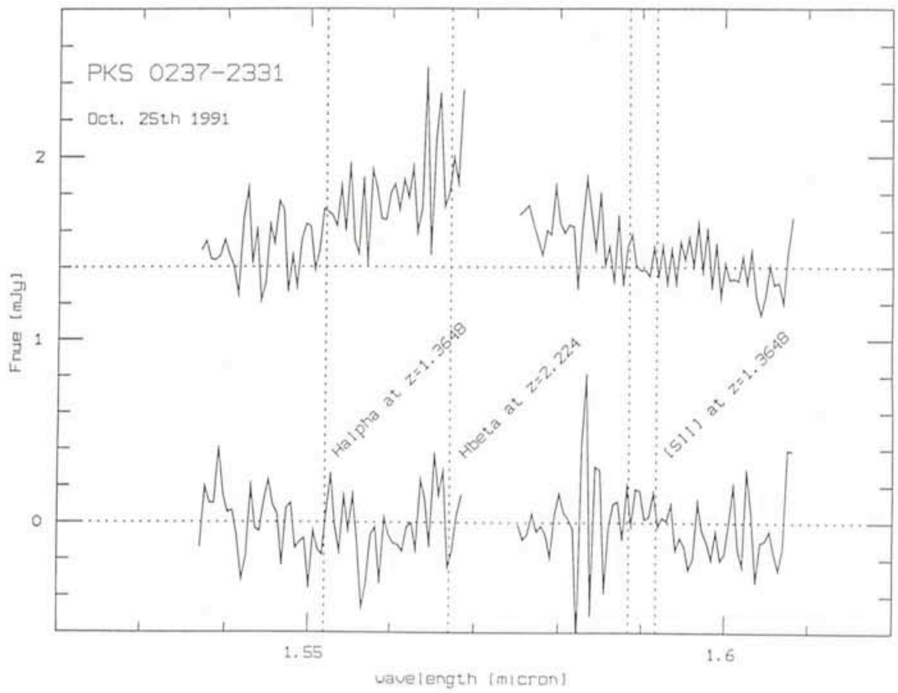

Figure 9: *Spectrum of Hβ at a redshift of z = 2.224 towards the quasar PKS 0237-23 (upper spectrum) and a reference sky position (lower spectrum). The horizontal dotted line in the upper spectrum marks the quasar continuum. The vertical lines show the location of Hα and [S II] at z = 1.3648. The centre of the Hβ line at z = 2.224 is indicated.*

region. Because the redshifts are, in general, larger than one, many of these transitions are shifted into the infrared domain. Figure 9 contains the spectrum between 1.54 μm and 1.61 μm towards the quasar PKS 0237-23 (Käufl et al. 1992) which has a redshift of z = 2.224. The lower part contains the spectrum of a reference position for comparison. The observations were aimed to detect Hα in emission and the [S II] doublet at z = 1.3648, which corresponds to the redshift of previously reported UV absorption lines. The total integration time is 16,000 s. Hα emission is not seen at z = 1.3648. The upper limit in the Hα luminosity of 2.5×10^{42} erg s^{-1} indicates that the star-formation rate in the intervening system is 22–36 $M_\odot$/yr at most. The continuum of the quasar in H is 1.4 ± 0.2 mJy. The Hβ line is detected at the redshift of the quasar, however. The gap in the spectrum right at the peak of Hβ reflects the serendipitous character of the observation. The line width is 4000 km/s and agrees with that of Hα, earlier detected in PKS 0237-23.

Acknowledgements

It is a pleasure to thank H.U. Käufl, A. Moorwood, E. Oliva, and L. Origlia for providing some of their unpublished results, and E. Oliva for making available his MIDAS routines to correct for the spectral line tilt.

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TIMMI at the 3.6-m Telescope

H. U. KÄUFL, ESO
R. JOUAN, P. O. LAGAGE, P. MASSE, P. MESTREAU, A. TARRIUS, DAPNIA/SAP, CEN-Saclay, France

Careful readers of *The Messenger* may have stumbled over the acronym TIMMI occurring in the context of instrumentation in various previous issues (see e.g. No. **61**, p. 58). In this article we report about the first commissioning run on La Silla in July 1992 and give a short description of the instrument. TIMMI stands for Thermal Infrared Multimode Instrument. TIMMI is supposed to become a general user instrument allowing for imaging as well as limited long-slit spectroscopy in the 10-μm atmospheric window. The project started in July 1990 when ESO signed a contract with the Service d'Astrophysique of the Commissariat à l'Energie Atomique for the development and supply of TIMMI (Principal Investigator: P. O. Lagage). The instrument was then built by the SAP according to ESO's specification in a period of two years.

1. Description of TIMMI

Like all infrared instrumentation TIMMI is a cryogenic instrument. It is mounted inside a Solid Nitrogen/Liquid Helium cryostat. Its optical principle is best described as an "infrared EFOSC". The optics consists of a f = 136-mm lens having a triple function: entrance window to the Dewar, focal reduction and field lensing. The telescope focal plane is located inside of the Dewar. Behind a f = 103-mm collimator there is a 3.6-mm ∅ pupil stop. The filterwheel is located behind that pupil stop in the collimated beam. This is followed by a lens-wheel.

The camera has three mechanical functions (operated remotely under computer control): a mechanism to exchange the cryogenic field mask with a cryogenic slit assembly, a filterwheel and a lenswheel. Figure 1 shows the non-trivial parts of the camera disassembled. The camera is interfaced to the telescope with the standard infrared adaptor (see Fig. 2) and utilizes the f/35 chopping secondary unit. It can be mounted both at the 3.6- and 2.2-m telescopes. At present, however, operation is foreseen primarily at the 3.6-m telescope.

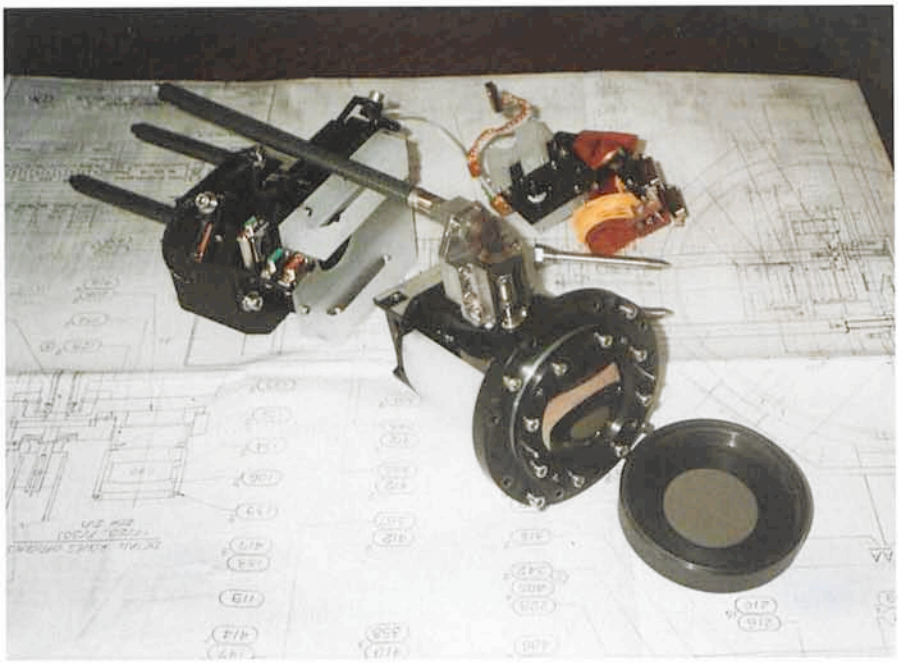

Figure 1: *The rare but essential ingredients of the camera cryostat are shown: cryostat entrance lens with mounting flange and slit assembly (front centre), block containing the lens wheel and the filter wheel (behind, left) and detector assembly with flexible cable (behind, right). The diameter of the flange holding the entrance window is 120 mm. All optics is from Germanium. Slit assembly and collimator are cooled to ≤ 75 K, lens and filter wheel to ≤ 60 K. The detector is connected directly to the liquid Helium bath. The greyish cylinders protruding into the upper left corner are the actuator rods connected to 4-phase stepper motors outside of the cryostat.*

The camera features a 64×64 element Gallium doped Silicon array bonded to a silicon Direct Voltage Readout (DVR) circuit. This detector has been manufactured by Leti/LIR, Centre d'Etudes Nucléaires de Grenoble, France. It has a well capacity of $\approx 2 \cdot 10^7 e^-$. The cut-Off wavelength of the detector material is ≈ 17.8 μm. Various magnifications can be chosen (at present 0.3 arcsec/pix, 0.46 arcsec/pix and 0.6 arcsec/pix). On the filterwheel a variety of standard filters as well as sufficient spare positions are available for specialized filters. The filters are mounted in a collimated beam so that no or only very limited refocussing of the instrument is required after change of the filter. Also the lenses are well enough pre-adjusted that no appreciable focus-shift occurs after the change of magnifications.

Because of the strong background radiation emitted by atmosphere and telescope in this part of the spectrum, rapid readout of the detector as well as fast processing of the data is required. Therefore TIMMI has an electronic front-end system somewhat faster but otherwise very similar to the ones already in use with the other infrared instruments

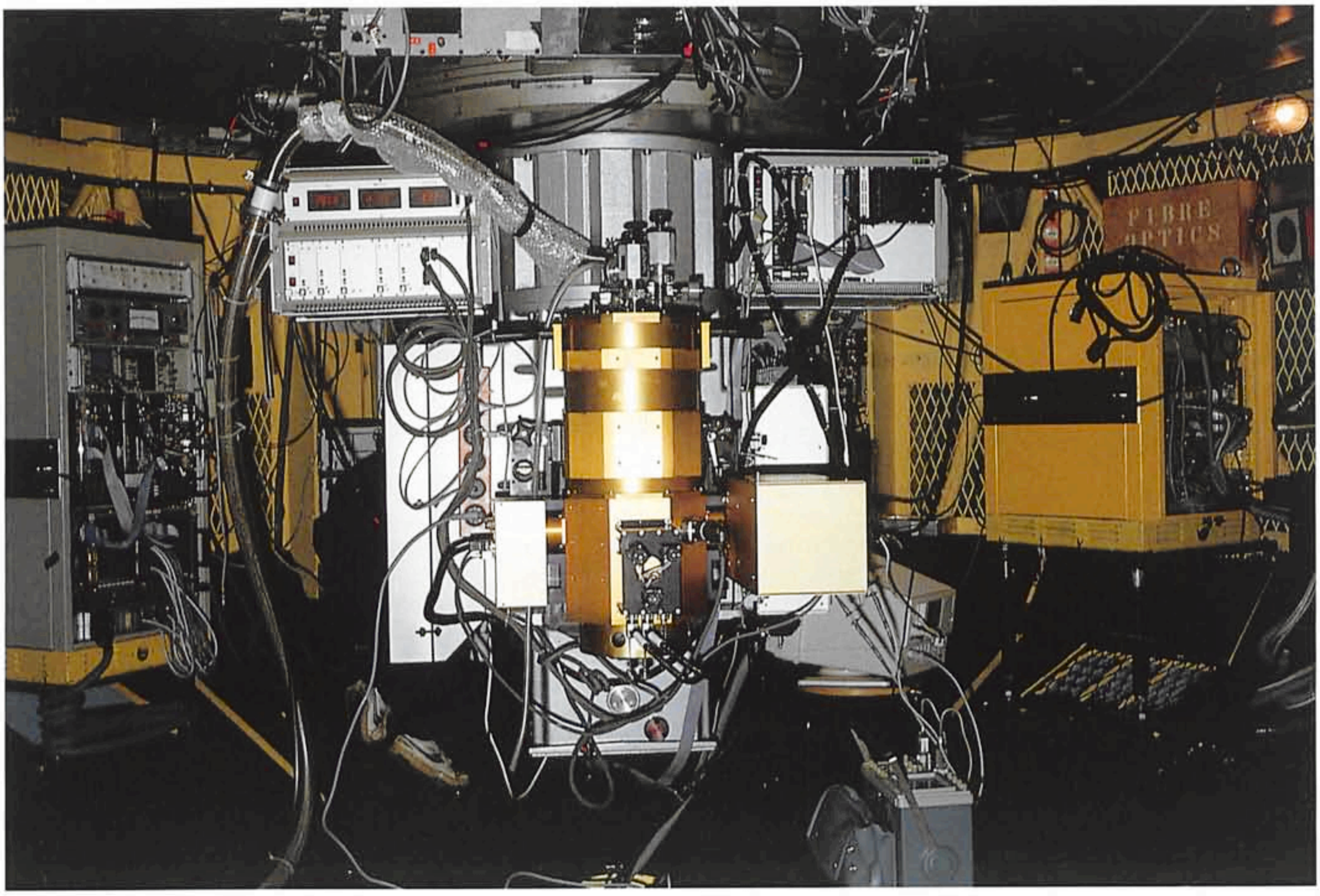

Figure 2: *This shows the complete cryostat of TIMMI mounted on the f/35 adaptor unit in the Cassegrain cage of the 3.6-m telescope. The entire camera/spectrometer is contained in a 30-cm diameter cryostat. In the lower centre of the cryostat the three stepper motor drives are easily distinguishable. On the top right of the adaptor flange the VME-rack with the preprocessing unit can be seen.*

(IRSPEC, IRAC1 and IRAC2) on La Silla. The frontend allows to read out the detector array in ≈ 7 ms and processing of the results according to the requirements of synchronous detection.

While TIMMI will provide new observational possibilities for the ESO users community it is also supposed to become a test-bed to gain experience for similar instrumentation at the VLT.

2. First Results

In the first test period a complete check-out of the imaging modes of the camera was possible. We could verify the image quality (typically 0.9 arcsec FWHM) which is only 30 % larger than the diffraction limit of the 3.6-m telescope. The sensitivity achieved is also within the range of expectations. When observing stars close to the detection limit of IRAS with a spectral bandpass 8.0–13.3 μm, we achieved e.g. for the 1000-mJy source SAO 192176 (IRAS 23468-2153) a S/N of 5–6 σ for the brightest pixel (scale 0.3 arcsec) for 80 s integration. If one compares the flux integrated over the 5 brightest pixels to the noise then the S/N becomes 9 σ. This indicates that on point sources TIMMI will allow to go fainter than the IRAS 12-μm channel while providing for near diffraction limited image quality.

TIMMI also compares favourably with the existing bolometer. Similar measurements with the other filters having a narrower spectral bandpass have not been done yet, but it can be expected that the sensitivity will be slightly better since the detector tends to perform better if it is exposed to less background radiation. For the above-quoted observation the background signal was $5 \cdot 10^5$ ADU per second and pixel, while the signal from the star was 110 ADU/s in the brightest pixel. All observing was done in chopping and nodding mode (≈ 6.3 Hz, amplitude 7–30 arcsec). As compared to nodding every 30s alone chopping increased the sensitivity typically 8–10 fold.

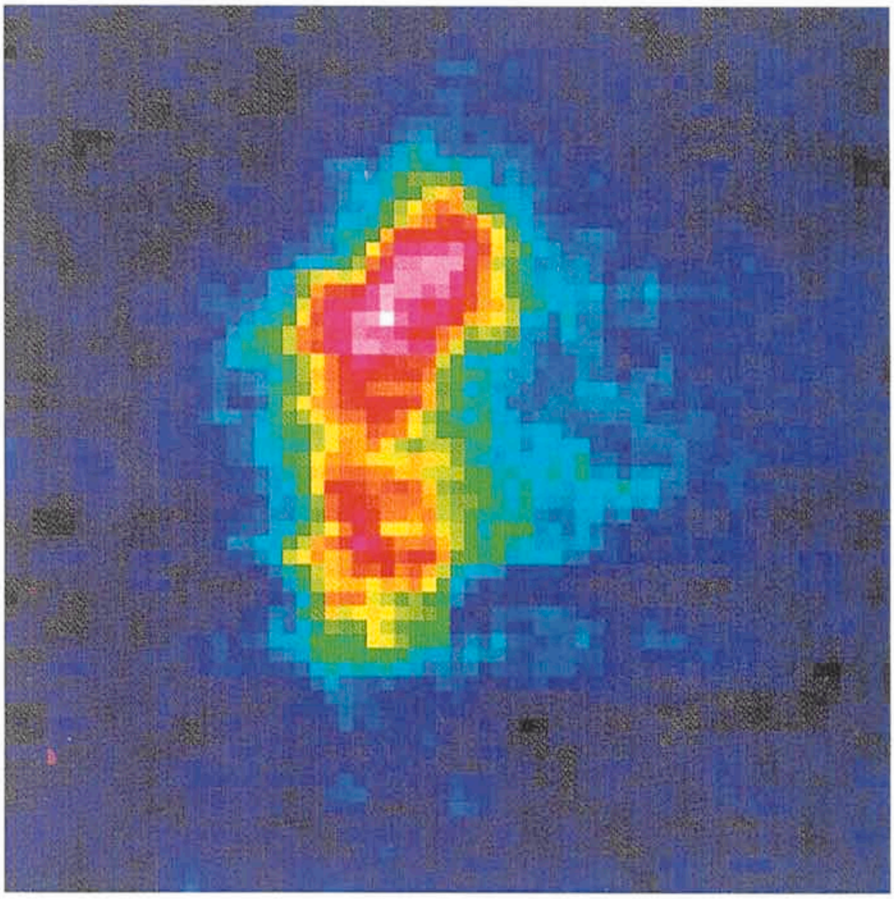

Figure 3: *This is an image of the Planetary Nebula NGC 7009 through a narrow-band filter centred at the wavelength of the 10.52-μm line of triple ionized Sulfur (ionization potential 47.3 eV). South is up on this image, east to the right. The pixel scale is 0.46 arcsec/pix, i.e. the size of the frame is ≈ 30×30 arcsec^2. The location of the central star would be right on the centre of the array but it is too faint at this wavelength to be detected. The observation of such lines in compact Planetary Nebulae is of particular scientific interest because of the high spatial resolution (0.9 arcsec FWHM) and the fact that even very compact nebulae are optically thin at these wavelengths. The integration time for this image was 12 min.*

In Figure 3 we show how the instrument operates with a narrow-band filter. This image was made using a 2%-bandpass centred around the wavelength (10.52 μm) of the forbidden transition of S IV. Similar filters are available for Ar III And Ne II. The Ne II filter was successfully used to image the low excitation Planetary Nebula IC 418.

Table of Filters of TIMMI:

M-band filter	λ_{centre}:04.71 μm	Δλ:0.63 μm
N-band filter	λ_{centre}:10.10 μm	Δλ:5.10 μm
N_1 filter	λ_{centre}:08.39 μm	Δλ:0.96 μm
N_2 filter	λ_{centre}:09.78 μm	Δλ:1.29 μm
N_3 filter	λ_{centre}:12.56 μm	Δλ:1.41 μm
ArIII	λ_{centre}:08.99 μm	Δλ:0.19 μm
SIV	λ_{centre}:10.52 μm	Δλ:0.23 μm
NeII	λ_{centre}:12.78 μm	Δλ:0.25 μm
Q-band	λ_{centre}:17.15 μm	Δλ:1.50 μm
...	λ_{centre}:11.65 μm	Δλ:2.70 μm
...	λ_{centre}:09.70 μm	Δλ:0.49 μm
...	λ_{centre}:11.30 μm	Δλ:0.57 μm
...	λ_{centre}:08.60 μm	Δλ:0.40 μm
...	λ_{centre}:07.70 μm	Δλ:0.35 μm

N.B.: The exact position of these filters may be slightly different because they still need to be exactly measured when mounted in the camera under operating conditions.

3. Future Work and Use of TIMMI by the Community

As stated above, TIMMI should also work as a moderate-resolution spectrometer. This mode could not yet be implemented, however, because ESO has not been able to procure suitable grisms (transmission gratings mounted to the back of prisms). Even though ESO had a prototype device on loan for evaluation from a commercial source, all attempts for procurement failed even though an intensive market survey was made. ESO therefore concluded a contract with the Fraunhofer Gesellschaft (Institut für Festkörpertechnologie, München) to produce such gratings from monocrystalline Germanium wafers. These gratings will then be packaged together with prisms and mounted to the filter wheel of TIMMI. We expect to receive the first test structures by the end of this year, while the complete set of grisms may be available in summer 1993. TIMMI will then provide a long-slit spectroscopic mode with a resolution $\lambda/\Delta\lambda \approx 300$ for a slit length of ≈ 35 arcsec.

As for the other IR systems on La Silla the preprocessor is a selfcontained hardware/software unit which also provides for a reasonable quick-look facility. Nevertheless, data transfer and data storage including more sophisticated on-line analysis of the raw data are required and have to be prepared. Right now TIMMI is operated from a MicroVAX which is made available on loan to ESO from the SAP for the observing runs. But even now all data can be easily transferred (via magnetic mass storage) to MIDAS for off-line analysis.

For operation at longer wavelengths (16.4 to 17.9 μm), a specialized lens is under construction which will be incorporated into the camera. This lens will be a doublet of CdTe with a pixel-scale of 0.45 arcsec/pix. A special antireflection coating will ensure that this mode will be ≈ 10 times more efficient as compared to using the standard Germanium camera lenses.

The next test period and a scientific observation period (the scientists of the SAP are entitled to several nights of guaranteed observing as a compensation for their effort) are scheduled for January 1993. ESO will inform the users in the announcement for observing period 52 (Oct. 1993 – March 1994) about how to apply for observing time with TIMMI.

Acknowledgements

We are grateful to all ESO staff in Garching and La Silla who supported us and thus made this first observing run successful. We would, however, like to specifically mention the help of B. Delabre, A. van Dijsseldonk, G. Fischer, M. Meyer, A. Moorwood and A. Silber in Garching and of H. Gemperlein, E. Matamoros, J. Roucher and U. Weilenmann at La Silla.

Fire at the 1-m Telescope!

During the past months, there had been much concern about how well the 1-m telescope dome is able to protect its valuable contents against the external elements. On some occasions, water was actually found in several places in the building after one of the numerous rainstorms this winter. As this might have a very adverse effect on the telescope electronics and optics, a programme to improve the water-impermeability of the dome was duly initiated.

On Sunday, October 25, asphalt had to be put on an area joining the building with the rotating dome. A torch was used in order to heat the asphalt to the appropriate temperature, but unfortunately some flames reached the inner part of the dome, which is covered by a special painting that is very inflammable. In a matter of seconds, all the inner part was on fire. An extinguisher that was ready for use was not of much help due to the great speed with which the fire progressed. The La Silla fire brigade came quickly (this was by the way the first time since its creation that its help was needed) and after a few minutes the situation was under control. Nobody was injured although the toxic gases produced inside the dome prevented people from entering without a mask for several hours.

As soon as possible, a thorough evaluation of the destruction took place. The inside cover of the dome was completely burnt. On November 10 it had already been cleaned and repainted. The cover of the floor suffered a lot, especially from drops of burning dome paint, and must be replaced. The inside crane is unusable. Hopefully, the delicate parts of the electronics and tele-

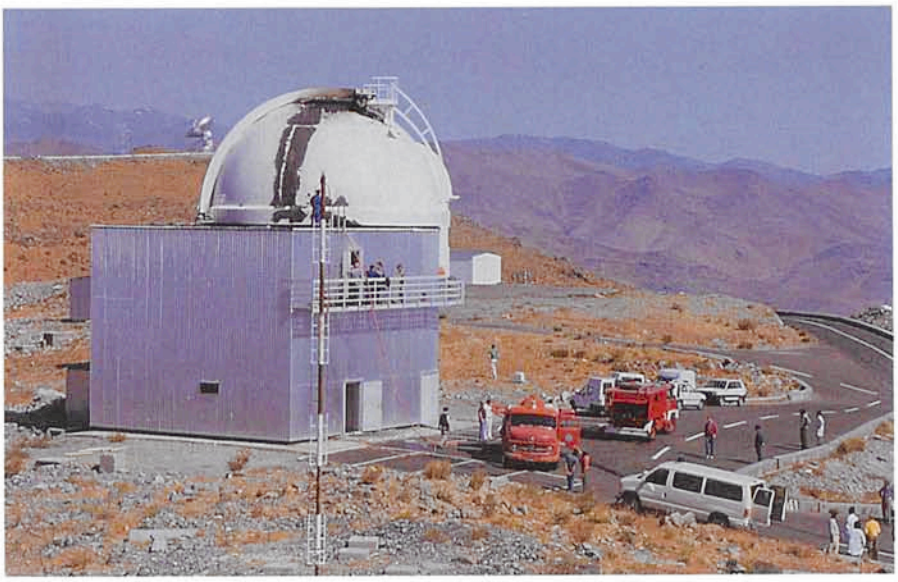

Figure 1: *The 1-metre dome after the fire on October 25, 1992. Photos by H. Barwig, München (who lost all his observing time).*

Acknowledgement

As visiting astronomers directly affected by the fire we would like to make the following remarks;

- Thanks to the quick, careful and efficient action of the ESO fire brigade, our special fiberoptic multicolour photometer (MCCP) was not severely damaged by the fire. After a lot of cleaning work and extensive tests that we were able to perform in the optical lab the next day, the instrument was once again operable.
- Shortly after the fire, the ESO staff members expressed their regret for the incident and immediately tried to obtain one or two extraordinary nights at one of the larger telescopes where our instrument could be used likewise: not an obvious gesture but one which was very welcome for us after the loss of all our observing time. Since it turned out that no test time was available, another observing run was arranged at the 1-m telescope in December.

We would like to thank all the people who made it possible for us still to perform our observations with such a short delay.

H. BARWIG, K.H. MANTEL,
Universitäts-Sternwarte München