spectrum with the image dissector scanner which displayed features similar to the ones of the Palomar spectra of 1958, also taken at maximum. In the meantime, infrared photometry had been obtained by Feast and Glass in South Africa *(Monthly Notices of the Royal Astronomical Society,* **161,** 293, 1973) and by Webster and Glass *(M.N.R.A.S.,* **166,** 491, 1974), which indicated that the star was both a strong and variable infrared emitter. At minimum light, the only spectrum described is the one mentioned by Herbig *(Astrophys. J.,* **127,** 312, 1958). It shows typical lines seen in the spectra of planetary nebulae ([OII], [NII], [SII]), but no carbon line in the usual wavelength range. An interesting optical spectrum was obtained by M. Pakull at ESO on May 30, 1982 when the star was becoming very faint. It shows a very different spectrum from the spectrum at maximum. C II lines are stronger with respect to the continuum (see figure), which itself has an opposite slope with respect to the energy distribution at maximum light, fairly typical of a B-type star. All these data are presently being analysed in collaboration with U. Heber (Kiel).

This object clearly deserves more attention, and observations (filter photographs, photometry and spectrometry) at various phases and in a wide energy range will be necessary before we understand the nature of this hot carbon star and its possible association with a neighbouring nebula. A possible model is the one of a moderately hot object surrounded by nebular material. Temporary but substantial ejection of gas leads to the formation of dust by condensation at high altitude and the star is obscured, while the infrared emission is strong. When the matter falls towards the central star, dust evaporates, due to the increasing temperature, and we see the infalling material as ionized carbon, giving rise to "inverted" P-Cygni profiles. At that phase the extension of the envelope is small and its volume emission in the lines is weak compared to the continuous photospheric emission. Therefore we do not see emission lines in the ultraviolet, but in contrast the emission lines appear in the visible and in the infrared where the photospheric emission is much weaker. This could be a qualitative model for the behaviour of this star, but many features remain to be explained and as Webster and Glass mention in the conclusion of their paper *(M.N.R.A.S.,* **166,** 451, 1974) "V 348 Sgr has something important to tell us" about stars at this stage of their evolution.

# A New Guider for the ESO 1 m Schmidt Telescope

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## Introduction

A new guider for the ESO 1 m Schmidt telescope was installed inside the telescope tube in June-July 1982. After about one year experience one can say that the system has proved to be very efficient. This device may be useful for other Schmidt telescopes where long exposures are hampered by guiding problems. Historically, the ESO Schmidt was equipped with two guiding telescopes of 20 cm diameter and 300 cm focal length. However, differential flexure between guiders and camera made long exposures impossible. Only a one-hour exposure, symmetrical with respect to the observer's meridian and using a low resolution 103 a-O or II a-O emulsion, was the very best one could obtain. To improve guiding conditions, two off-set guiders were constructed in succession and each one was used for a sufficiently long time to learn the requirements for an efficient off-set system. The new guider has its guide probe in the observer's meridian and at the North edge of the photographic plate. At this position the corrector plate is not vignetted by the main mirror's edge.

Compared with the 20 cm guiders there is a light gain of 3 magnitudes. An acquisition area of 0.071 square degree is available. In small field mode stars of $14^{m}.2$ are detectable and guiding, although with some effort, can be done on a 13th magnitude star. At the galactic pole 1.7 stars $\leq$ 13 m per 0.071 square degree can be acquired and at the Galactic equator 14 (Allen, *Astrophysical Quantities,* page 243). So star acquisition gives no problems.

In order to ensure a differential flexure-free link between guider and photographic plate, all optical parts of the guider between the guide probe and the cross wire are mounted as one strong unit on top of the North surface of the plate holder support device. The optics, imaging crosswire and star on the television camera detector are partly mounted on the tube wall because, for this part, differential flexure bears no consequences for perfect guiding.

With the 4-degree objective prism mounted, the guider sees spectra just as the photographic plate. These spectra are useless for guiding. Therefore, a two-prism system can be activated reducing the guide probe spectra into star images. This reduction can only be performed with the prisms placed in a parallel beam. So two objectives are used, the first one making the star beam parallel and the second one imaging the star on the cross wire. To avoid too large refracting angles for the prisms the focal length of the second objective must be not less than 600 mm. As a consequence the optical path between guide star and cross wire is so large that the beam must be folded within the area of the north surface of the plate holder support. This is achieved by introducing six mirrors. Two more mirrors are used to project guide star and cross wire on the television camera detector.

As the spectral dispersion of the objective prism must be in the direction of the declination, to obtain the best quality spectral plates, and the dispersion of the compensating prisms must be perpendicular to the declination direction, for reasons of mechanical stability, the spectra in the guide probe must be rotated over 90 degrees before they reach the compensating prisms. This rotation is achieved by a three mirror system in front of the first objective. In total eleven flat mirrors form part of the guider. At a reflexion angle of 45 degrees 87 % of the light is reflected. Therefore, the mirror system causes a light loss of about 1.7 magnitudes. To this should be added a light loss of about 0.2 magnitude due to the coated objectives. This loss of about 1.9 magnitudes is already taken into account in the limiting magnitude discussed above. All flat mirrors, except the first 3, have an accuracy of $\lambda/10$ and the first three $\lambda/5$. For long exposures and for declinations South of –50° the differential refraction between plate centre and guider is corrected by an electronic cross. (See Muller, *Abhandlungen der Hamburger Sternwarte,* Band X, Heft 2, 79.)

## Mechanical Description of the Schmidt Guider

Fig. 1 shows, inside the indicated ellipse, the location of the guider, and fig. 2 the detailed outlay of the optical parts. Mode

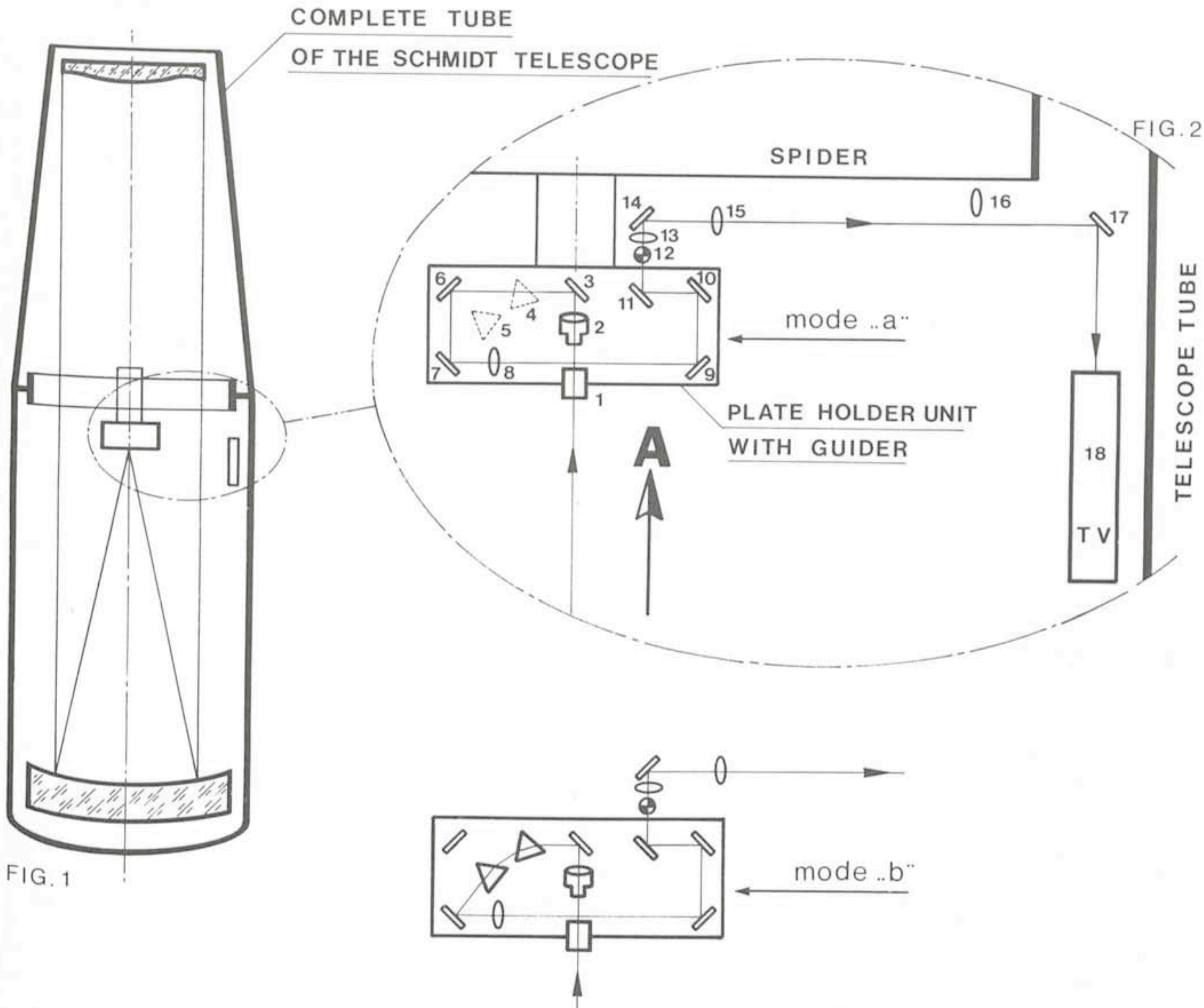


Fig. 1: *Sketch of the Schmidt telescope showing inside the ellipse the location of the guider.*

Fig. 2: *Detailed outlay of the optical parts of the guider. Mode "a", or "direct vision mode", is used for direct photography; mode "b", or "prism mode", when the objective prism is mounted; in this case, prisms 4 and 5 reduce the guide star spectrum into a starlike image.*

"a" is called the "direct vision mode" and mode "b" the "prism mode". Fig. 3 gives a top view of that part of the guider which is mounted on top of the plate holder support. The light enters through subassembly 1. This part consists of 3 mirrors causing the rotation of the guide field over 90 degrees. A drawing of this part is shown in fig. 4. The indicated light direction in fig. 4 is from the main mirror to the first guider objective. This objective is mounted on the subassembly 2 and is an F/2 Canon objective with a focal distance of 85 mm, producing a parallel beam along the paths 3, 4, 5, 7, 8 and 3, 6, 7, 8. The subassembly 2 has three degrees of freedom i.e. X and Y motion for star acquisition and Z motion for focusing with ranges of ± 5 mm. The bearings are completely free of backlash and clearance in the spindles is compensated by tension springs. The X, Y and Z positions are controlled by inductive gauge heads with 10 mm stroke and a setting accuracy of 5 microns. The gauge head controlling the Z position is clearly visible in fig. 3.

Part 3 is a fixed mounted flat mirror reflecting the parallel beam at an angle of 90 degrees with respect to the entering beam. After this reflexion, the observer can choose one of the

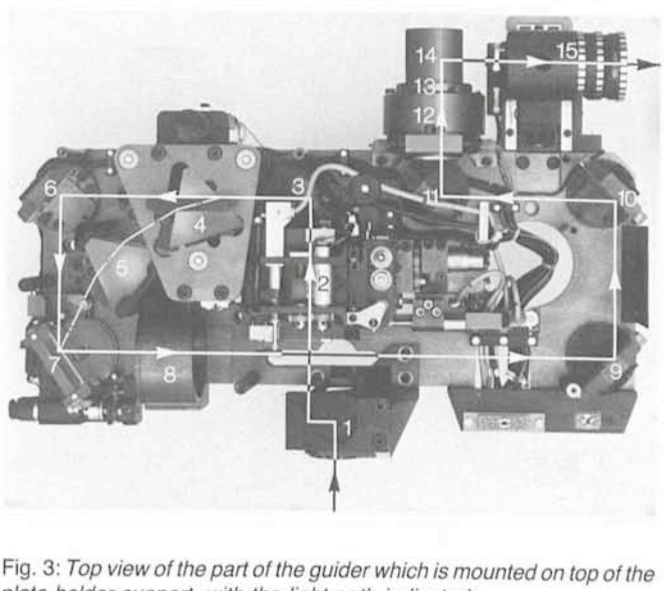


Fig. 3: *Top view of the part of the guider which is mounted on top of the plate holder support, with the light path indicated.*

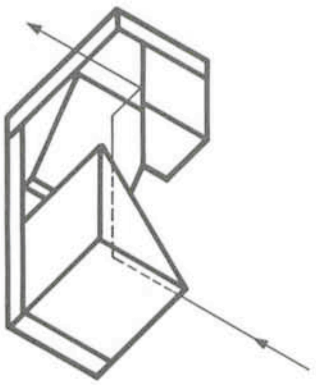

Fig. 4: *Drawing of subassembly 1 which consists of three mirrors producing a 90° rotation of the guide field.*

two modes "a" or "b" mentioned above. In mode "a" the beam passes underneath the upwards lifted prism 4 and goes to a fixed mirror 6 where it is reflected towards mirror 7. Mirror 7 reflects the parallel beam in the direction of the optical axis of objective 8. In mode "b" prism 4 is moved downwards into the parallel beam which now passes the prisms 4 and 5 and, when reaching mirror 7, is reflected in the direction of the optical axis of objective 8.

To achieve the same reflected direction for the beam coming either from mirror 6 or from prism 5, mirror 7 is made rotatable over a fixed angle and its position is commanded by the position of prism 4. The rotating table on which mirror 7 is mounted is clearly visible in fig. 3.

The second objective 8 has a focal length of 600 mm and a diameter of 60 mm. From this objective onwards there exists only one mode in which the imaging beam is reflected by the fixed mirrors 9, 10 and 11 to the cross wire device located at subassembly 12. Each wire of the cross is double and made of two strained quartz fibers, 30 microns in diameter and 300 microns apart, defining in the guide field a square of 2.9 × 2.9 arcsec square. The wires are illuminated by four LEDs positioned diagonally with respect to the cross.

The subassembly 13 holds a field lens with 250 mm focal length and 30 mm diameter.

The subassembly 14 contains a fixed mirror reflecting the guide beam to the tube wall. Here again the observer can choose between two modes, namely large field or small field mode.

Choosing small field mode, the subassembly 15 moves into the beam. This subassembly can support four different objectives with focal lengths of 140, 160, 180 and 200 mm and 30 mm diameter. Exchange of objectives is manual and can only be done when the telescope is in plate loading position.

Choosing large field mode, subassembly 15 moves outside the beam and objective 16 moves into the beam. This objective has a focal length of 200 mm and a diameter of 50 mm. It is mounted on a rotating arm which is attached to the tube wall. Changing the field modes takes 5 seconds.

Finally the beam is reflected by mirror 17 to the television camera 18.

The visible field on the monitor is for the large field, which fits completely within the monitor screen, 251 × 258 arcsec square and for the small field, where the dimensions of the monitor screens set the limits, 109 × 96 arcsec square for the 180 mm objective.

Except for the exchange of the four small field objectives all other functions are remote controlled from the observer's room.

The total weight of the guider unit shown in fig. 3 is 9 kg and it is accurately balanced to avoid spider rotation.

Except for the optical parts 1, 2, 4 and 5, all optics were purchased from Spindler and Hoyer, Göttingen. The objective 2 was bought in the local market. The optical parts 1, 4 and 5 were purchased from Horst Kaufmann, Crailsheim.

We would like to mention that all mechanical parts of this guider were manufactured by our mechanics in the Astro-Workshop at La Silla under the supervision of Jorge Díaz and Walter Vanhauwaert.

The electronic circuitry was designed by Rolando Medina of the T.R.S. and installed by him and his collaborators.

We also would like to thank Francis Franza and Maurice Le Luyer for their support during the design development of the optical parts 1, 4 and 5.

For technical information or drawings contact W. Eckert.

# PERSONNEL MOVEMENTS

## STAFF

### Arrivals

#### Europe

FINGER, Gert (A), Infrared Instrumentation Engineer, 11.7.1983
DE SCHOUWER, Marc (B), Administrative Assistant (Accounting), 19.9.1983

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GRANBOM, Sven (S), Head of operations, 1.10.1983

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KLIM, Klaus (DK), Electronics Engineer, 30.9.1983
LJUNG, Bo (S), Electronics Engineer, 30.11.1983

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ARDEBERG, Arne (S), Director at La Silla, 23.10.1983
NERI, René (F), Electro-mechanical Engineer, 31.12.1983

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BJÖRNSSON, Clæs-Ingvar (S), 30.9.1983
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### Departures

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LUCY, Leon (GB), 31.8.1983
SALVATI, Marco (I), 30.9.1983