Phase III

The NTT will be returned to active duty for the community as soon as possible. After the big bang, which barring unforseen problems will last around 6 to 7 months, the VLT science operations scheme shall be tested in real operations with the community providing the critical feedback to ESO. The details of the VLT operations scheme fill more than 70 pages so it is not possible to go into it at length here. The fundamental principle is that operations shall be predictable and reproducible. Given this starting principle we believe that it is possible for the users of the NTT to define their observations in an accurate enough manner that it shall be possible for the NTT team to execute these observations. The benefit to the community if such a scheme is successful is tremendous. One of the most obvious benefits is that observations shall be scheduled exactly when the conditions are best suited for them. During the first months following the big bang service observations shall be interleaved with system test phases. In normal operations we do not plan that all observations will be performed by the NTT team. Clearly some significant fraction of all observations on the NTT are sufficiently specialised that the principal investigator should be present when they are being executed. The exact ratio of service observations to classical observations is not specified and will, we believe, be determined by market forces.

The immediate future

At the time this article is published the big bang will be only 6 months away. The NTT team has a lot of work ahead of it both in building the new control system and in working on the tools necessary for the new operations scheme. Detailed calibration databases are being established for EMMI and SUSI. Reliable and accurate physical models of the instruments are being used to provide a good understanding of how the NTT really works. The combination of these activities is planned to culminate in good tools that make it possible to accurately define the observations.

As mentioned in previous issues of the Messenger the communications between the users and the telescope team are being facilitated using the ntt@eso.org email account. Information about the telescope and the instrumentation is now maintained on the Web for easy access. Check us out on http://www.eso.org/NTT/

Automated data reduction tools are being developed within ESO to receive the data coming from the instruments. The NTT data have been kept (archived) for many years now. However the goal of the archiving system is not simply to keep the data but to make them useful. Significant effort is being dedicated to make the archive into a scientifically useful tool.

Comings and goings

The restructuring of La Silla has resulted in the departure of Jesper Strom from the NTT team. As a founding member of the team he will be sorely missed. Congratulations Jesper on your new job as 2.2-m team leader. New arrivals in the NTT team are Paul Le Saux and Joaquin Perez from the operations and optics groups in La Silla and Karen Mueller in Garching. Welcome to all.

jspyromi@eso.org

ADDITIONAL NEWS FROM THE LA SILLA SITE

The La Silla News Page

The editors of the La Silla News Page would like to welcome readers of the Messenger to the second edition of a page devoted to reporting on technical updates and observational achievements at La Silla. We would like this page to inform the astronomical community of changes made to telescopes, instruments, operations, and of instrumental performances that cannot be reported conveniently elsewhere. Contributions and inquiries to this page from the community are most welcome. (P. Bouchet, R. Gredel, C. Lidman)

News From The Telescope Teams

The recently formed 3.6m + CAT and 2.2m + 1.5^2 Telescope Teams are glad to inform Users that accounts have been created at La Silla and Garching for general user support. These accounts will be checked daily by the Telescope Team coordinators, ensuring a more prompt interaction between ESO Users and Telescope Teams.

3.6m + CAT:

The account 360cats@eso.org has been created to enable ESO observers to provide both set-up requests and feedback of their observations. Observers are kindly invited to use this facility. In the case of special requests, we would like to have your input well before the beginning of your observing run. The account in Garching (360cats@eso.org) is mostly meant for assistance with proposal definition and data reduction. In addition, the 3.6m + CAT weekly reports can be accessed by typing 3p6wkrp nn, where nn is the number of the required week, from any account on the La Silla off-line system. The weekly reports can be retrieved as postscript files via ftp from lw5.ls.eso.org (username: ftp; password: userid; directory: pub/360cat). Via netscape, the reports are available using the option open location with address ftp.//lw5.ls.eso.org/pub/360cat.

2.2m + 1.5m^2:

The account 2p2team@ls.eso.org has been implemented at La Silla. This account is meant to serve as a contact point for all problems, questions and requests related to the ESO-MPI 2.2m, the Danish 1.54m and the ESO 1.52m telescopes. Support will also be available for the Dutch 90cm and the ESO 50cm telescopes. In the future it is foreseen to implement automatic forwarding to this account from the WWW ESO pages.

The Quality of the 3.6m main mirror

A. GILLIOTTE

With this note, a brief history of the 3.6m main mirror is given, together with a summary of the actions that have been and will be taken to better understand the problems affecting this unit.

The 3.6m main mirror is made with cemented hexagons of fused silica. On top of these hexagons, a layer of silica is deposited. During the first polishing phase, this layer had to be re-manufactured because it was originally too thin. Early after the installation of the mirror at the telescope, during 1976, a few “white frosted stains” were noticed on the main mirror surface. The evolution of these surface defects has been analysed during each aluminisation. Over the last ten years, the mirror was aluminised during 1985, 1988, 1990 and 1994... During the 1985 aluminisation, recording of the surface defects started, by producing manual maps of the surface. This recording can be done only during the aluminisation period because the fresh aluminium and the absence of dust allows a precise recognition of the surface structures.

This operation was refined during the following 1988 aluminisation with a mapping done under stronger illumination. With this technique, all kinds of defects such as scratches, cleaning stains, aluminium projections and “frosted zones” can be well resolved and mapped in detail. Following the results of this first detailed mapping, attempts were made to contact the main mirror manufacturing company in 1989, unfortunately, with no success. The same procedure was applied (under the same conditions) after 1988 and the evolution of the defects was described in the aluminisation reports of 1988, 1990 and 1994.

In Figures 1 and 2, the maps of the 3.6m main mirror, as recorded in 1988 and 1994, are presented. The comparison between these maps show the evolution of the blemishes in the last 6 years. During these years some new frosted zones close to the mirror center, affecting less than 0.2 percent of the mirror area, appeared. Please note that, due to the manual design of the maps, the maps give a picture which appears worse than in reality. This is due to the fact that all the defects are drawn with the same intensity, regardless of their true effect. Figure 3 shows a picture of a

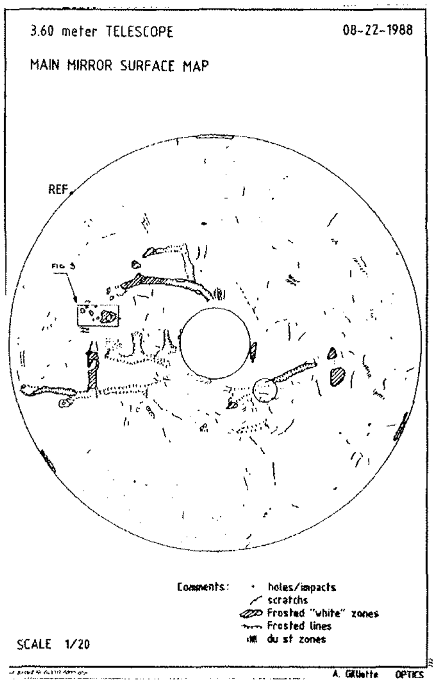

Figure 1.

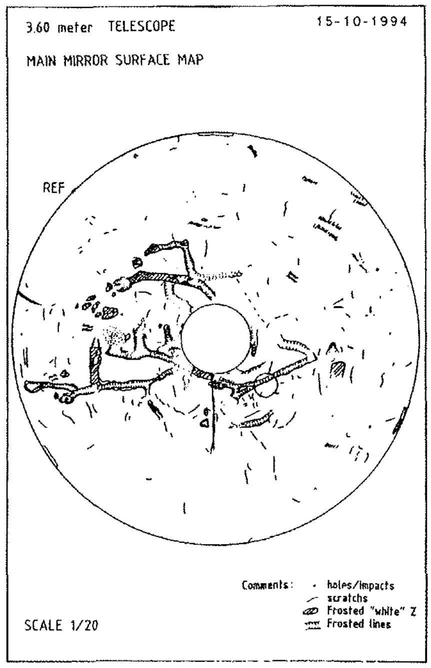

Figure 2.

small affected area (also indicated in Figure 1) with a frosted zone and spots, which appear as white regions. The size of the larger frosted stain is 70mm. Despite the low contribution of these defects to the overall telescope efficiency (see below), it was decided to establish a diagnostic of the mirror “illness”, in the framework of the 3.6m + CAT Upgrade Plan.

During the last aluminisation qualification of the frosted zones began, using both magnified surface images and the measured reflectivity of the affected areas. In Figure 4, the transition area between a frosted spot and a sound zone is shown. The spot appears in black and the magnification of the picture is 135, giving a spot diameter of about 0.5mm. A grain structure is easily visible, with a grain size of about 3 microns.

How do these defects affect observations?

After a fresh aluminisation the reflectivity at 670nm varies from 89% for for sound areas to 82% for the frosted ones. The rugosity (a measure of the roughness), which is 15Å for an excellent mirror, varies from 60Å in good zone to 140Å in an affected one. Dust on the mirror produces a similar roughness of about 120Å. The zones affected by the defects cover only 2% of the whole mirror surface. The contribution of the defects on the overall telescope efficiency is negligible, in comparison to that produced by dust.

IR observers may be concerned by the influence of the surface blemishes on emissivity. Emissivity is regularly monitored at 10μm, and no enhancement has been recorded in the last few years. In fact the measurements show a decreasing trend of emissivity with time, probably due to the CO_2 cleaning procedures that were adopted in the last few years. This shows that emissivity is largely dominated by dust.

Future Steps

Contacts have been successfully re-established with both the manufacturing and polishing companies. It was found

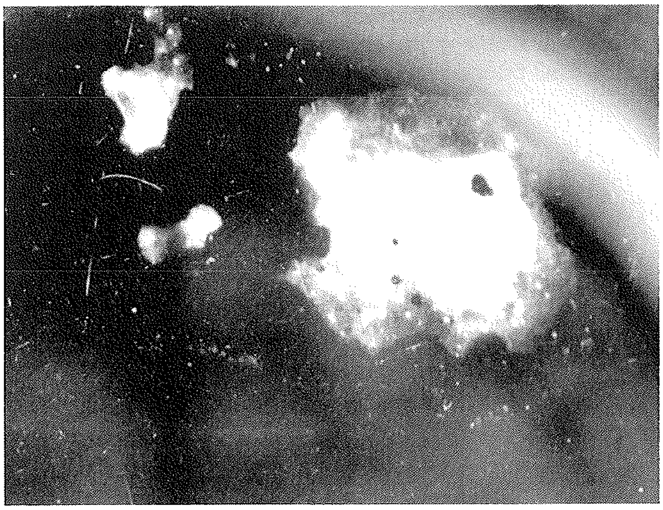

Figure 3.

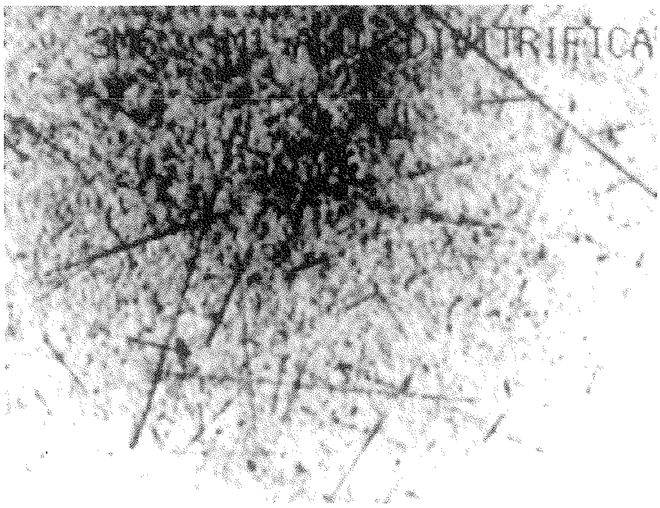

Figure 4.

that no other mirrors having the same characteristics as the 3.6m main are in use. This implies that no direct comparison can be performed. In addition, it has emerged that, due to the manufacturing and polishing history of the mirror, some parts it may be sensitive to particular chemicals.

The next aluminisation of the 3.6m main mirror is anticipated during June 1996. The frosted areas will be analyzed with higher precision. Specific instrumentation will be used to characterise the degradation process:

- A phase contrast microscope will be provided by REOSC and used to figure out the depth of the defects. This instrument is also used to characterise the VLT mirror surface quality.
- An Atomic Scale Tribometer will be also used to map precisely the surface with a very high resolution.
- Surface images with a magnification of 270 will help detail the grain structure.
- Following the results of these tests a small sample of one of the affected zones will be sent for a chemical analysis. A sample from the mirror bottom has been already analyzed and it will be used for comparison. The results show that the sample is almost pure silica with only 0.1% in an amorphous phase.

Even if the slow evolution of the 3.6m main mirror defects does not suggest a dramatic impact on telescope performance in the coming years, in order to obtain full control of telescope quality, the degradation process must be understood.

The Aluminisation of the Main Mirrors

The La Silla Optics Support Team

During period 55, the main mirrors of the 1.5m, 1m, CAT, 90cm Dutch and 1.54m Danish telescopes were successfully aluminised. The reflectivity of the fresh aluminium was measured to be around 90% at 670nm. A surface quality study was initiated to determine the evolution of the mirror surface quality. Magnified images and rugosity measurements of the surface have been obtained for each mirror. The rugosity ranges from 15Å for the best mirror to 40Å for the poorest. Dust will, after one year, increase this number to around 120Å producing both light diffusion and an increase in the emissivity.

The aluminisations were performed with the small aluminisation plant located within the 1.5m telescope building. This plant was refurbished completely by La Silla staff to solve the poor adherence of the aluminium layer. A LN_2 trap was added between the chamber and the oil diffusion pump to stop the oil backstreaming towards the aluminising chamber. The glow discharge cathode was also modified to increase the size of the plasma within the chamber. The good adherence of the aluminium has met the objectives of this plant improvement.

A new cleaning method called "Peel-Off" was successfully tested. A peel off lacquer has been developed by a chemical company in Germany in close collaboration with a staff member at ESO Garching. The efficiency of this cleaning is very good as both the reflectivity and rugosity reach 95% of the values reached after a fresh aluminisation. A program to monitor the time dependent adherence of the aluminium will start soon. It is hoped that this technique will reduce the number of risky mirror handling operations.

Meanwhile, CO_2 snow flake techniques are used to maintain the mirror reflectivity within an acceptable range. The frequency of the cleaning is still under study, but it seems that the dust conditions at La Silla will force us to clean every two weeks. The recently deposited dust must be removed before it sticks. Unfortunately, this method of cleaning must be avoided during conditions of high humidity. These conditions are common during the Chilean summer, so the mirror reflectivity decreases beyond the restoring powers of the CO_2 snow flake technique. This would be a good period for the promising peel off techniques to be applied.

The aluminisation plant for the larger mirrors was also recently refurbished by VTD, a German vacuum company. The 2.2m main mirror aluminisation is scheduled for April '96, while the 3.6m aluminisation is scheduled for June '96 (see article by Alain Gilliotte). The NTT mirrors will be aluminised during the coming "big bang" period, after June '96.

The Seeing at the 3.6m Telescope: Status of the Study

S. GUISARD

A first series of test nights dedicated to study the seeing at the 3.6 m telescope commenced in September this year and will conclude in February 1996. During these tests, both the seeing and the pupil image are continuously recorded in order to allow for a better understanding of the phenomena.

The actions taken so far have concentrated on tracking down and suppressing heat sources inside the dome, especially near the light beam. The encoder of the Cassegrain rotator and the electronics rack on the M2 unit are two examples. The former was insulated from the beam. It is located 20 cm from the beam at 1 meter from the Cassegrain focus. The latter, which was dissipating about 60 watts in the centre of the beam, is now only switched on when focusing is required.

Current work includes a preliminary approach to ventilate the mirror and a study for cooling the electronic racks in the cage, which generate several hundreds watts.

A seeing database is now used at the workstation in the control room. It is dedicated to recording and archiving the seeing measurements made every night. The software allows for automatic recording of all environmental conditions; temperature inside the dome measured at 15 various locations, wind speed and direction, slit direction, outside seeing at the seeing monitor (dimm2), etc. This data is saved each time a seeing measurement is made. This is done at least once per night. These measurements are straightforward and quickly made; it takes less than 30 seconds for the night assistant to enter into the data base the seeing, the zenith distance, and to specify the wavelength of the instrument. All the other information is transferred automatically to the workstation. In parallel, a programme running on a PC continuously records and displays environmental conditions.

A preliminary conclusion of the changes made to the 3.6 m and the results obtained will occur after the February test nights. Improving the seeing at the 3.6 m is a long term study; there are many parameters involved, and the problem cannot be solved in a few months. Other test nights will be requested during the coming periods to continue this programme for improving image quality.

Calibration of the IRAC2B Fabry-Perot

C. LIDMAN & R. GREDEL

The performance of the warm Fabry-Perot (FP) used with the IRAC2B camera on the 2.2 m telescope has now been characterised.

Across the array, the wavelength of maximum transmission varies. Using lens LC, the variation amounts to 8 Å over the central section, but from the center to the edge it is more than 16 Å. The variation is caused by a combination of two effects: a tilt added to the FP relative to the optical axis so that a bright thermal ring lies near the edge of the array and not in the center, and a higher than anticipated error in the non-flatness of the FP plates. These effects are inherent to the system and also occur with other imaging FPs (cf. Aspin et al. 1992 MNRAS 258, 684; Inoue et al. 1993 PaSJ 45, 539).

A map of the wavelength shift can be made by scanning a bright night sky line. The line at 2.18 microns is particularly well suited for such a task. Recent tests have shown that the shift can be determined to within 1 Å, and, over the central one arc minute of the array (using lens LC again), the map appears to vary little from one run to the next. However, this does not mean that the map does not vary with wavelength. This is still to be determined.

Instrumental fluxes of lines that are narrower than the instrument resolution, which is near 15 Å, can be recovered to about 5% if six wavelength settings are employed, four across the line and two well separated from the red and blue wings of the line. For lens LC, this result applies to the central one arc minute of the array. Flat-fielding, sky-subtraction and correction for the illumination pattern are done following the procedures used for broadband imaging. It is very important that dome flats be obtained for each wavelength setting.

The conclusion from this extensive testing is that the FP on IRAC2B can be used for studies that want to determine either line fluxes, velocity fields or both.

IRAC1

C. LIDMAN

Many projects employing IRAC1 image in the near IR, 1 to 2.5 microns, as well as the mid IR. As IRAC2B is significantly more sensitive in the near IR, we strongly recommend to observers who are planning observations in this wavelength region to combine observations with IRAC2B and IRAC1. To those observers who will have time on IRAC1 in the near future, we would like you to consider whether or not you can complete some of your programme using IRAC2B. It is sometimes possible, schedule permitting, to observe with IRAC1 and IRAC2B during a scheduled IRAC1 run.

We wish to emphasise that broad band M is not currently possible with IRAC1. The background flux is simply too high for the shortest integration now available. There are, however, two narrow band filters available, MN1 and MN2. These filters are about four times narrower than broad band M. Observers should realise that this reduces the sensitivity of IRAC1 at M.

ADONIS unveils Ultra-compact H II Regions Morphology

B. STECKLUM, T.L. HAYWARD, M. FELDT AND M. LÖWE

Until recently, the spatial resolution of infrared observations did not permit us to decide whether a single star or a dense stellar cluster powers the Ultra-compact H II regions (UCHRs). From radio interferometric observations, there is evidence for the presence of binary or multiple systems of massive stars. Conventional near-infrared (NIR) imaging has great difficulty in resolving this issue. The typical distance of several kiloparsecs to UCHRs implies that very high angular resolution is required to resolve the star forming complex into single stars. Furthermore, the diffuse radiation (due to thermal emission, recombination lines, and scattering) from the UCHR enhances the background against which the embedded stars have to be detected.

The advent of ADONIS (Adaptive Optics Near Infrared System) at the 3.6 m telescope now allows us to disclose UCHR morphology. As an example, we show the first results obtained for one such object in August 1995. The object (G45.45+0.06) is a cometary UCHR (Wood and Churchwell 1989) with a sharp ionisation front almost east-west aligned. A single star of spectral type O 7.5 can account for the observed radio flux. The detection of NH_3 emission indicates the presence of dense molecular gas (Churchwell et al. 1990). The kinematic distance to G45.5+0.06 is 6.6 kpc.

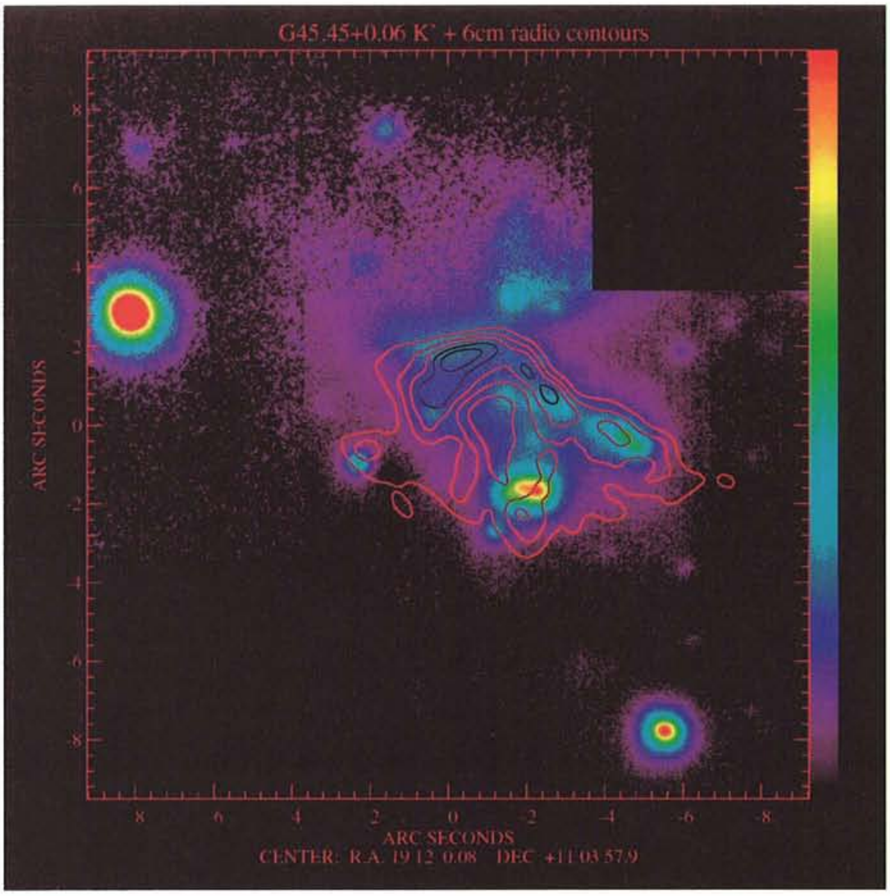

Figure 1.

The displayed image was obtained with the SHARP II camera (Hofmann et al. 1991) through the K' filter. The FWHM of the stellar profiles is 0.4 (during the observations the seeing monitor reported 1 seeing). This image reveals a cluster of stars, embedded in nebulosity, at the position of the UCHR. A chain of six stars almost coincides with the ionisation front. South of this arc, there is an object with a head-tail structure that does not have an obvious counterpart at radio wavelengths. Deconvolution of this image discloses that a jet like feature emerges from this star which is associated with H emission. The very good spatial resolution could be achieved because it was possible to close the loop on a bright star in the field.

Other targets of our UCHR sample share similar properties which supports the suggestion that the morphology of ionised gas and warm dust are often very different (Hayward et al. 1994). Our adaptive optics and MIR imaging suggests that UCHRs are very compact star clusters with members of different mass and evolutionary state.

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First Light on COMIC and SHARP II+

The ESO Adaptive Optics Group and F. LACOMBE, O. MARCO, F. EISENHAUER, and R. HOFMANN

COMIC and SHARP II+, the new high resolution cameras for the ESO adaptive optics system ADONIS, were commissioned in November 1995.

COMIC, developed by a group from Meudon Observatory, operates between 1 and 5 μm but is optimized for the 3 to 5 μm wavelength region. Two image scales are available: 35 mas/pixel (for J, H

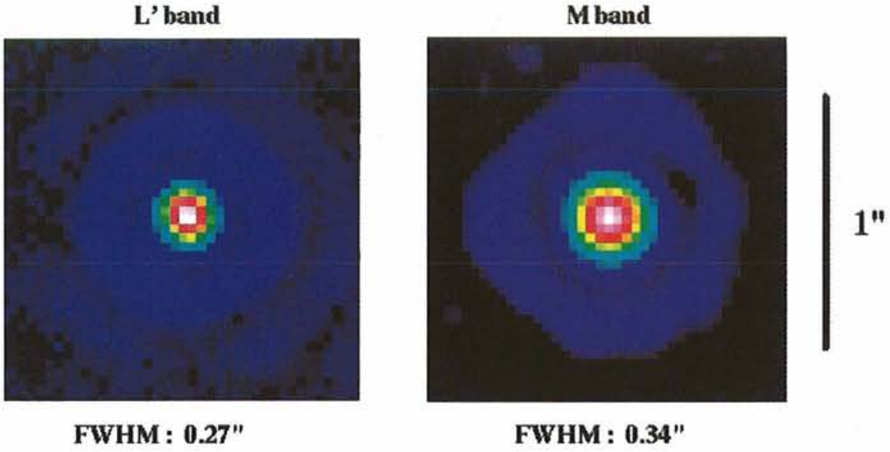

Figure 1: *51 Pegasus with COMIC.*

and K) and 100 mas/pixel (for L and M), leading to a field-of-view of 4.5 x 4.5 arcsec and 12.8 x 12.8 arcsec, respectively. Several narrow band filters and 2 CVFs covering the 1.3–2.5 μm and 2.5–4.5 μm ranges, respectively, are available. A 128 x 128 array manufactured by LIR is used as detector, and its associated electronics was built by Grenoble Observatory.

The first astronomical object which was observed with COMIC is the bright solar type star 51 Pegasus. Radial velocity studies by Mayor and Queloz (1995) provide convincing evidence for the presence of a planet with a mass of the order of that of Jupiter. The L and M images, displayed above, do not show any structure around the star.

SHARP II+ operates between 1 and 2.5μm. It was developed by the Max Plank Institut für Extraterrestrische Physik (MPE) on the basis of the IR camera which was used until now with ADONIS. SHARP II+ is equipped with an Atmospheric Dispersion Compensator unit (ADC), a Polarimeter, and two Fabry-Perot etalons covering the K-band with spectral resolutions of 950 and 2600 and an effective finesse of 40 and 51, respectively. The standard J, H, K and K' and various narrow band filters are available, as well as a CVF covering the H and K bands. The detector is a 256 x 256 NICMOS 3 array manufactured by Rockwell. Three image scales are available for the whole 1–2.5 μm wavelength range: 35 mas/pixel, 50 mas/pixel, and 100 mas/pixel, leading to a field-of-view of 9x9 arcsec, 12.8 x 12.8 arcsec and 25.6 x 25.6 arcsec, respectively.

In order to compare the performance of the new camera with the old SHARP II, previously used with ADONIS, we have observed the object G45.45+0.06, described above in the note from Stecklum et al. The image shown below was obtained through the K'filter, with a pixel size of 50 mas, which is the same as that used by Stecklum et al. The ADONIS correction is not as good as that obtained by Stecklum, however, as the object was already at an airmass of 2.6 when it was observed! The exposure time was 100 seconds on the object and 100 seconds on the star (three time less than for the Stecklum et al. image). The new image shows a clear brightening of the extended source.

Together with the two new cameras, a new user interface and a new data acquisition programme were installed and debugged. The new software, and SHARP II+, are now being offered to visitors on a regular basis. A more detailed technical description of COMIC will be included in a future issue of The Messenger.

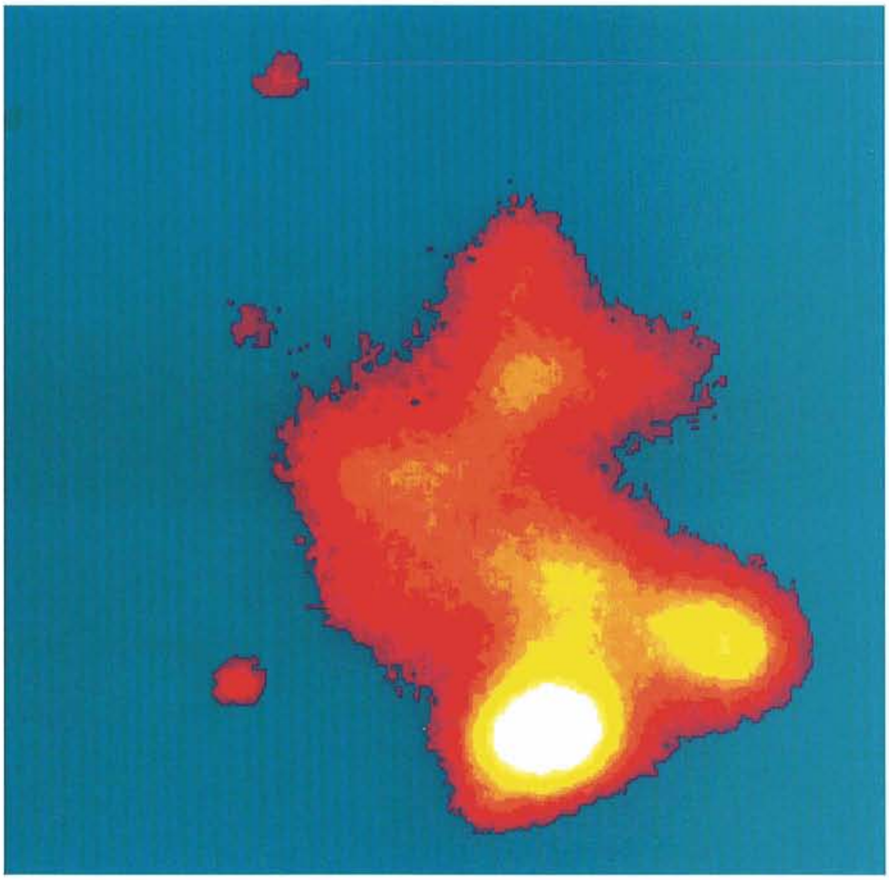

Figure 2: *G45.45+0.06 with SHARP II+.*

References

Mayor, M., and Queloz, D., 1995: in the *9th Cambridge Workshop* on "Cool Stars Stellar Systems and the Sun" held in Florence (Italy), 3–6 October 1995; R. Pallavicini and A. Dupree, eds. (in press)

An unusual view of the first VLT mirror taken from the top of the test tower during the final acceptance test performed in November 1995. This records one of the last walks on the mirror! The human presence gives an idea of the size of the VLT mirror.