the radio outbursts in a few objects. This is achieved through photopolarimetric monitoring once a month at the NOT from September 1991 to February 1992. The radio observations of these objects are done monthly or semimonthly at Metsähovi and SEST. Margo and Hugh Aller observe the radio polarization of the objects in Michigan.

For most of the sources, once a month is a good enough time resolution because the growth of the radio flare lasts typically a few months. This kind of optical monitoring is really essential to our model. It became possible when Hannu Karttunen joined our project and promised to take care of the monthly one night observations.

So what is the probability that a given night in each month during October - February is clear? Peukut pystyyn!

Figure 2: Although the author's main interest lies in Blazars, she also frequently studies the Sun.

Planetary Science with the NOT



Kaare Aksnes

Introduction
Judging from the allocation of NOT observing time to solar system studies so far, this very broad field does not have many proponents in the Nordic countries. Yet planetary objects are today being actively observed with medium to large size telescopes at Kitt Peak, Lowell, Mt. Palomar, Mauna Kea and many other places. The purpose of this article is to focus on some areas in planetary science in which the NOT can make valuable contributions.

Scientific Justification
There is perhaps a tendency among astrophysicists to regard ground-based observations in the solar system to be of limited value in comparison with observations from space. Unlike stellar, galactic or extragalactic objects, objects in the solar system are all accessible to in situ measurements from spaceprobes. So, why bother at all making observations in the solar system with the inferior resolution and the atmospheric distortions that plague observations from the ground? Two obvious answers are the far lower cost and much longer time basis of Earth-based observations. Besides, many astrometric, photometric, and spectroscopic investigations do not require high spatial resolution.

Ground-Based versus Space
It is true that the most exciting new discoveries in the solar system during the last 30 years have been made with the aid of instrumented satellites and spaceprobes, primarily through close-up imaging. This has tended to overshadow many important, albeit less spectacular discoveries made from the ground. Ground-based observations have greatly added to the number of known small bodies in the solar system - rings, satellites, comets, and asteroids - and to our understanding of their dynamics and physics.

Uranian rings
Despite the superior ring resolution achieved with Voyager 2's TV cameras, by far the most precise information about the geometry and dynamics of the Uranian rings has come from ring occultations of stars observed from the ground.

Occultations and Moons
Photometric and spectroscopic observations of star occultations by planets, satellites, asteroids, and comets, and of mutual events between planets and satellites, have provided important data on the positions, sizes, and atmospheres of those objects. Remarkable new insight in the Pluto system has come from the photographic detection of Pluto's moon Charon in 1978 and subsequent speckle interferometry and photometric observations of Charon and the Pluto-Charon mutual events in 1985-1990. IR photometry of mutual events involving Io is even used to map the volcanic hot spots on Io.

Oort Cloud
The introduction of CCD techniques has made astrometry, photometry, and spectroscopy of comets and asteroids much more efficient and precise and has lowered the detection threshold considerably. Much current effort is aimed at tracing the short-period comets back to an original source which many believe is an inner Oort cloud of comets, the so-called Kuiper belt, stretching about 2x104 AU beyond the orbit of Neptune. The main difficulty is estimating the non-gravitational forces caused by outgassing from cometary nuclei, a phenomenon which in itself sheds light on the composition and lifetimes of comets.

Outgassing
Recent detection of outgassing from at least one asteroid, Chiron, is in line with an old idea that some asteroids are extinct comets. Ground-based observations in the last 15 years of positions, rotations, and spectral reflectance of asteroids have greatly increased our knowledge about the dynamical, physical, and chemical properties of these objects.

With no claim to being exhaustive, I mention below some specific solar system targets suited for observations with the NOT.

Comets and Asteroids
Until recently, observations of comets have been limited to short segments around the perihelia of their orbits. The use of very fast CCD cameras on large telescopes now makes comets observable out to at least 15 AU. From such extended observations the orbits can be improved, and needed insight be gained about how the outgassing and the non-gravitational forces vary with distance. The search for cometary activity in near-earth asteroids is also of much current interest. These are all examples of on-going or scheduled NOT applications.

Satellites
Thanks to superb seeing and excellent optical and mechanical quality, NOT ought to be capable of detecting the faint inner satellites Thebe, Adrastea, and Metis of Jupiter and Janus and Epimetheus of Saturn, all of which have very poorly determined orbits. With the closing up of Saturn's rings in the next few years, Janus and Epimetheus are becoming more accessible. These satellites move in almost identical orbits, but avoid collisions through an intricate interplay in so-called horseshoe orbits, a limiting case in the three-body problem. In 1995 mutual occultations and eclipses among Saturn's satellites should be observed photometrically to yield very precise positional data on the satellites in support of the Cassini mission. A particular challenge to the NOT is to try to resolve Charon from Pluto, the two having a maximum separation of only 0.85 arcsec. If adaptive optics is installed on the NOT, Charon will be a fine test object.

Star Occultations by Planets, Satellites or Rings
Uranus, Neptune, and Pluto are sufficiently faint that occultations of faint stars by these planets, their rings, or satellites are observable with modern high-speed photometers on fairly large telescopes. Such observations are the best means for mapping rings and ring arcs whose subtle dynamics is as yet far from fully understood.

Lightcurves of occultations by the planets will yield information about the density of the upper atmospheres and the sizes and oblatenesses of the planets. According to a recent search, the Uranus and Neptune systems may occult respectively 76 stars and 18 stars brighter than mag 14 between 1991 and 2000. In the same interval, there are 32 stars brighter than mag 16 coming close enough to Pluto, and 28 to Charon, to possibly become occulted.

Activities at the Nordic Telescope Group

Development activities for 1992 have been discussed by the Scientific Technical Committee and Council. On this basis, detailed plans for the work of the Nordic Telescope Group have been set up.

Guide star acquisition often takes valuable telescope time. To increase efficiency, it is planned to connect a CD-ROM to the telescope control computer. The control system will, optionally, automatically select the best guide star and direct the guide star viewing probe to the star.

The questionnaire survey, described elsewhere in this issue of NOT NEWS, shows that many astronomers would welcome image sharpening. Thus, construction of a first version adaptive optics system will be initiated. Plans are explained in detail under separate heading.

Several groups plan to use large CCDs. For many applications it is attractive to apply such detectors with a wide-field focal reducer. Also a wide-field filter mechanism is needed. It is therefore planned to start development of a wide-field focal reducer in 1992.

Finally, a project improving interface to instrumentation, including a fiber coupling unit, is planned for 1992.

Image Sharpening on the NOT

In the sixties, many large telescopes were designed. The seventies saw a revolutionary development of detector technology. In the eighties, a new generation of powerful telescopes emerged. During these three decades, astronomers got used to an observable Universe of continuously increasing dimensions.

Already in the eighties, much attention was focused on image quality of telescopes. One result was the appearance of practical adaptive optical systems. No doubt, in the nineties, adaptive systems will be given high attention. Such techniques will increase the effective size of existing and future telescopes, allowing new advance in spatial resolution.

Frame Selection

Presently, two different approaches are applied to improve image quality. These are frame selection and adaptive optics. With the frame selection technique, only the best frames from solid state detectors are used. Most of the photons are, in practice, discarded. This technique can be further improved by removal of image motion from individual images. Best results are obtained with a telescope diameter of 0.6-1 m. This is the dimension of the Swedish Solar telescope on La Palma, successfully applying the frame selection technique. For larger telescopes, frame selection is less attractive, since more light must be discarded to achieve a significant improvement of image quality.

Adaptive Optics

Another approach for image improvement involves wavefront compensation for atmospheric effects. Traditionally, this is done with a segmented or deformable auxiliary mirror. The closed loop system uses a wavefront sensor, normally of Shack-Hartmann type.

Recently, an alternative approach has been suggested and tested. The principle is to record wavefront and image simultaneously at high frequency. Afterwards, in postprocessing, images are added and corrected for aberrations measured by the wavefront sensor. When systems get further developed, it may be possible to correct images on-line.

Artificial Stars

A serious drawback of present adaptive optics is the need for a reference star within the isoplanatic patch. If such a reference star cannot be found, the target object itself must be used for reference. However, due to lack of photons, full correction will normally not be possible.

To overcome the problem defined by scarcity of bright reference stars within the isoplanatic patch, much effort is, at various institutes, devoted to exploitation of artificial star technology. One attractive technique is to apply fluorescence of sodium molecules in the mesosphere at a height of 90 km. The expectations of future developments of such methods are considerable.

NOT Development Activities

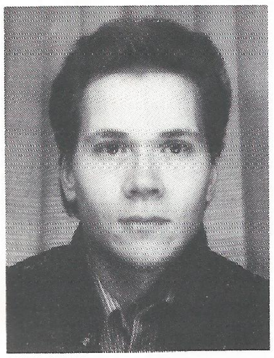
For the NOT, a stepwise plan for adaptive optics development has been defined. The first phase has been endorsed by the Scientific Technical Committee.

A „software“ adaptive optics system, as described above, will be developed. The system will allow simultaneous recording of image and wavefront, the latter recorded by a Shack-Hartmann wavefront sensor. Optical, mechanical and electronics components will be built by the Nordic Telescope Group. Guang-ming Dai, Ph. D. student at the Lund Observatory, will be responsible for the software part. Development of the system will start in early 1992. We hope that the system will be useful for science programmes already at an early phase of the project.

Invitation

Nordic groups with interest in this type of development are invited to contact the Nordic Telescope Group. Contributions in various disciplines and specialties are welcome.

CCD Imaging of Active Galaxies at the NOT



Jari Kotilainen
Institute of Astronomy, Madingley Road, Cambridge CB3 0HA, England

The Privilege of Using the NOT
I have had the privilege of being one of the most frequent visiting observers at the NOT. During my three observing runs (July 1990, November 1990 and July 1991), I have used a variety of instrumentation. Observations have been made with the UBVRI photopolarimeter, with the SIRS infrared spectrometer and with the CCD camera equipped with narrow band filters and with polarizer. The common thread of all the runs has been broadband CCD imaging of a sample of active galactic nuclei (AGN) in B, V, R and I filters. Similar observations of the Southern sources in the sample have been obtained at the Cerro Tololo Interamerican Observatory (CTIO) in Chile. The imaging of the sample is now complete.

Trying to Resolve a Controversy
The main aim of the observations described is to throw light on the long debated but still unresolved controversy on the relative strengths of the non-stellar and stellar components within the nucleus of active galaxies. We have previously analyzed and discussed the results of near-infrared imaging in the J, H and K bands of the same sample (Kotilainen et al., Mon. Not. R. astr. Soc., in press). The technique used is to decompose the radial luminosity profiles into components representing a point source AGN, a bulge following de Vaucouler's $r^{1/4}$ law and an exponential disk. Following this decomposition, we try to derive the percentage contribution of each component to the integrated flux

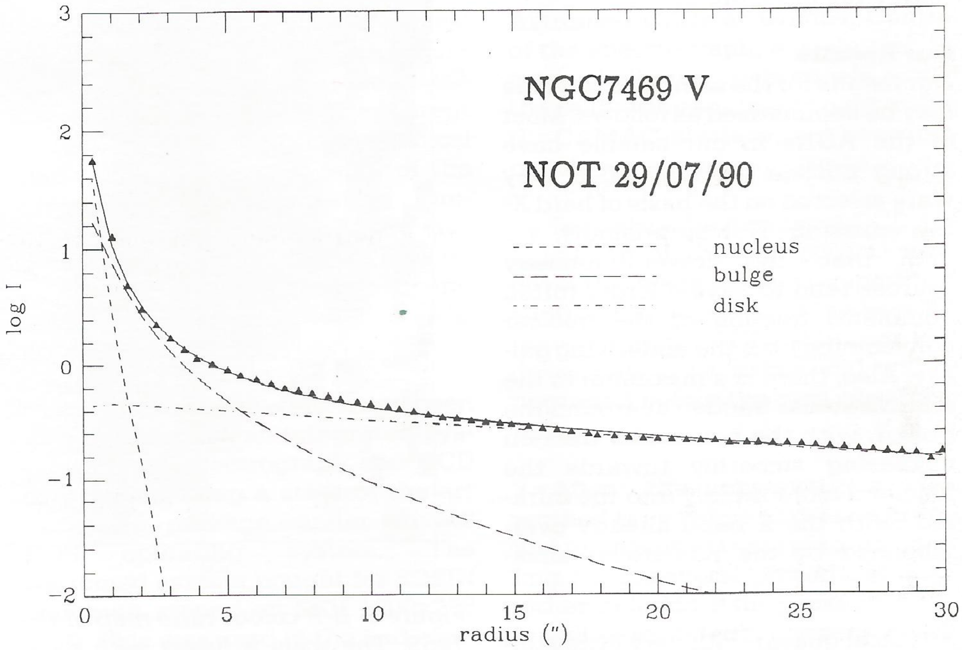


Figure 1. The radial luminosity profile of NGC 7469 in the V band. The short dashed line represents the active nucleus, the long dashed line the bulge, and the dot-dashed line the disk. I = relative intensity.

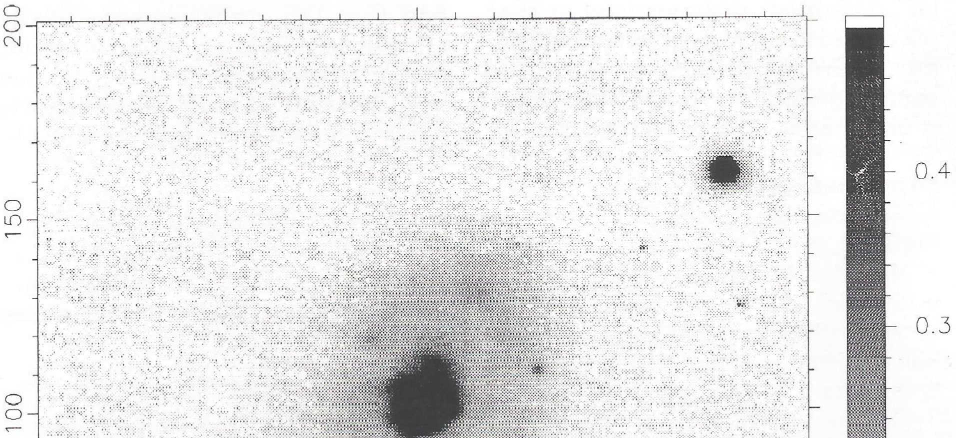


Figure 2. A direct CCD image of NGC 7469 in the B band. The field covers 60 arcsec x 60 arcsec. Pixel scale is 0.30 arcsec/px and seeing FWHM ~ 1.0 arcsec.

within a small aperture. Using essentially the same procedure, we have decomposed the nuclear components based on the optical CCD images obtained with the NOT and at CTIO. An example of the results of the profile decomposition in the V band is shown for the Seyfert galaxy NGC 7469 in Figure 1.

Our Results

Our results for the sample as a whole may be summarized as follows. Most of the AGNs in our sample have strong nuclear activity, since they were selected on the basis of hard X-ray emission. Not surprisingly, we find that the lower-luminosity sources tend to have a larger (often dominant) fraction of the nuclear light coming from the underlying galaxy. Also, there is a maximum in the relative stellar fraction at around the I band, with the non-stellar fraction increasing smoothly towards the blue and more rapidly into the infrared, with the K band already overwhelmed by the non-stellar emission.

A typical quasar with very little stellar contribution exhibits a minimum in the energy distribution at 1 μm, between the blue bump (from the accretion disc) and the near-infrared bump (from hot dust). Thus, the relative strength of any underlying stellar component is maximized at that wavelength. However, the absolute flux of the stellar component of our sample galaxies usually peaks in the H band, as in normal spiral galaxies.

Some Data from the NOT

As an example of the NOT data, in Figure 2, we show the B band image of NGC 7469. The image covers the innermost 60 x 60 arcseconds (1 arcsec ~ 500 pc, with H_0 = 50 km s^{-1} kpc^{-1}), with a pixel scale of 0.30 arcsec/px. The seeing was 1.0 arcsec FWHM at the time of observations. Besides the bright nucleus, we see a ring of star-forming regions around it.

In Figure 3, we show the B-R colour ratio map of the innermost 20 x 20 arcseconds. The map of NGC 7469 reveals an arclike region of blue material to the SW of the nucleus, possibly showing a region of intense star formation, or the effect of differential reddening, embedded in the redder underlying stellar population.

These data are being combined with the IR data to study the stellar populations in the host galaxies of Seyfert 1 nuclei. Preliminarily, we find that the stellar colours in the nuclear region are generally redder than in normal spirals. Most galaxies have redder V-K and J-K and slightly bluer B-V colours towards the nucleus.

Stellar evolutionary models cannot account for these colours and gradients and additional contributions are needed from differential reddening, hot dust, an extremely red population and/or an extreme IMF must be responsible. In the future we also plan to consider the origin of the non-stellar continuum from UV to IR by combining the data with UV/optical spectra and IRAS measurements, and by fitting the continuum with non-thermal power law and thermal accretion disk and dust components.

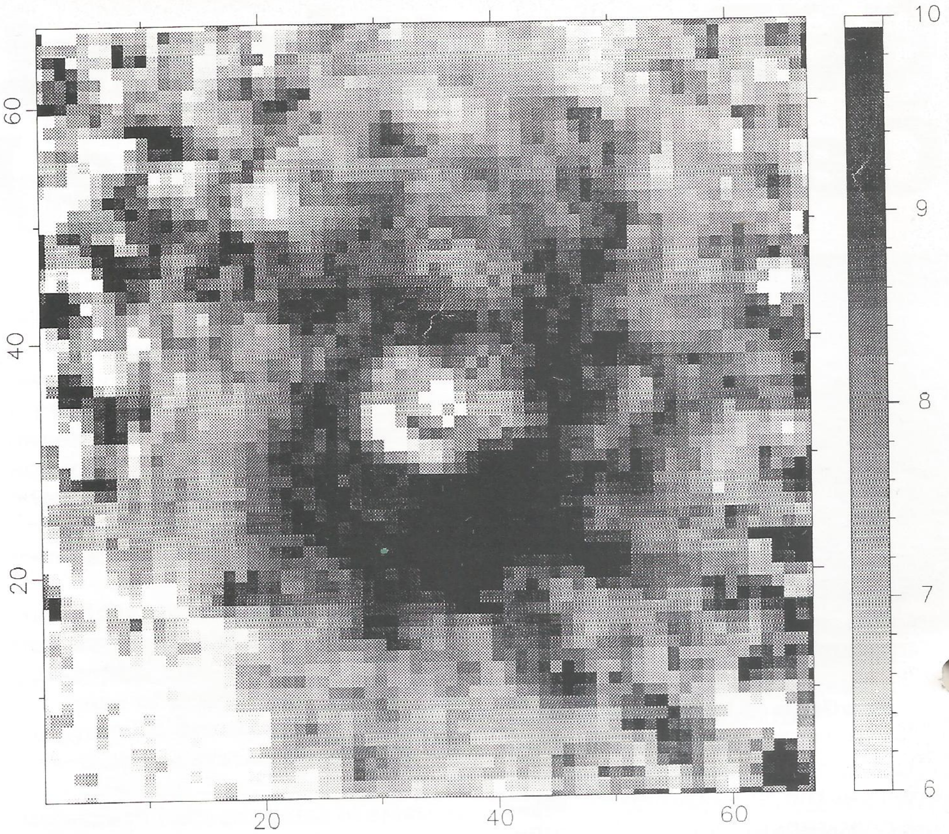


Figure 3. B-R colour ratio map of the innermost 20 arcsec x 20 arcsec of NGC 7469. The scale is linear with dark shade indicating bluer and light shade redder colours.

Accountancy News

According to decision of Council, NOT accountancy takes, from the first of January 1992, place at the Lund Observatory. Council finds close ties to the directorate an attractive feature.

In consequence, NOT accountancy now leaves the experienced and firm hands of Marianne Nilsson at the Swedish Royal Academy of Science. Some of us feel slightly nervous at this notion. However, other experienced hands are taking over this important task. In charge are now Eva Jurlander and Gun Wiesel. We offer our warmest thanks to Marianne and welcome Eva and Gun in their new responsibilities.

SOFIN Spectrograph

Ilkka Tuominen

Tight Installation Programme
The SOFIN high resolution spectrograph was installed and the first period of testing completed during May and June this year. The instrument constructors at the Crimean Astrophysical Observatory worked under extreme pressure during the last few weeks preceding delivery.

Exciting Transport
The transport and export arrangements themselves make an extraordinary story. The ship from Sevastopol never arrived at Santa Cruz de Tenerife, as contracted. Instead the boxes were transferred on the open sea to a rescue ship and arrived finally at Gran Canaria.

Software in a Rush
Partly for transport reasons, partly because the CCD system from Astromed Ltd, Cambridge, was delivered directly to La Palma, the final, complete, version of the software was not available before delivery. To solve the problem, Ilya Ilyin from Crimea was sent to La Palma in advance, at the end of April. He managed to get the development version of the software ready before the 1st of June, in spite of several extra problems, in addition to the late arrival of the spectrograph. These included delay in arrival of the computer and 25 m RISC cables which were retained in the Madrid airport, the wrong CCD Dewar front panel, which had to be changed etc. The development version of the software was adequate for the 10 nights observing time granted.

Installation Crew
The installation crew arrived at La Palma on 25 May, including V. Pronik (optics), A. Lagutin (mechanical parts), A. Buckach (electronics), and from Helsinki N. Piskunov and the author. There were no apparent problems with optics, mechanical parts or electronics, in spite of the quite risky transportation (unplanned). At present there are two cameras: for the 1st camera f = 2 m, for the 2nd f = 1 m. The fastest camera will be installed in 1992.

Integrated System
Concerning the software, it had been decided to make an integrated system for the spectrograph and CCD control, including a state of the art observing package, under an MS DOS operating system. The Astromed system bought for SOFIN was built around an EEV 1200x298 CCD. This was used in the 2nd camera. In the 1st camera we were happy to be allowed to use the Uppsala 1200x770 CCD.

Present Software Situation
Regarding software, the situation is, briefly, as follows:

1. The definition of programming tools and design of the software were started early, using the experience we gained with the two Astromed CCDs at Crimea. Control of the spectrograph, e.g. shutter, filters, echelle and prism angels, and of the calibration sources of light, using the CAMAC interface, had been fully developed already at Crimea.

2. To control the Astromed CCD, initialization of the electronics, readout of the image, on-line temperature control, the selection of the best parameters for the CCD calibration was developed at La Palma and will be upgraded before the next observing run.

3. After the observations, Ilya worked at La Palma to the end of July and fully revised the rapid data handling logic. Several procedures were either included in the package in July or will be included in January/February, such as line identification, parametrization of comparison spectra, pre-observation facilities (e.g. for the selection of spectral regions from the focal plane map of the echelle spectrum), local data base etc.

Performance
Concerning the performance of the spectrograph, full exploitation of its properties can only be achieved with the advanced version of the soft-

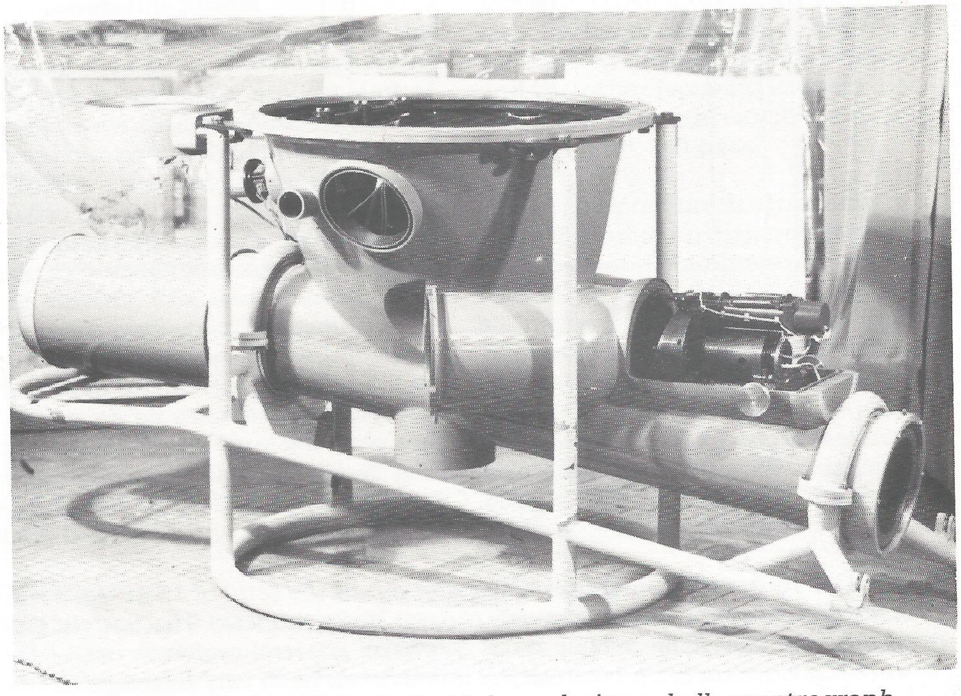


Figure 1: General view of the Sofin high resolution echelle spectrograph.

ware. These properties include calibration of the temperature dependent parameters of the CCD, slit calibration and mapping of the camera field effects, vignetting and aberration curve, detailed measurements of the resolution through use of a narrow line lamp. During the installation period we solved many more immediate problems and made preliminary estimates of the performance.

Resolution and Exposure Times
Two-pixel resolution is attainable, but probably not in the whole 1200 pixel range. A two-pixel resolution corresponds to the theoretical resolutions of the cameras, which are 170 000 for the 1st camera and 85 000 for the 2nd. Our observations were made just before the re-aluminization of the primary mirror of the telescope. Making a correction of a factor of two to the exposure time to compensate for our use of the old mirror coating, some preliminary estimates may be made for the relation between signal-to-noise ratio, S/N, and exposure time.

We find that for the 2nd camera and optimal resolution, a one hour exposure of a star with V = 7 gives S/N = 300 around lambda 6000. For the 1st camera, at optimal resolution, a two hour exposure gives the same S/N. If S/N = 100 is adequate, the exposure times given can be divided by nine.

Vignetting Small
The effect of vignetting on the efficiency of the 1st camera is very small. Hence the useful spectral region is defined and limited by the EEV CCD sensitivity. Around the Ca H and K lines the quantum efficiency is about 20%. At the red end we have observed as far as the helium line at lambda 10830 although the efficiency is already down to only a few percent there. The vignetting of the 2nd camera is larger. To find the most useful wavelength region, it is necessary to consult the focal plane map.

First Conclusions
In conclusion, we are trying to develop a highly sophisticated system. At the present time, observers who have little experience with the instrument cannot use it without help from our group members. The data we collected in June are useful partially for testing purposes but partially also for scientific investigations. We are presently analyzing it using another state of the art reduction package in Helsinki.

Science Programmes
The main observing programmes for which we are planning to use the instrument include surface mapping of stellar active regions and their associated magnetic fields, using inversion methods, and related chromospheric and coronal activity. Our recent measurements of the magnetic field in cool local starspots of a BY Dra star, based on NSO data, prove that the methods work. This magnetic map was derived using radiative transfer solutions, including magnetic field, of the local synthetic spectrum on the stellar surface from a grid of model atmospheres, constituting about 30 absorption lines with different Lande factors, and an inverse solution from the sequence of observed spectra. The inversion needed about 20 cpu hours with the Finnish Cray XMP.

Spectral Resolution - Time Resolution
The high resolution camera was designed to give optimal resolution for the purposes described. In order to make full use of the high spectral resolution, a correspondingly high time resolution over the rotational periods is needed. This is because the resolution of the resulting images is equally dependent on the spectral and the time resolution. For this reason relatively long observing runs and coordination of different observing programmes is needed. We hope that the NOT with SOFIN will provide us with the opportunity to achieve our goals.

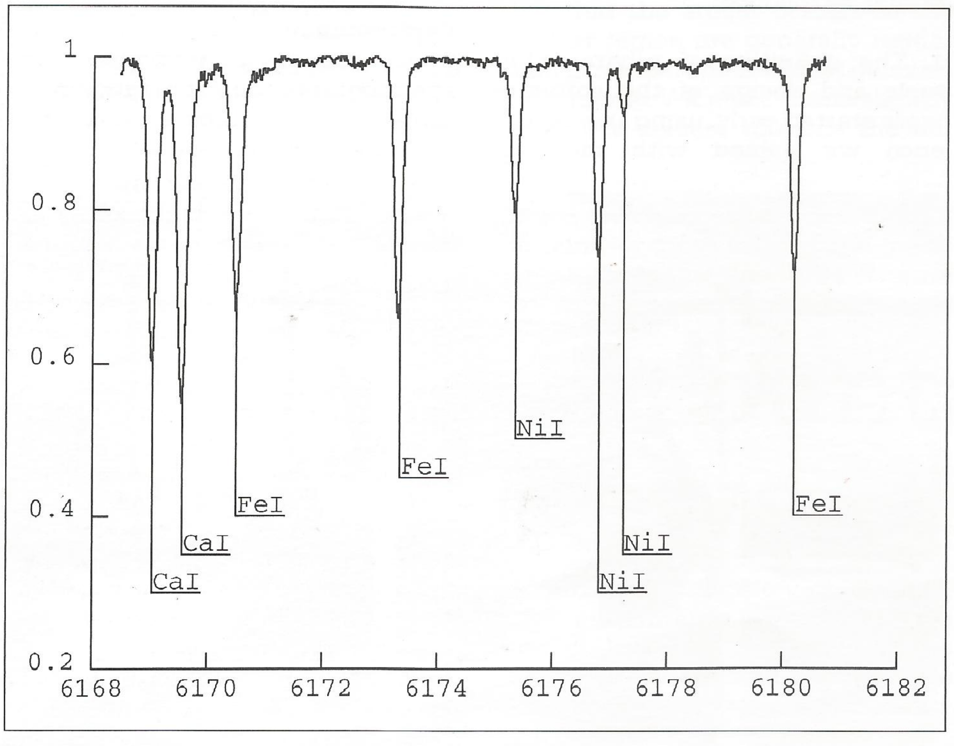


Figure 2: A 10 A strip taken from one order out of the total of 18 orders in an echelle spectrogram obtained with the 1st Sofin camera. The star is Ksii Bootes A (G8V, V=4.5). S/N is about 300. The spectral region is useful for magnetic surface imaging because the lines shown have very different Lande factors.

Funding of Adaptive Optics

Realizing the high potential of adaptive optics, Anders Reiz of the Copenhagen Observatory has applied for funds for an image sharpening device. In response, the Bodil Pedersen Foundation has generously granted DKK 409 500 for such equipment to be used with the NOT. We highly appreciate this valuable contribution to Nordic astronomy. Development work has started.

Anlaug brings her Moons to the Mountain

Anlaug Kaas

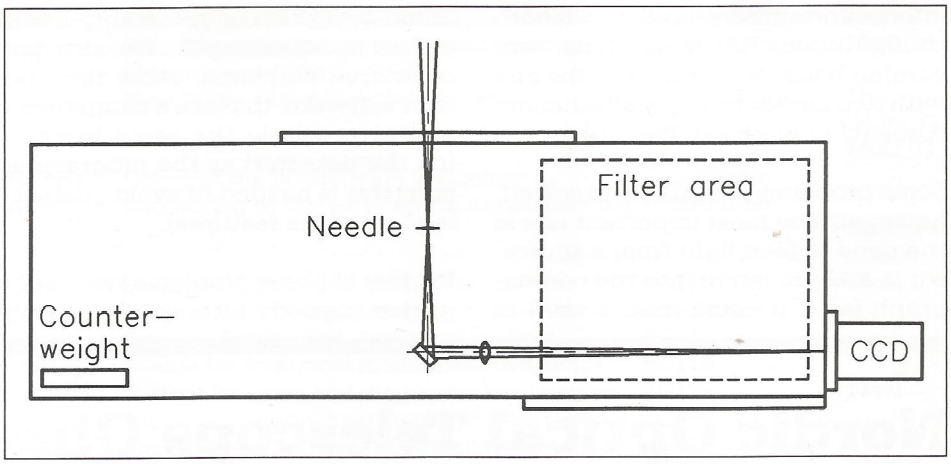
Anlaug Djupvik is well known to NOT NEWS readers. Following her participation in the 1990 Nordic Research Course on La Palma, she was convinced to share her impressions with our readers. She finished her article (in NOT NEWS No. 3) expressing the hope to be able and permitted to come back to Roque de los Muchachos as a „grown-up" astronomer. And permitted she is. Very much so.

Anlaug specializes in planetary science. Her favourite subject deals with the moons of Jupiter and Saturn. She seems confident that they can be better observed with the NOT than with other telescopes earlier at her disposal. We do not dispute this.

Except for her deep interest in planetary science in itself, Anlaug has been rather active in some adhering fields. Her passion for science history is well known as is her work with the nomenclature concerned with planetary surfaces.

Scientists are often accused of aloofness and even downright asocial behaviour. Such accusations may not always be totally unfair with all astronomers. However, we bet that staff and visitors around Anlaug will have a hard time to stick to their eremitic behaviour. She even managed to get Oslo staff sociable, introducing the Christmas Party tradition to frosty Norwegians.

Fanatic to her moons, it seems only quite correct that Anlaug starts her time at La Palma in the second part of her honeymoon. Anlaug and Steinar Kaas are both warmly welcome to La Palma. By the way, what about their cat?



A Coronagraph for the NOT

Bengt Gustafsson

Fine Images - Faint Details
The excellent seeing on La Palma, well matched by the optical quality of the NOT, makes it possible to study fine and faint details very close to bright stars or galactic nuclei. Still, in order to prevent light from the bright object from swamping the faint structures in its neighbourhood, due to scattering in the instrument and in the detector, one needs a mean to block out this light. Such a device, called a coronagraph, has been built at Uppsala Astronomical Observatory.

Circumstellar Shells
The specific scientific reason for this project was our interest in studying circumstellar shells around carbon stars in scattering atomic resonance lines such as the Na D lines and the K I 7699A line. Other groups at our institute, working on active galaxies and small bodies in the Solar system, also expressed interest in obtaining this device. The aim at using it at relatively high spectral resolution required a fairly extensive construction, able to house a high-resolution filter, such as the tunable universal filter constructed by Alan Title and collaborators at the Lockheed Inc., and presently in use at the Swedish Solar telescope on La Palma.

Coronagraph
The instrument was designed and built by two engineers, Björn Einarsson and Mats Thunman, as a project concluding their M. Sc. exam. The resulting system (cf fig.) consists of only four optical components: one blocking device, in practice shaped as a needle, which can be moved in the Cassegrain focal plane by a computer-controlled xy table, one lens which images the focal plane onto the detector with a magnification of about a factor of 2, the filter (e.g. the Lockheed filter, a Fabry-Perot etalon or just normal interference filters or even broad-band ones - a filter wheel is mounted close to the detector which may also be used for the order-sorting filters if a high-resolution filter is used), and the detector, in practice a CCD. An alternative setup can also be used with two lenses, one collimating the light after the needle and the other focusing it again after the filter, through which then only parallel light will pass.

These components are mounted in a fairly big and rigid construction of steel bars and aluminium, calculated to be rigid enough for the image not to move significantly even under relatively long exposures as a result of flexures. The instrument is designed for a maximum weight of the filter of about 20 kg and a maximum size of roughly 40 x 40 x 40 cm (if parallel light is required, the length must not exceed 20 cm).

First Tests and Results
The coronagraph was tested at short runs at the NOT, the first in June 1991, the second in August 1991. We used the Stockholm CCD, 4 Å broad

interference filters, and tried both configurations (the single lens, converging beam one as well as the one with two lenses and a parallel beam). It seems to work satisfactorily.

Some problems are still to be solved, however. The most important one is the need to feed light from a source, e.g. a sodium lamp, into the coronagraph (as if it came from a star) in order to calibrate the Fabry-Perot etalon in wavelength. We also encountered problems, using the present software, to place a comparison star at precisely the same location (on the detector) as the programme star (this is needed to avoid „detecting" spurious features).

In view of these problems we would advice anybody interested in using this equipment to contact us before planning observations.

The coronagraph is described in detail by Einarsson and Thunman in a report from the Institute of Technology, Uppsala University: UPTEC 91083E. The project was financed by Salén-stiftelsen.

Nordic Optical Telescope Observing Schedule

Starting date	Ending date	Principal investigator	Institute	Programme	Instrument(s)	Remarks
Oct 03	Oct 05	P. Lilje	NORDITA	Gravitational lensing by rich galaxy clusters	CCD Camera	MoQ 03
Oct 05	Oct 07	K. Mattila	Helsinki obs	Line and continuum polarization of M31	CCD Camera	
Oct 07	Oct 08	L. Valtaoja	Tuorla obs	Origin of the polarization variability	Polarimeter	
Oct 07	Oct 08	L. Valtaoja	Tuorla obs	Monitoring of the wavelength dependent pol.	Polarimeter	MoQ 07
Oct 08	Oct 13	Rodriquez Espinoza	IAC	Muestra completa de AGN	CCD Camera	
Oct 13	Oct 15	J. Hjorth	Aarhus obs	Superb seeing imaging of the core of M15	CCD Camera	MoQ 13
Oct 15	Oct 17	B.R. Pettersen	Oslo obs	NOT-IUE-ROSAT observations of flares	LDS	MoQ 16
Oct 17	Oct 22	A. Manchado	IAC	Espectroscopia de nebulosas planetarias	LDS	
Oct 22	Oct 30	L. Nordh	Stockh obs	Array imaging at 10 microm and 3.5 microm.	Special	MoQ 23
Oct 30	Nov 02	M. Vestergaard	Copenh obs	QSO emission line properties (continued)	LDS	MoQ 30
Nov 02	Nov 05	H. E. Jørgensen	Copenh obs	Spectroscopic observations of NGC 1275	LDS	
Nov 05	Nov 06	L. Valtaoja	Tuorla obs	Origin of the polarization variability	Polarimeter	
Nov 05	Nov 06	L. Valtaoja	Tuorla obs	Monitoring of the wavelength dependent pol.	Polarimeter	
Nov 06	Nov 08	E. Valtaoja	Tuorla obs	What is the parent population of BL Lac obj.	CCD Camera	MoQ 07
Nov 08	Nov 11	P.-I. Emanuelsen	NOT	High speed photometry of ZZ Ceti stars	Texas photom.	
Nov 11	Nov 13	B. Pagel	NORDITA	Multicolour surface photometry of HII gal.	CCD Camera	
Nov 13	Nov 15	C.-I. Lagerkvist	Upps obs	The opposition effect of dark asteroids	CCD Camera	MoQ 14
Nov 15	Nov 19	J.E. Beckman	IAC	Medio interestelar a 200 pc	QUBES	
Nov 19	Nov 26					Techn. time
Nov 26	Nov 29	M. Fridlund	ESTEC	ESA time	ESA PCD+CCD	MoQ 26
Nov 29	Nov 30	G. Gahm	Stockh obs	Photopolarimetry of pre-main-sequence disks	Polarimeter	
Nov 30	Dec 02	M. Fridlund	ESTEC	ESA time	CCD Camera	Even 01.00 LT
Nov 30	Dec 02	P. Hakala	Helsinki obs	Simultaneous multifrequency program	Polarimeter	LT 01.00 morn
Dec 02	Dec 03	G. Gahm	Stockh obs	Photopolarimetry of pre-main-sequence disks	Polarimeter	
Dec 03	Dec 04	M. Fridlund	ESTEC	ESA time	CCD Camera	Even 01.00 LT
Dec 03	Dec 04	P. Hakala	Helsinki obs	Simultaneous multifrequency program	Polarimeter	LT 01.00 morn
Dec 04	Dec 05	G. Gahm	Stockh obs	Photopolarimetry of pre-main-sequence disks	Polarimeter	MoQ 04
Dec 05	Dec 06	L. Valtaoja	Tuorla obs	Origin of the polarization variability	Polarimeter	
Dec 05	Dec 06	L. Valtaoja	Tuorla obs	Monitoring of the wavelength dependent pol.	Polarimeter	
Dec 06	Dec 11	H. Castaneda	IAC	Cumulos estelares en regiones HII	CCD Camera	
Dec 11	Dec 18			CCI time		
Dec 18	Dec 21					Techn. time
Dec 21	Dec 23	B.R. Pettersen	Oslo obs	Spectroscopic survey of late type M dwarfs	LDS	MoQ 21
Dec 23	Dec 25	F. Grundahl Jensen	NOT	Test of stellar evolution by CCD photometry	LDS	Shared 1/2,1/2
Dec 23	Dec 25	K. Aksnes	Oslo obs	CCD astrometry of comets	LDS	Shared 1/2,1/2
Dec 25	Dec 29	E. Laurikainen	Tuorla obs	Spectroscopy of interacting galaxies	LDS + CCD	MoQ 27
Dec 29	Jan 01	E. Laurikainen	Tuorla obs	Spectroscopy of GPS sources	LDS	
Jan 01	Jan 02	L. Valtaoja	Tuorla obs	Origin of the polarization variability	Polarimeter	
Jan 01	Jan 02	L. Valtaoja	Tuorla obs	Monitoring of the wavelength dependent pol.	Polarimeter	MoQ 01
Jan 02	Jan 05	Martinez Gonzalez	IAC	Identificacion de radio galaxias	CCD	
Jan 05	Jan 09	I. Perez Fournon	IAC	Cumulos de galaxias	LDS + CCD	
Jan 09	Jan 12	K. Nilsson	Tuorla obs	Microvariability in blazars	Polarimeter	MoQ 09
Jan 12	Jan 17	S. Frandsen	Aarhus obs	Detection of stellar oscillations by a network	CCD Camera	MoQ 16
Jan 17	Jan 22					Techn. time

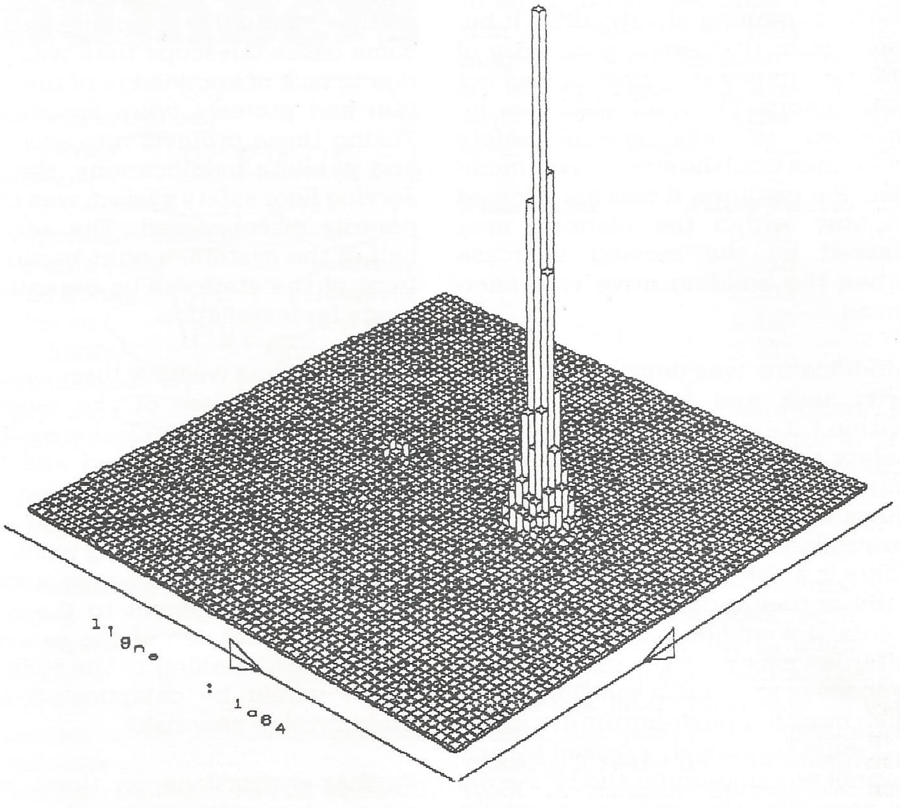
Jan 22	Jan 26	J.-E. Solheim	Tromsø obs	Investigation of g-mode pulstions of two	Texas photom.	MoQ 22
Jan 26	Jan 30	R. Stabell	Oslo obs	Search for gravitationally lensed quasars	LDS + CCD	MoQ 29
Jan 30	Feb 02	Rodriquez Espinoza	IAC	Muestra completa de AGN	CCD Camera	
Feb 02	Feb 04	P. B. Lilje	NORDITA	New limits to the Hubble constant	CCD Camera	1h Feige 34 for Theijl MoQ 03
Feb 04	Feb 05	L. Valtaoja	Tuorla obs	Origin of the polarization variability	Polarimeter	
Feb 04	Feb 05	L. Valtaoja	Tuorla obs	Monitoring of the wavelength dependent pol.	Polarimeter	
Feb 05	Feb 17					Techn. time
Feb 17	Feb 26	I. Tuominen	Helsinki obs	Surface imaging and radial velocity	SOFIN	MoQ 17
Feb 17	Feb 26	I. Tuominen	Helsinki obs	Magnetic and binary imaging of RS CVn	SOFIN	
Feb 17	Feb 26	I. Tuominen	Helsinki obs	Surface distribution, temperature field	SOFIN	
Feb 17	Feb 26	I. Tuominen	Helsinki obs	Search for rotational modulation in spectra	SOFIN	
Feb 17	Feb 26	I. Tuominen	Helsinki obs	Surface imaging and magn. surface imaging	SOFIN	MoQ 24
Feb 26	Feb 29	A. Ardeberg	Lund obs	High-resolution spectroscopy of interstellar	SOFIN	
Feb 29	Mar 02	B. Gustafsson	Upps obs	Spectroscopic studies of circumstellar	SOFIN	
Mar 02	Mar 05	B. Gustafsson	Upps obs	An exploratory study on galaxies	CCD Camera	MoQ 02
Mar 05	Mar 08	K. Aksnes	Oslo obs	CCD astrometry of comets	LDS + CCD	Shared 1/3
Mar 05	Mar 08	F. Grundahl Jensen	NOT	Test of stellar evolution theory by CCD	LDS + CCD	Shared 2/3
Mar 08	Mar 11	T. Oja	Kvistab obs	UBVRI photometry at the NGP	Polarim. + CCD	Shared 1/2,1/2
Mar 08	Mar 11	Staff			Polarim. + CCD	MoQ 10
Mar 11	Mar 20					Techn. time
Mar 20	Mar 29	A. Ardeberg	Lund obs	Commissioning of uvbyHß photometer	uvbyHß photom.	MoQ 27
Mar 29	Apr 03	B. Thomsen	Aarhus obs	Population gradients in elliptical galaxies	LDS + CCD	2 h exp Akujor

Observations at 10 µm using a 64x64 Array Camera

G. Olofsson and P-O. Lagage

Diffraction Limit Reached
Image quality has been the main goal for the NOT project and it may be of interest that the diffraction limit has now been reached - not by means of active or adaptive optics, but by turning to a long wavelength.

IR Array Detectors
As a follow-up of the array detector development for ISO, a series of arrays optimized for ground-based work was produced at LIR, Grenoble, and put into operation at the Service d'Astrophysique, CEA (Saclay). These Si:Ga arrays are 4 times larger than the ISO arrays and to handle the enormous thermal background photon flux, the individual pixel has a large well capacitance (~10^{7} e-). Still, using a broad-band filter at 10 µm requires a read-out cycle of less than 10 ms. The present system provides a read-out every 7 ms and the accumulated charge is measured with an accuracy of 1000:1 for each frame. This means that the device is almost (within a factor 2-3) photon noise limited.



This image of µ Ceph at 10 µm demonstrates the image quality obtained with the IR camera on the NOT. The pixel size is 0.55 arcsec and no image processing has been applied.

Mapping
Even though the single pixel provided by a good bolometer is a magnitude more sensitive, the advantage of an array is obvious when it comes to mapping. In particular, the array camera is useful in resolving small spatial structures. The same difficulties apply to an array detector as to a bolometer when it comes to cancelling the huge background emission from the sky and the telescope (typically 1010 photons/px sec).

Focal Plane Chopper
Usually, an undersized, wobbling secondary mirror is used in combination with frequent telescope beam-shifts for cancelling the background. As NOT is not equipped with an IR top unit, a focal plane chopper has been constructed at the Stockholm Observatory which optically simulates a wobbling primary mirror.

Two Observing Runs
So far we have used the system during two observing runs with the NOT. In February this year, we measured (much to our surprise) a system emissivity of 100% - but after looking at the telescope we were less surprised. The combination of high emissivity (which implied a too low bias voltage) and a poor transmission was quite harmful and only a few bright sources could be observed. During our latest run (8 nights - quite generous!), the weather was terrible, but the two-three hours of open dome were still useful. We could measure the emissivity of the system (sky + telescope + chopper module + scattered radiation) and we got 50%. As a comparison, using the same camera at the CFHT (Hawaii) equipped with an IR top unit, 30% emissivity was measured.

Observations
A bright star, μ Ceph, was observed for focussing and alignment, and we could confirm the performance of the telescope (beam-shift controlled by the camera system), the chopper module and the on-line reduction software. This single observation indicates a sensitivity of ~2 Jy (1σ, 1sec). Our conclusion is that the NOT can be used for sensitive high-resolution imaging in the thermal infrared.

Safety at the NOT

In 1990, we invited a safety engineer from the University of Lund to have a critical look at our installations at La Palma and give his recommendations for improvement. This was done and a report was given in NOTNEWS no. 4.

In the beginning of July, 1991, it became clear that existing circuitry of the emergency stop system was not satisfactory. Thus, all staff was instructed to take special safety measures until the system was modified. For instance, it was not allowed to stay within the platform area passed by the moving staircase when the building drive was energized.

Modification was done as a high priority task and was implemented within 1-2 months. At the same time, safety aspects of the rotating building and telescope were re-evaluated. Since these structures are remotely controlled from the control room, there is a risk of personnel injury. To fulfil normal industrial safety standards, it would be required either to interdict access to the energized telescope or to install a so-called dead-man button: a push-button in a hand-set must be actively pressed by personnel working under the telescope to keep the telescope energized. To reduce risk of injury at the external staircase, a light barrier 15 cm in front of the staircase could be used. The Scientific-Technical Committee noted the inconvenience caused to observers but approved installation.

The first part of the system with the hand-set was installed on the observing floor in November. Many astronomers found that the new safety feature made life complicated. In some cases telescope time was lost due to lack of knowledge of the system and protests were forwarded. Taking these protests into account, and pending modifications, the observing floor safety system was temporarily disconnected. The second half of the system, a light barrier in front of the staircase, is essentially ready for installation.

For a long time we have discussed to solve the problem of the moving staircase in a mechanical way. The staircase can be removed and the catwalk around the telescope elevated about 1.8 m. Access to the rotating telescope building would be in a radial manner. However, access with heavy equipment to the telescope floor and use of the external elevator for handling of the primary mirror would be complicated and could involve new risks.

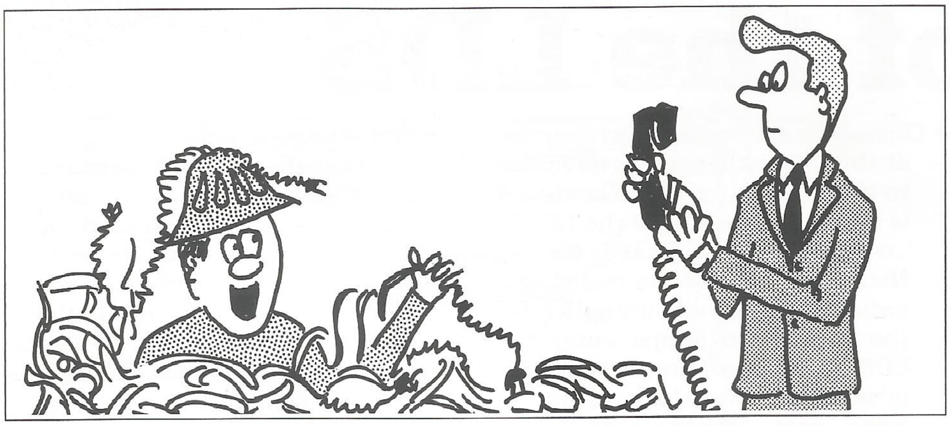
Further discussions on these and other safety matters should lead to improved safety systems. We hope that complications for observers can be minimized.

Reprints please

L.O. Lodén and T. Oja

Excellent Results
At this time, the NOT has been in operation for a considerable period. A lot of observations have been carried out with our excellent telescope, and a corresponding amount of scientific material has been collected. In addition, quite some of the results have already been published or are very close to being published.

Let us Know
For the local staff, as well as for visiting observers it would be of very great interest to be continuously informed about the results and publications in question. So, please, as soon as you have some conclusions ready and written down, send a copy to La Palma for our little NOT library. It has to be noted that we are interested, not only in refereed articles published in established international journals, but also in preprints and any kind of reports, wherever they might appear.



Oye niño, dale un numero nuevo, nada mas

Esteemed client, our sophisticated technology is at your service

Annual change of Telephone numbers

New year, new visions, new telephone numbers. As we all suspected, the new year implies, among other exiciting events, the introduction of new telephone numbers for the Roque de los Muchachos Observatory. See below for latest update.

From interested parties, some comments have been received.

- Minister: We see a positive influence on GNP and the employment sector ...
- Islander: I swear, I have nothing to du with telephones ...
- Local printer of stationary and business cards: I love the telephone company!
- IAC employee (on telephone): I would say that ... click, bzzz ... are really not ... bzzz, click, bzzz ... and honestly, this is ... bzzz, click ...
- Astronomer: The telephone lines!

Well, this is the mo[illegible] it I have ever[illegible] Frankly, I [illegible]

- Responsible officer[illegible] telephone com[illegible] aturally, and as a mat[illegible] However, for this ve[illegible] a it may, accordingly, [illegible] ervice. Now, nevertherless, w[illegible] I try at any rate, [illegible] ... ... click, bzzz, bzzz, click [illegible]

Telephone numbers from end of 1991 until ...?

NOT telescope building	+34 22 40 56 60
NOT service building	+34 22 40 56 61
NOT appartment	+34 22 40 55 21
Residencia reception	+34 22 40 55 00
Residencia telefax	+34 22 40 55 01
Residencia administration	+34 22 40 55 40

Neutral Filters of the Photopolarimeter

Tarmo Oja

High Sensitivity

The red- and infrared-sensitive (GaAs) photomultipliers of the Photopolarimeter are very sensitive. This is indeed a definite advantage when hunting for the faintest possible quasar properly observable. The red colour band gives for most objects the highest of all count rates. But every medal has a reverse, and so do red-sensitive photomultipliers.

Bright Stars and Neutral Filters

Sensitive also means fragile, and bright stars cannot be measured without danger to the photomultiplier. The bright limit is at around a red magnitude of 9, and too many standard stars are brighter than that. If you make polarimetry only, this is no problem. You just select one of the neutral (grey) filters available, thus making the bright limit around 2.5 or 5.0 magnitudes brighter. The neutral filters are, however, not exactly neutral, so this procedure cannot be used for photometry.

Filter Calibration

In order to improve upon the situation regarding photometry, the 2.5 magnitude filter has been calibrated by simply measuring a number of stars with and without the filter. The result is as follows.

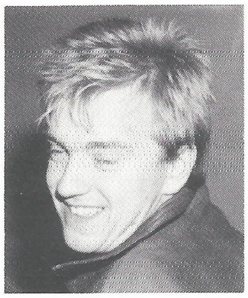
Pass Band	Filter Factor
U	2.501
B	2.515
V	2.503
R	2.480
I	2.431

Filter factors are expressed in magnitudes. The mean error in the factor determinations is around 0.003 magnitudes.

Naked Eye Stars

Using the above filter factors, you can use standard stars with red magnitudes as bright as about 6.5 and still get useful results. The 5.0 magnitude filter remains to be calibrated. But even such a calibration would not really help all those who wish to monitor Betelgeuse and Sirius. They would have to bring their own well-calibrated 11 magnitude neutral filter (and find some clever way to persuade the OPC).

Status of the LDS



Frank Grundahl

Tests in September

The Aarhus-Tromsø Low Dispersion Spectrograph (LDS) was successfully tested in September 1991. In May 1991, both CCDs were shipped back to Aarhus because of a leak in one of the Dewars (GEC in primary channel) and QE hysteresis in the TK512 chip. The leak has been cured but the QE hysteresis still remains because the replacement device from Tektronix had problems with several bright lines in the bias/flat field. It was therefore decided to retain the old chip on the instrument until this problem has been solved. For a general description of the LDS, see articles in NOT NEWS Nos. 2 and 3.

Present Status

What is then the current status of the LDS with regard to observations in the rest of this period? The following points summarize the relevant facts:

- The primary channel was put to work (for the first time) in September, so it is now possible to use both channels, but not simultaneously, due to a missing frame buffer card. In January, an attempt will be made to install this card.

- The CCD in the primary channel has been tilted in order to minimize the focus variations across the chip due to chromatic aberrations in the camera lenses. This means that this channel is now unsuited for direct imaging. Also, the pixel size for imaging is 0".86, which will give undersampling of the PSF in all but the worst seeing conditions.

- A new dichroic mirror has been installed as the old one was too thin and therefore had flexure. The mirror reflects all light below 6000 Å to the secondary channel and transmits all above to the primary channel.

- Observers are encouraged to arrive at the NOT at least one day prior to their observing run, because it is now possible to use the LDS in „training mode". That is to say that all is just like the real observations except that only light from the calibration lamps enter the LDS. The control program, HOST, is mousedriven (don't forget to bring some cheese!) and very easy to use, and after one evening of training, you will know all about how to use it.

- Several different spectral calibration lamps are available (Hg/Cd, He, Cs, K, Ne) and listings of the visible lines for the different setups are (at the time of writing) in the process of being compiled. These will be made available to the observers.

- At present, only the Strömgren vby and H-beta filters and a Johnson V filter are available. These are of imaging quality and transmission curves are also present. If you have own filters for imaging, they should have a diameter of about 60 mm in order not to give vignetting of the field. Contact Bjarne Thomsen to get frames for these.

- The currently available slits are 1".1, 1".5 and 2".2 wide.

- As there is no possibility for slit viewing, the LDS is rather unsuited for survey projects of bright objects because the average time spent on moving from one object to the next, centering on the slit and finding a guide star, is about 10-15 min., i.e. you waste a lot of time if your exposures are short.

- In NOT NEWS No. 3, Bjarne Thomsen reported that the overall quantum efficiency was somewhat lower than calculated. This seems to be largely due to the fact that the reflectivity of the primary, at the time of test observations, was lower than assumed. Further, the reflectivity of the secondary mirror is somewhat lower than assumed in the calculations. Also, the QE of the TK512 device is possibly lower than the figures given by Tektronix due to the hysteresis problem.

- The exact wavelength ranges for the different setups are now known to be:

Primary:	200 gr/mm	5900Å-10000Å	7.2Å/pix
	300 gr/mm	6000Å-9800Å	12Å/pix
Secondary:	400 gr/mm	4800Å-6300Å	3Å/pix
	600 gr/mm	4400Å- 5300Å	1.8Å/pix

These values should be precise to about 40 Å, as the exact numbers are slightly dependent on which slit is used.

Practicalities

The readout noise and conversion factors of the CCDs are 6.5 e- rms and 2.6 e-/ADU respectively for TK512. For the GEC, the corresponding numbers are 6-7 e- and 6-7 e-/ADU.

- It is not possible to get spectral scanlines at the control computer. However, if you transfer your images via Ethernet to the HP835, you can use IRAF instead. A small image processing system, IMSYS, has been installed on the control computer. This system can be used for simple image operations and display.

- The disk of the control computer can hold about 200 full frame images at a time so do not worry about space. Do, however, bring your own magnetic tapes. One tape can hold 55 full frame, unpacked images.

- A detailed manual for the operation of the LDS will be available at the telescope from about Christmas. This will contain relevant information on how to observe with the LDS, what to watch out for and some technical data.

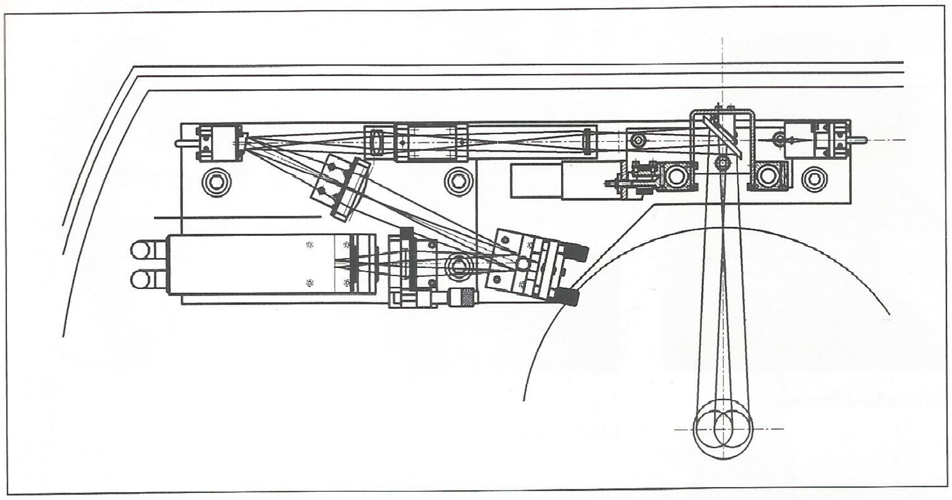


Figure 1: Layout of fiber coupling unit in NOT adapter.

Fiber Coupling to the NOT

Do you wish to connect your instrument to the NOT via fibers? This will soon be possible. Thanks to a grant from the Velux Foundation, a fiber-fed spectrograph is being designed. As a parallel undertaking, we can soon offer a fiber coupling facility also for other users.

Velux Spectrograph
Engineer Søren Dybdal from the Nordic Telescope Group reports fine progress on the spectrograph. Manufacture is on the way at the astronomical institutes in Oslo and Brorfelde. Details on the spectrograph will be given in a subsequent issue of NOTNEWS.

The unit for coupling of fibers to the telescope is nearly completed. Installation on the telescope is foreseen for the near future.

Fiber Details
Telescope light can be directed into any of twelve optical fibers. Initially, only four will be installed. There will be a fiber-end viewing facility with an ICCD camera, sensitive to a magnitude of about 15. Calibration light from four spectral calibration lamps or an incandescent lamp can be transmitted into the fibers.

The first fibers will be of type Polymicro FVP 100/110/125 and FBP 100/110/125 with a diameter of 100 microns, corresponding to 1.1 arcsec on the sky. Exit beams from the fibers will be around f/6. Transmittance of fibers, including various optical elements in the coupling unit, but excluding 3 Al-reflections in the telescope, is shown in Figure 2.

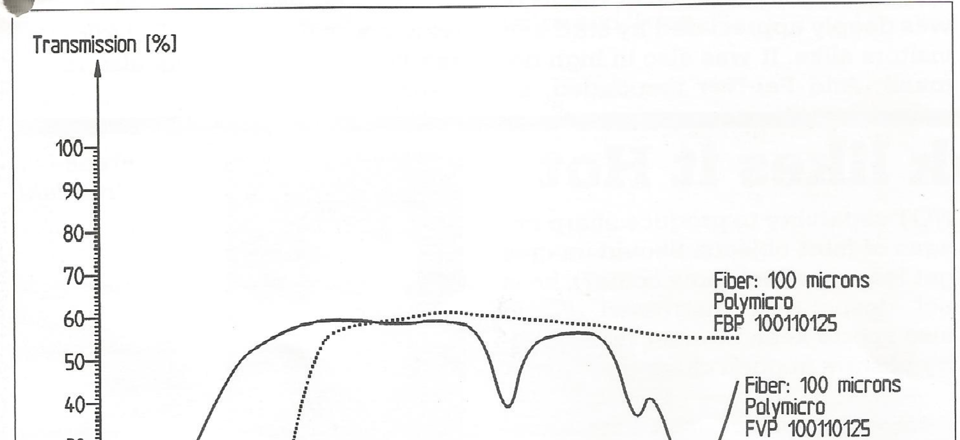


Figure 2: Transmittance of fiber coupling link and fiber. Curves are shown for two different choices of fiber.

Interested?
If you wish to make use of this new facility, you should contact the Nordic Telescope Group.

Ultimately, we hope to find money for a separate laboratory for fiber-coupled instrumentation. Donators should feel free to contact the NOT organization.

Power People

With the Council meeting at Roque de los Muchachos in October 1991, both Jorma Hattula and Mauri Valtonen left NOT council. Had just one of them left, that would have been a blow. The departure of both was a real shock.

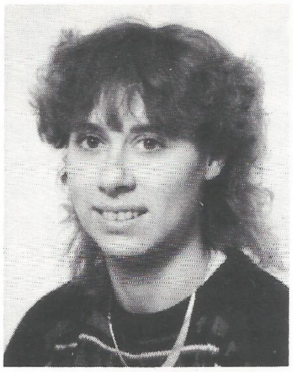
With their knowledge and high spirit, Jorma and Mauri have meant a lot to the NOTSA and to Nordic collaboration as a whole. Special mention must be made of their hard efforts to assist in the development of NOT staff at Cruz del Fraile. Concerning opening of staff positions as well as recruitment of the right people, the help and advice of Jorma and Mauri have been invaluable.

Trying to get accustomed to a NOT Council without Jorma and Hattula, we express our gratitude for their contributions. Well aware that their other activities are more than enough to fill (and saturate) their complete working time, we still hope to see them soon again in our activities.

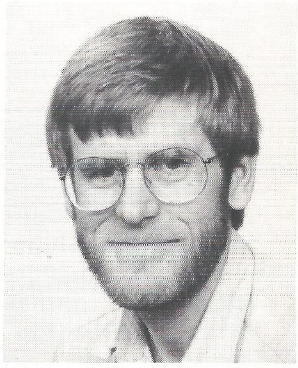
One consequence of the departure of Jorma Hattula and Mauri Valtonen is that Vilppu Piirola will move from the NOT STC to Council. Experienced as few, Vilppu will, no doubt, make a flying start. In the STC, Vilppu will be replaced by Tapio Korhonen, thus returning to his previous post. As Vilppu, Tapio is just too well-known to need any sort of introduction.

New Staff at the Nordic Telescope Group

The Nordic Telescope Group has expanded with three new staff members.


Merete Nielsen


Poul Henning Christensen


Bo Lindberg

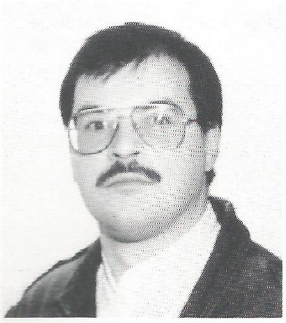
Mechanical engineer Poul Henning Christensen, 47, joined the group in September. He has a strong background in structural design. In his industrial carrier, P. H. has, among other things, been project responsible for the construction of the world's largest tower crane and 300 m high antenna masts. Thus, if you are looking for 300 m high site testing masts, you may wish to contact the Telescope Group . . .

Optical engineer Bo Lindberg, 47, also joined the Telescope Group in September. Bo has wide knowledge of practical optical design and industrial vision systems. He was formerly with Hasselblad AB, spent a year at the Optical Sciences Center in Tucson and worked as an independent consultant in Sweden for some years.

Finally, draughtsperson Merete Nielsen, 24, came to the project group in November. She has worked with CAD systems in industry and, in addition, has a professional education from England in technical illustration techniques. Contact us if you need a flashy airbrush drawing . . .

The newcomers are mostly involved in LEST activities. However, also NOT projects may draw upon their expertise. Arrival of our new collaborators has further widened our field competence.

Per-Ivar Pulls Back


Per-Ivar Emanuelsen

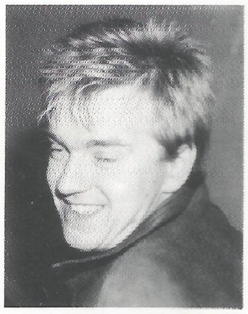
In the previous issue of the NOT NEWS, we had the pleasure to introduce Per-Ivar Emanuelsen as new member of our Cruz del Fraile staff. Now, he has already left to return to his icy homeland. He stayed a year with us. That was too short indeed.

Some astronomers working with telescope facilities specialize in imaging devices, some in photometers and some in spectrographs. Per-Ivar specialized in all of these gadgets. Plus the telescope.

Per-Ivar's broad knowledge of all sorts of instrumentation at the NOT was deeply appreciated by staff and visitors alike. It was also in high demand. And Per-Ivar responded, always as positive and helpful as knowledgeable.

Parallel to his dedicated work for the astronomical community, Per-Ivar keenly pursued his scientific programmes. These days, he seems to give some preference to pulsating white dwarfs. Tracking the nature of the pulsations, Per-Ivar combines observing data from ground based telescopes and satellites. Naturally, his favourite telescope is the NOT. That way, we will have good chances to see Per-Ivar at La Palma also in the future.

Smashing Frank likes it Hot


Frank Grundahl

Sporty people seems to be the thing at Cruz del Fraile. Biking Niklas left and hard-smashing Frank arrived. And he was well equipped. Finding charts, coordinate lists, half-ready and soon-to-be-written manuscripts, various sporty outfits and Trine.

Frank arrived in August 1991. True to his habits, he started with an ace. Already basically familiar with the NOT, he got into hard work at once and won first set.

With one of his scientific interests centred on evolution of globular clusters, Frank has a vital interest in the NOT capability to produce sharp images of faint objects. Should images get less excellent (how come?), he is not desperately distressed. Frank also sports keen interest in variability of stars in open clusters.

Genuinely fascinated by his observing programmes and of their outcome, Frank is also very much interested in the technical part of astronomy. That he dominates it is obvious. Visiting observers know. A new ace in our pack of cards. And a most welcome one.

Frank and Trine lead a hot life also at home. Frank uses the kitchen as a true advanced laboratory. He labels his decoctions Mexican food, eagerly inviting his friends to share his eating gamble. So far, few serious accidents have been reported. And Trine tends to get immune. But she prefers chocolate...

The NOT Girls

Lotta Bakos and Trine Renner Andersen

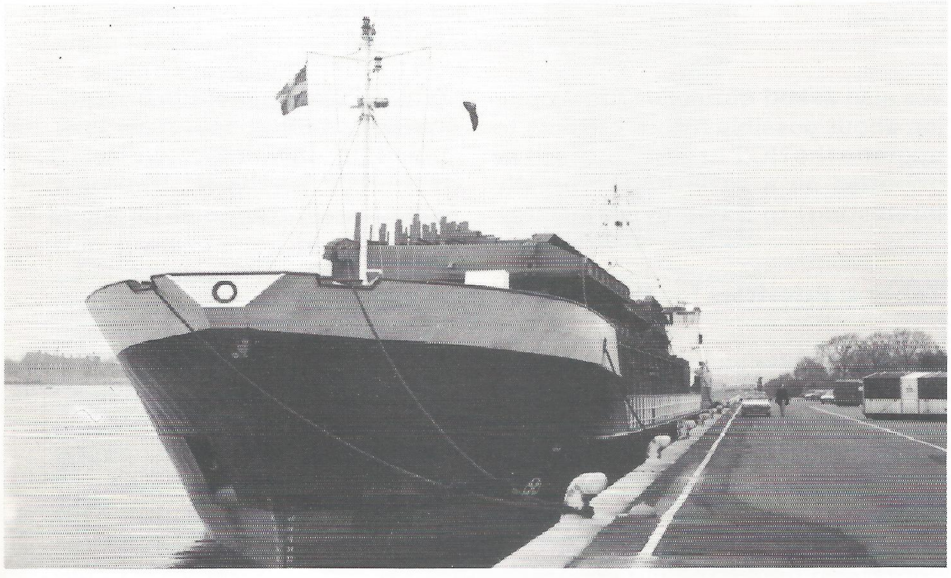
Sitting Around
Here we are sitting in downtown Santa Cruz waiting for our hardworking husbands to come home. And when they come, what do they bring us? - Nothing but dirty clothes.

Talking Around
They talk about the marvelous astronomers who have been using the fantastic telescope, and then we ask ourselves if you astronomers have ever thought about who make these staff men work? The staff may be supporting you, but we support the staff.

Asking Around
Now you might ask yourself: How can I thank these girls? - It isn't difficult. We simply suggest a little chocolate and some liquorice allsorts.

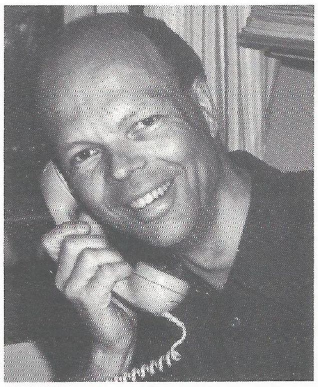
Hope to see you very soon on La Palma.

The staff supporters
Lotta and Trine



MS Chocolate Charity, chartered by Nordic task force Pro Vilda Dulce, awaiting orders for take-off.

The NOT STC's Questionnaire Survey



Johannes Andersen,
NOT Scientific Technical Committee Chairman

Background
With the NOT now in regular use by Nordic astronomers and a basic set of auxiliary instruments in operation or being commissioned, it is appropriate to review the present status and consider plans for future improvements in the services offered to the community. Rational planning requires knowledge of the users' views on the present NOT performance and their scientific interests for the future, and major future undertakings require a broad backing in the community. As a basis for such plans, the NOT Scientific-Technical Committee (STC) undertook a questionnaire survey of the Nordic astronomical community in early 1991 in order to assess the initial performance of the NOT observatory. The survey also addressed the projected use of existing instrumentation as well as plans and wishes for a next generation of focal-plane instruments for the NOT and/or technical improvements of the telescope itself.

A summary of the results of the survey has been distributed to those who responded. For the benefit of those who did not receive this information, it is summarized and briefly discussed in this article. It should also be mentioned here that the survey will be put to immediate use by the STC: At its October meeting on La Palma, the NOT Council directed the STC (naturally in collaboration with the Director) to prepare a comprehensive five-year plan for the technical development of the NOT observatory. In this review, particular attention is to be given to the balance of priorities between optimizing the use of the present instruments, provide new instruments, and upgrade the facilities of the NOT itself.

Basic Results of the Survey

A total of 47 answers were received: 19 from Denmark, 11 from Finland, 4 from Norway, and 13 from Sweden. Overall, we estimate that somewhat more than half of the potential Nordic user community reacted to the questionnaire, but the distribution by country and user institution is rather uneven, keen interest being shown at some institutes and hardly any at others. Still, the return is sufficient to make the survey a useful planning tool: Within the limits of small-number statistics, the replies received should be representative of the Nordic community as a whole.

The main quantitative results of the survey are summarized in the following tables. Table 1 gives the distribution of scientific interests indicated by the participants, each individual figuring in as many subjects as indicated in the reply. The table shows a very broad distribution of interests within stellar, Galactic, and extragalactic astronomy and some specialization amongst the Nordic countries.

The projected use of existing NOT instruments over two three-year periods is analyzed in Table 2. Interest is expressed quantitatively as the desired number of nights per year, a ceiling of 20 nights/year being imposed to limit bias by ambitious individuals. The following notation is used in Table 2 (and 3): N_{rep} = No. of replies; N_{req} = No. of nights/year requested; N_{av} = average requested nights/year/person. The distribution results from a combination of user interests, telescope capabilities (image quality!), and instrument availability.

More information on user interests is contained in Table 3, which shows the projected use of future NOT instruments (same notation as Table 2). Of these, the first three are projects for which definite proposals already exist, while the rest are instruments proposed in replies to the questionnaire. Again, the interest in *direct imaging* is overwhelming, with high-quality spectroscopy in a not unexpected second place. The possibilities for providing the necessary front-line instruments are now being carefully studied.

Table 1: Distribution of research areas

Subject:	DK	SF	N	S	All
Solar system	1		1		2
Stellar atmospheres, activity, seismology	4	6	2	2	14
Stellar structure and evolution	5	3	2	1	11
Interstellar matter, star formation	1	3		7	11
Galactic structure, dynamics, evolution; star clusters	7			5	12
Galaxies and galaxy clusters	7	2		2	11
Active galactic nuclei, QSO's gravitational lenses	4	2	2	3	11
Cosmology, Big-Bang nucleosynthesis, large scale structure	6			1	7
Instrumentation, observing techniques	4				4

Table 2: Projected Use of Existing NOT Instruments

Instrument:	1992-94			1995-97		
	N_{rep}	N_{req}	N_{av}	N_{rep}	N_{req}	N_{av}
Direct CCD camera	27	194	7.2	18	115	6.4
Photopolarimeter	11	89	8.1	9	85	9.4
High-speed photometer	6	2	4.2	4	22	5.5
Low-resolution IR spectrometer	3	17	5.7	1	4	4.0
Low-Disp. Spectr./Focal Reducer	18	100	5.6	10	58	5.8
SOFIN high-res. spectrograph	12	96	8.0	9	87	9.7
uvbyß photometer	8	35	4.4	6	19	3.2
Boller & Chivens spectrograph	9	44	4.9	4	17	4.3
ESA Photon Counting Detector	11	3	33.0	6	18	3.0
Totals:		633	5.7		425	5.7

Table 3: Projected Use of New or Proposed NOT Instruments.

Instrument:	1992-94			1995-97		
	N_{rep}	N_{req}	N_{av}	N_{rep}	N_{req}	N_{av}
Fiber-fed spectrograph (VELUX)	10	68	6.8	8	66	8.3
Wide-field CCD camera	23	166	7.2	18	126	7.0
Frame grabber/image selection	4	30	7.5	3	20	6.7
IR array camera (1-5m wanted)	8	36	4.5	7	34	4.9
Standby high-speed photometer	2	4	2.0	2	4	2.0
Multi-fiber spectrograph	4	31	7.8	2	16	8.0
Other (far-IR photometers, etc.)	2	23	11.5	3	23	7.7
Totals:		358	6.8		289	7.0

We also asked our colleagues' opinion about possible future projects to upgrade the NOT itself, expressed as priorities on a scale from 1 (mildly interesting) to 3 (vitally important).

Table 4 lists the average priorities for five pre-existing proposals and one added in the answers (last line), separately for the N_{rep} replies mentioning each item and for all 29 replies.

Table 4: Priorities for Future NOT Upgrade Projects.

Project	N_{rep}	Grade by all	Grade by proponents
Remote control from Nordic home base	19	1.6	1.0
Remote control from user institute	23	1.5	1.2
Active optics (slow support corrections)	21	1.9	1.3
Adaptive optics (rapid seeing correction)	16	1.9	1.0
Wobbling IR secondary mirror	11	1.9	0.7
Improved data handling and transport	5	2.6	0.5
Total replies:	29	-	-

Some Conclusions
In addition to the replies to our fixed-format questions as summarized in the tables above, the STC received many thoughtful and constructive comments on the future of the NOT. These will be carefully studied in preparation for the long-term planning mentioned above. At this point, the main conclusions of the survey can be formulated as follows:

- The interest in the NOT and the demand for observing time is enormous and unrelenting in the foreseeable future. The emphatic wishes for longer individual observing runs will be very difficult to accommodate on a single telescope.

- Observers seem generally pleased with the services offered at the NOT. The chief priority is consolidation of operations at La Palma, so that one can be certain that instruments are ready and running for the observing run, documentation is available before and during the run, adequate instruction is given, modern data handling, storage, and transportation facilities are available, and any technical problems are solved with minimum loss of observing time. This is seen as more important than adding new features to the telescope at this point. NORDBOARD was suggested as a medium for up-to-date information and exchange of views on technical matters. Regarding support at the telescope, opinions were remarkably divided, from „absolutely excellent, outstanding" via „maybe useful first night for unexperienced observers" to „full night assistant service needed!". It is perhaps appropriate to note in this connection that, while the NOT staff will do their utmost to help observers, especially those with little previous experience, this is no substitute for the obligation of every scientist to study in advance the characteristics and limitations of the tools with which she/he has chosen to work.

- Regarding new instruments, the outstanding high-priority item is larger, lower-noise, blue-sensitive CCDs. These are requested both for wide-field direct and spectroscopic imaging and for high-resolution spectroscopy in a wide spectral range. Thus, the instruments now being developed by the STC Working Groups are solidly backed by the community.

- The wish for new, more powerful focal-plane instruments is mixed with concern that the staff may not be able to cope with the operation and maintenance of them all. Over-abundance and under-standardization of instruments are seen as a real concern.

- Amongst projects for future upgrade of the NOT itself, preservation and, if possible, improvement of the image quality and accessible field clearly has top priority. Remote control follows next, but is seen more as a convenience than a necessity.

- The concept of „Key Observing Projects" is viewed rather coolly, given the already high pressure for observing time. There is considerable interest in a „Service Observing" mode, allowing short and/or time-critical observations to be made by the staff. It is recognized that consolidation of the staff is needed to allow this.

The STC's Role
The STC's questionnaire survey and this account of it are intended to emphasize the STC's wish to stay in close contact with our user community. The purpose of the NOT project is to offer Nordic astronomers the best possible conditions for their observational research, and the main task of the NOT STC is to synthesize the views, plans, and wishes of the community into practical, coherent, and balanced plans for the technical development of the NOT and its associated facilities. The questionnaire survey was an attempt to collect these views in a coordinated and systematic way. It is no secret that we would have been better equipped for our task if many more of our colleagues had taken the moderate trouble to reply to our questions, and your STC representative will always be glad to receive your suggestions for improvements in present or future services at the NOT. This is especially important at the present time, since the first contacts between the Associates concerning the renewal of the NOT Agreement from 1994 should begin just half a year from now, and the future scope of the NOT facilities will therefore soon be up for review in any case.

vby-ß Photometry with the NOT

Helge Jønch-Sørensen

Background
The formation, evolution and structure of the Galaxy is still a puzzling question. Until some 10 years ago, the structure of the Milky Way was well described by the classical five populations of the „Vatican congress" (see e.g. Blaauw 1965, in Stars and Stellar Systems vol. V), and the formation of the Galaxy was understood by the rapid, continuous collapse concept of Eggen, Lynden-Bell and Sandage 1962 (ApJ 136, 748). Nowadays, we all look for thick and thin disks, round and „not-so-round" haloes, just as we realize that the early evolution involved more than just a rapid collapse of the pre-Galactic material.

Samples of Stars
In order to understand the structure of our Galaxy, we need accurate data for a large number of stars from all populations, avoiding as many selection biases as possible. The major parts of our present knowledge are based on samples of stars from our „local swimming pool" in the Galaxy, lacking accurate data for more distant stars. „In situ" samples of the various populations are essential to trace any discontinuity between the halo and the (thick) disk. Another problem requiring accurate data for distant stars is the presence (or ab-

sence) of metallicity gradients in the disk and halo which are key features in many models of the chemical evolution in the Galaxy.

Strömgren Photometry

Being a Nordic astronomer you realize, of course, that the Strömgren photometry (combined with the ß index) is a powerful tool in getting information of M(V), E(b-y), age and [Fe/H] of individual stars for a range of spectral types. Combined with a large telescope and a sensitive detector, the uvby-ß system can yield valuable astrophysical information for stars to distances of many kpc. In 1987, Jens Knude and I initiated a CCD uvby field star photometry program at the Danish 1.5 m telescope at La Silla (Jønch-Sørensen, Knude 1990, A&A, 238, 75), observing fields at high to intermediate galactic latitudes.

In the present project, the chemical structure of the old disk is studied from accurate photometry of individual main sequence stars brighter than $V=19^m$. In May 1991, the program was granted two nights (May 20-22) at the NOT using the LDS camera in imaging mode. Thereby our program is exported to the northern hemisphere and now also involves CCD ß photometry for the first time. The results have been submitted to A&A and I will summarize below, concentrating on the observations.

Observations with the NOT

The first night started with some technical problems, including a „merry-go-round" trip in an unstoppable building. These problems were quickly solved by the technicians and the telescope, building and LDS camera behaved nicely for the rest of the night and so did the weather. The second night, the weather was also stable though not photometric. In fact only the moon could be seen through the clouds!

The LDS was used because of the very poor sensitivity in the blue of the on-line CCD camera that makes u and v observations impossible. The primary channel of the LDS camera was equipped with a TK512 CCD chip showing good uv response. Unfortunately, the optics of the LDS camera were not optimized for uv transparency so u magnitudes could not be obtained in May 1991.

The field of view was 4'x4' and the pixel size 0."47. With the very good seeing conditions at the NOT, this pixel size can cause an undersampling of the stars, severely affecting later attempts to perform point spread function fitting and thereby reducing the accuracy of the final magnitudes. Fortunately, compared to the previous nights, the seeing on May 20-21 was rather poor, approximately 0."8!

Program fields were chosen in the direction (1,b) = (5°,+42°) and the primary empirical aim was to obtain magnitudes on the standard Strömgren system with an accuracy better than $0.^m015$ in each single magnitude to a limiting magnitude of $V=18^m$. Due to the limited dynamical range of a CCD, series of exposures with varying integration times have to be obtained in order to achieve the mentioned accuracy for stars with magnitudes ranging from $V=9^m$ to 18^m. We observed 3-4 frames in each filter with integration times varying a factor of 60 between the shortest and longest exposures, e.g. a sequence like 10-600 seconds in v,b,y,$ß_{wide}$ and 60-3600 seconds in $ß_{narrow}$.

Bias, Dark and Flatfield Frames

Bias frames were obtained at the start and end of the night and they confirmed the slight decrease of the bias level during the night which was noticed in the overscan region of the science frames. The general level decreased from 464.5 to 462.5 ADU, probably due to some varying potential of the auxiliary electronics. Bias subtraction was performed using a mean bias frame combined from 20 exposures.

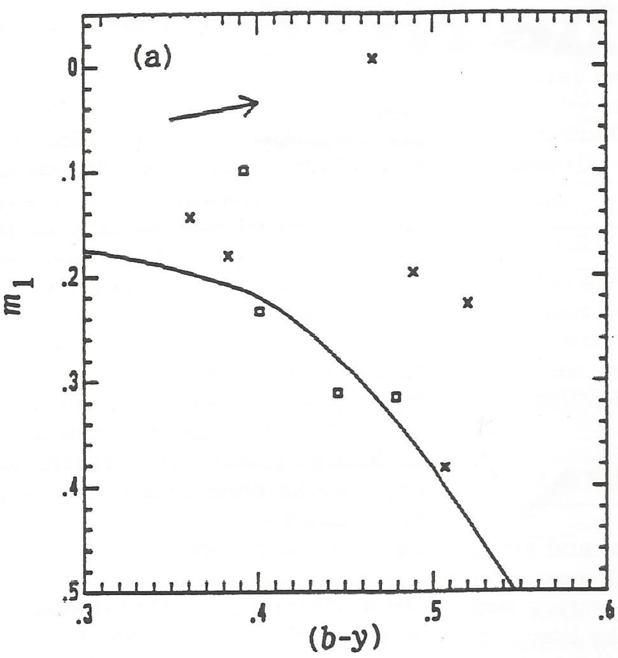


Figure 1 a: (b-y) versus m_1 for 10 stars in the 4'x4' field brighter than $V=18.^m5$. Boxes: stars with $\sigma_{m1}<0.^m03$ (see text). The curve is the standard dwarf sequence adopted from Crawford (1975) and Olsen (1984). The arrow indicates a reddening of $E(b-y)=0.^m0.5$

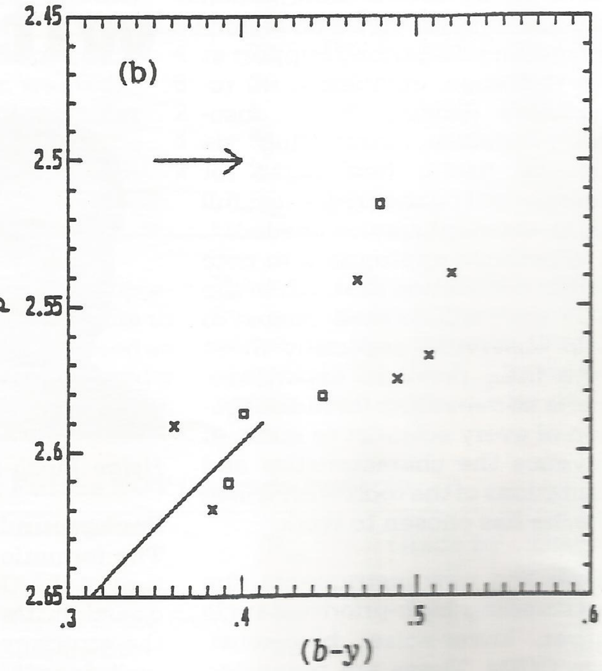


Figure1b: (b-y) versus ß, symbols as in Fig 1a. Note that the standard relation adopted from Crawford (1975) only extends to $ß=2.^m590$.

Dark frames were also obtained, but the dark level was very low, less than 2 e-/hour/pixel, and showed no structure. No dark subtraction was therefore performed.

Both dome and sky flat fields were obtained covering a large range in intensity. The difference between dome and sky flats was at a moderate level, approx. 1%, but comparing high level flat fields to low level flat fields revealed that the first approximately 100 rows suffered from a kind of „fat zero". It seems that the affected rows experience a sudden increase in sensitivity when the general level in the frame exceeded a level around 500 e-pixel. The deviation from high- to low-level flat fields falls from a maximum of 20% at the first rows to 0 for rows above number 120. This effect is serious in science frames, because nearly all background levels are below the „non-linearity level" and the level of a large fraction of the pixels in a star profile will be above this level. However, compensation for problems with non-linearities like this can (when detected) be achieved through use of appropriate technical frames and great care during the preprocessing.

According to Bjarne Thomsen, the effect has never been reported before and has now vanished. Future observers should nevertheless be aware that the first part of the frame might be difficult to flat field.

Preliminary Results

The most important result is that the CCD ß photometry was tested and did not present any problems. Two (one) nights are not much for a CCD field star survey when 10-15 standard stars must be observed each night. Thus, only one CCD field was fully observed in all 5 bands. The resulting (b-y)-m_1 and (b-y)-ß diagrams for 10 stars brighter than V=18.^{m}5 are shown in Figure 1. Boxes represent stars with $\sigma_{m1}<0.^m03$ and crosses stars with $0.^m03<\sigma_{m1}<0.^m06$.

The first group meets our required accuracy and these stars are brighter than V=16.^{m}2.

Without u magnitudes we have no information on luminosity. As a consequence, we cannot distinguish between metallicity, reddening and evolutionary effects in the diagrams. However, making the (obviously wrong) assumption that all stars in Figure 1 are on the (b-y)-c_1 standard relation, meaning that they are practically not evolved, suggestive [Fe/H] values can be estimated using the calibration of Schuster and Nissen 1989 (A&A, 221, 65).

In Figure 2, the resulting metallicities are shown versus apparent magnitude V. These results are naturally very sensitive to the amount of interstellar reddening which can be derived from a $(b-y)_0$-ß relation if the c_1-index hence luminosity class is available. The brightest star in the sample is SAO 121065, quoted to be an F8 V star. Thus our „main sequence assumption" is probably quite reasonable for this star. Using the calibration of $(b-y)_0$ from Schuster and Nissen (1989), results in a reddening value of E(b-y)=0.^{m}011. It is not reasonable to assume that the faint (V>15^m), low metallicity stars are just highly reddened stars assigned to low [Fe/H]. We actually sample stars with rather low metallicity and these stars probably belong to the halo or thick disk.

The faintest star in Figure 2 has V approx. 18.^{m}4 and adopting M_V from the (b-y)-c_1, c_1-M_V relations results in a distance to the star of nearly 3.5 kpc. Thus, the star is situated at a height of more than 2 kpc above the plane of the Galaxy.

The program field will be observed again using the Danish 1.5 m telescope at La Silla. Thereby we obtain the missing u magnitudes and it will also be possible to compare the CCD photometry and estimate the external accuracy.

Summarizing, the results of this one night of data proved that uvby-ß photometry with a CCD is very well suited for determination of accurate data for stars fainter than V=17^m. However, the main obstacle is the low uv performance of CCDs and camera. In the near future, we all look forward to the appearance of large, uv sensitive CCDs that will mean a breakthrough in the field of intermediate band faint star photometry.

Finally, I would like to acknowledge both staff at La Palma and, especially, Bjarne Thomsen. Thanks to Bjarne, I could feel free like an experienced LDS user after only a few hours. Sorry for keeping you up all night, Bjarne.

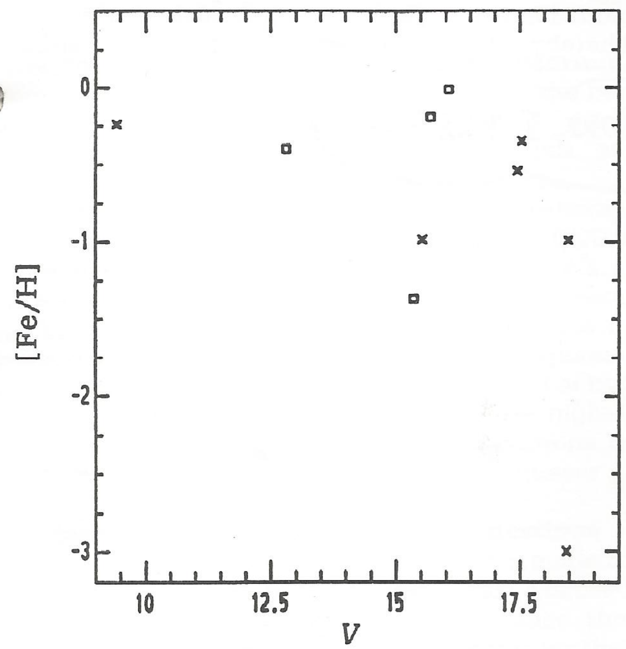


Figure 2: [Fe/H] versus apparent magnitude V. Symbols as in Figure 1.

Be Scrupulous about the Applications!

Lars Olof Lodén

Application

When you apply for observing time at the NOT, you have to fill in an application form for information to the persons concerned. In the first instance, this information is intended for the Observing Programmes Committee, who has to form an opinion of the prerequisites for the performance of the proposed observations and to distribute the time.

Information

However, the information given in your application is also for the guidance of the local staff, i.e. resident astronomers and technicians. They need to know a lot of things rather closely, in order to render the actual observations possible, or at least to facilitate or optimize the outcome of your run.

Auxiliary Instrumentation

Firstly, this concerns the auxiliary equipment. It is a very good idea to send a letter or a fax or to try to get through a phone-call to the observatory already before you write your application to make sure that a certain piece of equipment is really working, or that a particular filter is available. At that time it may still be possible to adjust or repair, or even to buy new filters, or whatever it may be. Then, prior to the observing run, if time has been allotted, we would also appreciate a brief notice and confirmation that everything is going to conform to the statement in the application. Some minor changes might still be possible to make then.

Observer

Secondly, it is highly important to indicate the name and address of the actual observers, i.e. the persons who are coming to La Palma in order to perform the observations. Thus far, there has been some confusion on that point, causing serious trouble for the local staff and sometimes obstructing the performance of the project. The information in question should appear in the box with the heading

Observer(s), institutional address(es), telephone number(s) (in the Nordic version of the application form).

The point is that the local staff must really be confident that the persons arriving at La Palma are the same ones as those who are named in the box mentioned above. Thereby, one should note that the concept „observer“ is not the same as „principal investigator“, although they may occasionally coincide in practice. If there is a person who should be considered as „principal investigator“, then meaning leader of the project, we recommend that you underline her/his name in the form. This is not compulsory, however.

Change of Observer

If, for some reason, you should have to perform a change in the composition of the observer team, please notify both the Director's office (Herta Nilsson or Eva Jurlander) and the local staff as soon as possible. Substantial changes in the program should not be made without the Director's permission.

In order to emphasize the degree of urgency of these requirements, we may present a few explicit instances and scenarios, which illustrate the awkward situations threatening, if the information to the local staff is misleading.

Suppose we expect an observer, who is known to master the actual equipment extremely well. Certainly, we consider her or him more suitable

than anyone else as an instructor for an unexperienced staff member. Therefore, we let this staff member support the observer in question during the first night scheduled. If then, instead, there comes a completely unexperienced observer, we may really run into trouble.

When two observers of the same sex are registered, we are frequently asked to reserve a double room at the hotel in order to reduce costs. Suppose then that there unexpectedly arrive two observers of opposite sex. Suppose, in addition, that the hotel is fully booked (it happens very often). Then there may occur a rather bizarre situation and, after all, Spain is a catholic country, and very recently the pope expressed serious concern about the development of the moral there.

It happens that we need some contact with the observers prior to the observations for an important message. If we then send this message to the wrong person, it could jeopardize quite a lot.

Imagine also that we ask for Mr. so and so at the reception of the hotel. Then there would be some rather unfortunate confusion if these persons are unknown and, instead, we should have asked for Mr. or Miss something completely different!

Co-Observers
Still, it is as important as ever that the observers do not work alone, and hence, that a co-observer is present. Therefore, it is not just a formality to put a second name in the actual box in the application form. Furthermore, it is, in practice, completely necessary to have a car during an observing run at the NOT, and hence, at least one of the observers must have a driver's licence. Therefore, if one of the observers should have to be exchanged, one should make sure that there is still at least one person with a licence in the team.

Be Clear
One of the causes for the misconceptions described here, is found in the fact that the Spanish application forms are not identical to the Nordic ones. As a consequence, we cannot give exactly the same advice to all applicants. The fundamental principle is, however, that you all express yourself as clearly as possible in order to pave the way for maximum success.

Data Transport and Storage

On the HP off-line computer at Cruz del Fraile, a Digital Audio Tape (DAT) unit will be installed. The unit can, with data compression, handle up to 8 Gb. Without data compression, 2 Gb as well as 1.3 Gb tapes can be handled. The DAT unit has been ordered.

To observe for Others

L.O. Lodén

T. Oja

Monitoring Programme
Since the beginning of 1991, a monitoring programme has been in progress at the NOT. This programme, named „Monitoring gravitationally lensed quasars", involves CCD imaging in various wave bands of a number of multi-imaged quasars about once a week. The observations are executed, as a service to the quasar team, by local members of staff or by the regular observers of those nights, generally making observations completely unrelated to the quasar project.

Questions
This mode of operation has in some cases caused certain discord, partly because the observers, of course, consider their own project more important. In addition, they sometimes declare themselves completely unaware of this obligation, and taken by surprise, when they are reminded by a local staff member. Often enough, they do not know very much if anything about the scientific aim of the quasar project. In particular, they do not understand why the observations for this programme have to be carried out so frequently.

Suggestion
For the reasons exposed, we suggest that the principal investigators of future corresponding projects, as well as of a possible continuation of the present monitoring programme, inform observers (and not only the Observing Programmes Committee) about the scientific aims of their projects. If you have received telescope time for a programme including observations to be made by others than those directly involved in the project, what about writing down your ingenious ideas on a piece of paper, say one single-spaced A4 page, and sending it to La Palma as well as to the Director for distribution to the observers concerned?

0.4 to 0.6 arcsec imaging of young stars

Sum of eight 5 min I band exposures of Herbig Ae/Be stars V376 (lower) and V633 Cas. Distance between stars is 37 arcsec. North is down and East right. See article inside this issue on page 6.