ANNUAL REPORT 1971

EUROPEAN SOUTHERN OBSERVATORY

ANNUAL REPORT 1971

prensented to the Council
by the Director General, Prof. A. Blaauw

Organisation Européenne pour des
Recherches Astronomiques dans l'Hémisphère Austral

EUROPEAN SOUTHERN OBSERVATORY

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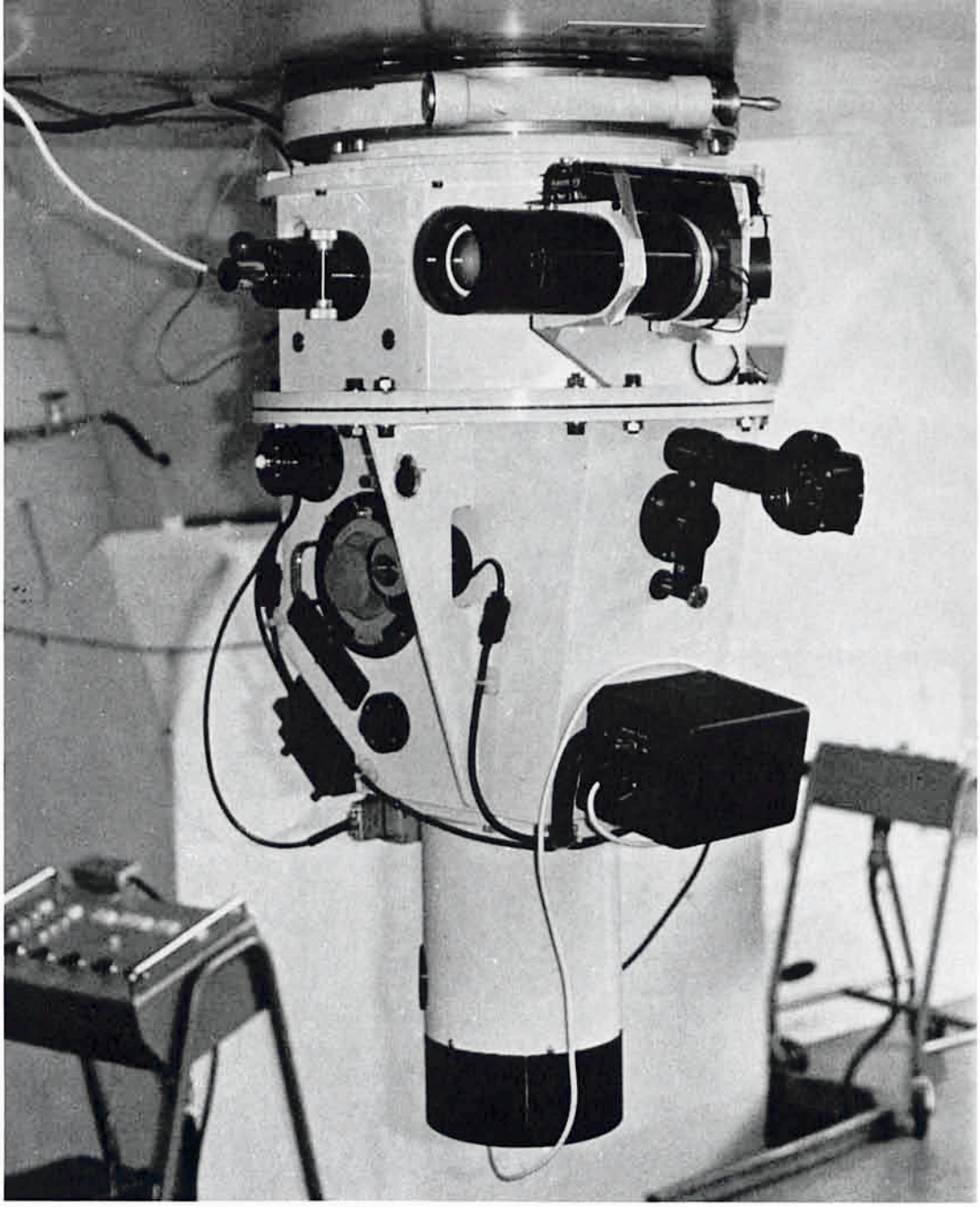
INTRODUCTION

General Developments and Special Events

The year 1971 brought continued growth and developments in all divisions of the Organization. Far from being an observatory in regular operation, ESO is still being built up, according to the programme formulated in its Convention. Planning and construction determined the nature of the work of most of its staff, at least as much as the utilization of the existing observational facilities.

The TP-Division, in charge of the 3.6 m telescope project, established in 1970, vigorously took up its activities. It profited much from the facilities offered by CERN. Reconsideration of the original designs led to important changes in the telescope building and to some essential modifications of the telescope design. The work of the Division was inspired by discussions on large telescope design in general at an international conference initiated by ESO, held in March at CERN.

In Chile, where the regular operations conducted by the local staff of astronomers and by visiting astronomers from Europe continued to increase in intensity, im-



New ESO Cassegrain Image Tube Spectrograph. A three-stage image intensifier is incorporated into the finder.

RESEARCH ACTIVITIES

Research Programmes

Visitors' Research

Tables 1–4 summarize the programmes undertaken by visiting astronomers during 1971.

Galactic Structure

The Galactic plane

Bigay, Garnier, Georgelin and M^{me} Georgelin studied a 4º5 x 4º5 region in Carina. With Perot-Fabry rings they obtained radial velocities of 10 H II regions: noncircular motions are found only in the outer edge of the spiral feature, they are

$V_{mod} - V_{obs} = 3{,}7$ km s^{-1}. A comparison with radio observations was made. The distances of 29 exciting stars or early-type stars were obtained from spectroscopic and photoelectric observations; these observations proved that at this longitude we are looking tangentially along a spiral arm between 2 and 5 kpc.

Dubois obtained a large number of spectrograms of galactic supergiants in order to establish a quantitative calibration system based on line intensities and to apply them to the supergiants of the SMC.

M^{me} Grenier reports that she obtained 150 spectra with the RV Cass spectrograph for completion of a programme begun in January and February 1970. The aim is to study the kinematic, physical and chemical properties of G-type stars in the direction of galactic rotation.

The two observing periods will allow the study of 62 stars. The number is still insufficient for a statistical study.

Haug used the 1 m photometric telescope for H β observations of stars in Norma. 750 single observations were reduced, the transformation to the standard system was established. A r.m.s. error of the final H β indices of $\pm$ $0^m.006$ may be expected. More than 150 out of a total of 212 H β indices are in the range $2.62 <$ H β < 2.77, where reliable absolute magnitudes can be derived with the help of existing calibrations.

Concerning the corresponding UBV observations (890 single observations) obtained with a 16-inch telescope on Cerro Tololo, the charts were read, the results punched on cards and transformed into UBV data with the help of the standards observed along with the programme stars. Some final adjustments have still to be made. K. Bredow, a student of Hamburg University, is responsible for handling the data.

M^{lle} Jonas observed 3 galactic fields, at

$l = 245°$ (associations Pup OB 1 and 2)

$l = 315°$ (near α Cen)

$l = 337°$ (OB association Ara OB 1)

with the astrograph GPO for the determination of spectral types and radial velocities.

The plates of Puppis fields were first studied:

- spectral types were determined with good precision till magnitude 12
- radial velocities are being measured on a spectrocomparator.

In the two other fields, stars were listed and are going to be classified.

Klinkmann observed the area $l = 315°$ to $l = 325°$ $|b| \leq 2°$ with the astrograph GPO in order to obtain spectral classification of stars measured in UBV and H β and in particular to search for new WR stars.

Chu-Kit is studying the structure of the Galaxy in the direction of Carina. He took spectrograms of O-B type stars with the coudé spectrograph of the 1.52 m telescope. The dispersion used is 12.4 Å/mm.

The most distant stars of his observations are at 7 kpc from the sun.

The radial velocities of the interstellar Calcium and of the stars are being compared with the same derived from the Schmidt model. He noted that on each side of $l = 292°$ the residual velocities $\triangle V = V_{obs}-V_{mod}$ are of opposite signs as R. Humphreys demonstrated.

Lyngå used the 1 m telescope to carry out observations in three galactic fields at $l = 280°$, $289°$ and $298°$ with $b = 0°$. The UBV sequences were extended to about $V = 17.0$ by means of offset photometry. A start was made to establish RI sequences in the fields.

He used the RV Cass on the 1.52 m telescope to observe OB stars in the Carina and Centaurus sections of the Southern Milky Way for MK classification and radial velocity determinations.

Neckel observed 253 stars of types M2, M3 III as a continuation of his studies of the distribution of M stars; he has previously observed the Northern Milky Way.

Grenon reports the following results from observations in the Geneva 7 colour system for a programme initiated by Drs. Golay and Spite:

In order to ensure better comparability with the photometric system of Geneva the measurements were made with a Swiss photometer containing the original series of filters; these together with the photomultipliers define the 7 pass bands.

1002 measurements in 7 colours and 95 measurements of only visual magnitudes were obtained. The total number of new objects available in 7 colours amount to 303, normally measured twice.

The initial part of the programme contains the establishment of a photometric standard sequence, in 7 colours, of a precision comparable to the one so far obtained in the northern hemisphere. At present it contains 33 stars of magnitude 6.0 to 9.0 and of spectral types that range between O to M, in a zone centered at $\delta = -35°$ and extending from $\alpha = 11^h$ to 6^h.

All the stars of that standard sequence were measured at least four times together with well measured stars from the northern hemisphere. Their colours are given with a standard error of $\sigma = 0.005$ magnitude.

Starting from the standard sequence so determined, the apparent magnitudes were calculated for all the programme stars. Taking into account the number of measurements per star the resulting precision is 0.005 to 0.007 magnitude.

Galactic Clusters

Borgman and Koornneef used a special offset-guiding K- and L-photometer with LN_2 cooled PbS cells, constructed by Borgman at the Kapteyn Observatory in Roden, to observe stars in a heavily reddened cluster in Ara. The reduction of the data gathered with this photometer attached to the 1 m ESO telescope

during the month of August 1971 is in progress, but preliminary infrared colours of approximately 30 individual stars in the cluster seem to substantiate the early (1970) conclusions. There is no indication that the thermal radiation expected from the dust is significantly influencing the stellar measurements at 2,2 μ or even 3,5 μ. This indicates a dust temperature smaller than 1000 K. In order to get more information on the total mass, the density and the temperature of the dust, it is necessary to make observations at even greater wavelengths. It is expected that 5 μ observations will be made in the near future.

Dachs obtained 28 coudé spectra with a dispersion of 20 Å/mm in the blue wavelength region λ 3400 – 5000 Å for 22 early-type stars in the open cluster NGC 2516. Several formerly unknown stars with peculiar spectra were detected. These include one B-type emission-line star (HD 65663), one titanium star (HD 66318) and four silicon stars.

He established photoelectric sequences in the UBV system down to magnitude $V = 15^m.8$ in the open clusters NGC 2516, NGC 4755, and in Norma. These observations were supplemented by observations at the 61-cm telescope of the University of Bochum.

He has also taken 35 plates of 8 galactic fields in Carina, Crux, and Norma with the GPO astrograph.

Grenon observed stars in the galactic cluster NGC 6475 using the Geneva 7 colour system. A systematic study of the central region of these clusters has made it possible to isolate a group of 100 stars as possible members; they have a magnitude lower than or equal to 11.0. Of these stars 78 have been measured, 66 of them twice. For the latter the precision of the normalized colours and the visual magnitudes is of the order of 0.007 mag.

The following problems will be analyzed by means of photometric criteria: membership of cluster, binaries, interstellar reddening, metal abundance, distance modulus and age, taking into account the particular distribution of rotation velocities in the cluster and their effect on the determination of the indicated parameters.

High-latitude Areas

Alcaíno established a photoelectric sequence of ten stars in the magnitude range $10 < V < 15$ for the globular cluster NGC 6101.

M^{me} Andrillat, Fehrenbach and Swings continued their programme of spectrographic observations of southern planetary nebulae. The study of the spectroscopic material made real progress. A first, more or less qualitative and descriptive, examination was completed; it contains about 30 pages. This work was done in Liège. A second part, devoted to radial velocities, is being taken care of by the Marseilles Group.

Grenon, in collaboration with Spite, has begun a study of K giants in the neighbourhood of the galactic pole. He has measured with the same precision as above in the Geneva 7 colour system:

– 54 giants G5 III to K3 III of magnitude 5.5 to 6.5

– 51 stars of type G5 to K3 of magnitude 7 to 10.

A small proportion of the second sample has been found to be of class V.

These measurements will be published with an indication of absolute magnitude, spectral type, [Fe/H] and photometric parallax.

A number of interesting objects were included in the observations:

– 33 stars of very high velocity, with regard to determining their [Fe/H], absolute magnitude and approximate age.

– A group of stars of type dM with large trigonometric parallax.

– A group of K sub-giants.

– 13 multiple systems of late spectral type and of the combination (dK + dM) and (gK + dG); they are included with the aim of establishing the absolute magnitude calibration and the chemical composition of the cool stars.

Plaut carried out the following photometric programmes in B and V:

1. Standard stars in fields 1 ($l = 0°$, $b = +29°$) and 2 ($l = 4°$, $b = +11°$) of the Palomar-Groningen Variable Star Survey.

2. 16 RR Lyrae-type variables in the same fields.

The reductions were made in the conventional way. B and V magnitudes in the Cape E regions were used as standards. The relations of the instrumental magnitudes and the standard ones are

$$v - 10^{m}.00 = \underset{\pm 21}{-0.032} + \underset{\pm 2}{1.000}\,(V - 10.00) - \underset{\pm 7}{.049}\,(B-V)$$

$$b - 10.00 = \underset{\pm 21}{-0.006} + \underset{\pm 2}{1.004}\,(B - 10.00) - \underset{\pm 8}{.046}\,(B-V)$$

These observations combined with those during 1970 allow the magnitude scale and zero point of the three fields to be determined more accurately than was possible with earlier measurements. As a consequence, the photometric base of the variable-star survey is more strengthened. The observations of the variable stars yield accurate colour indices and, hence, a determination of the interstellar absorption in the observed directions.

P. S. The reports that R, I observations with the 1 m photometric telescope were carried out by J. van Paradijs in a programme to determine the luminosity function of M dwarfs.

26 M stars were observed twice, and 78 once. For the sequence stars (Kron's standard stars in Harvard regions D2 and D10) these numbers are 10 and 16, respectively.

The Magellanic Clouds

Appenzeller used the 1 m photometric telescope and the ESO photometer to carry out differential UBV photometry for 18 bolometrically very bright O and B stars in the Large Magellanic Cloud. The objective of this programme was to detect small-amplitude short-period luminosity fluctuations in these stars and to compare the results with theoretical predictions for the structure and evolution of very massive stars. For this purpose each programme star was repeatedly observed during at least three different nights. Almost 800 UBV observations were obtained. A preliminary examination of the reduced data shows that luminosity fluctuations much larger than the statistical errors are present in at least a major part of the observed stars. One star (no known variable) brightened slowly by 0.4 magnitude during the observing run.

Azzopardi observed the Small Magellanic Cloud with the GPO astrograph.

He obtained 23 plates for spectral classification in the direction of the Small Magellanic Cloud and 14 plates of supergiant stars for absolute magnitude calibration.

9 of the 14 fields that cover the region studied were investigated. The known members of the Small Magellanic Cloud were identified and are ready to be measured with the automatic microphotometer.

Bigay has measured photoelectrically in the UBV system various objects in the Large Magellanic Cloud (LMC):

1. About 50 Population I and globular clusters (total measures).
2. About 60 early-type stars belonging to 8 Population I clusters in LMC.
3. About 100 O-B stars from the Sanduleak catalogue of 1272 stars brighter than photographic magnitude 14.

The results from the investigations in 2) and 3) were prepared for publication by Bigay, Bernard, Paturel and Roux. Two-colour diagrams, colour-magnitude diagrams and colour-spectral type diagrams are given. The conclusion is drawn that these very young stars studied in the LMC do not differ in any significant way photometrically from their galactic counterparts.

M^{me} Carozzi continued the study of the junction of the Small Magellanic Cloud – Large Magellanic Cloud. She is preparing an article on interesting junction stars. They have the following characteristics:

– they are of intermediate or high velocity

– the spectral type varies quite considerably (B – A → K)

– they are certainly not supergiants.

M[lles] Divan and Burnichon observed 13 supergiants of types B and A with the Chalonge spectrograph attached to the Cassegrain focus of the 1.52 m telescope. They determined the spectrophotometric parameters of the BCD classification (λ_1 D, φ_b) and the gradients φ_{rb} (6200 – 4000 Å) and φ_{uv} (3700 – 3130 Å). The following results were obtained:

1. The λ_1 and D values obtained confirm that the LMC supergiants are even more luminous than those of the Galaxy.

2. The spectral types λ_1D obtained for 13 supergiants are in good agreement with those determined spectroscopically by Prévot and Maurice.

3. The interstellar reddening obtained is somewhat larger than normally found for the LMC.

4. The distance modulus of the LMC was determined by a new method completely independent of the ones so far used. This has been done by using four stars in the LMC which are somewhat less luminous than the other stars studied. This makes them coincide with the galactic stars in λ_1D. The distance obtained is somewhat smaller than generally found. Part of the difference would be attributed to the difference in interstellar reddening; this is larger for these four stars than for the other stars in general.

All these results were communicated in Symposium N° 50 at Córdoba.

In order to determine the spectrophotometric gradients, the atmospheric absorption coefficient a_λ and the ozone quantity were determined every night. The results are:

1. The a_λ values determined for different directions in the sky were always identical within a single night (except for one case in 12 nights).

2. a_λ is a linear function of $(\mu_0^2 - 1)^2\ \lambda^{-4}$ (Rayleigh's law) and this linear relation was always close to the theoretical one. This result is possible only for a very dry atmosphere. The presence of mist will always make the a_λ function considerably different from that predicted by the Rayleigh law.

3. The reduced thickness of the ozone layer of the high atmosphere is found to be somewhat higher (although not very high) than the value normally accepted for this season (January) and for this latitude (–30°).

M[me] Duflot and Fehrenbach continued the observations of the Large Magellanic Cloud with the GPO astrograph in order to complete their material. This programme is aimed at getting well centered plates of the regions which were badly situated in the former fields and also as an extension.

The Catalogue in "Astronomy and Astrophysics, Special Supplement Series N° 1, 1970" listed 475 LMC stars and 1830 galactic stars in the direction of the LMC found on the plates taken mostly on La Silla during former years. 63 LMC stars and 209 galactic stars have now been added (in press). The radial velocities of 435 LMC stars and 1182 galactic stars have been determined. With the help of the radial velocities the study of the rotation of the LMC is under way.

Fehrenbach measured a number of radial velocities in spectra obtained with the coudé spectrograph in order to determine their quality. The agreement of these velocities with those of IAU is excellent. The radial velocity measurements of a certain number of stars of the LMC have been published in "Astronomy and Astrophysics": "La mesure des vitesses radiales au spectrographe coudé du télescope de 152 cm de l'Observatoire de Haute Provence".

It was found that the radial velocity of a number of supergiant stars varied with the number of the lines in the Balmer series. This effect may be explained by an expansion motion of the stellar atmosphere.

Fehrenbach has also published a new study of the star S22 "L'étoile S22 du Grand Nuage de Magellan présentant les raies de FeII et FeII en émission", for which he obtained an excellent spectrum in December, 1970.

In this case, too, a strong variation of the radial velocities is noted with the numbers of the lines in the Balmer series; the existence of a high ionization layer containing He II seems certain.

Klare and Schnur established one R, I – sequence and two UBV – sequences in the Small Magellanic Cloud. The observations are still being reduced.

Herczeg observed the variable HV 2241(h $57^m.2$, $-66°38'$) photoelectrically with the 1 m telescope on La Silla. Between January 9 and 31, in 4 complete and 12 half nights, 501 UBV observations were secured.

HV 2441 is the brightest eclipsing variable ($P = 4^d.34$, m(min) = 14.3) in the Large Cloud, situated near NGC 1760; according to Thackeray, the B-type supergiant is a system member. A preliminary discussion of the light variations, based on Harvard photographic observations, was given by Russell. The 1971 La Silla measurements were referred to the near-by star HDE 268732. The difference comparison star-check star indicates a mean error of one measurement: $\pm 0^m.026$. An incomplete light curve has been obtained. It is very similar to that of β Lyrae. Since 3P = 13 days, a continual coverage of the light variation is not possible within a few weeks. The investigation is to be completed in January 1972.

M^{lle} Martin used the GPO astrograph for two new programmes with the aim of detecting member stars of the LMC.

For the first programme the two prisms forming the objective prism system were adjusted so that the two spectra obtained for each star were touching each others. A simple examination of the plates allows the detection of high radial velocities by measuring only the distance of two homologous lines.

The second programme concerned the detection of faint blue stars in the Bar. Under normal observing conditions the detection is very limited due to the great number of superposed spectra and also due to the sky background. An interference filter was placed in front of the lens, cutting out the spectrum to the red of H δ, and suppressing completely the sky background. The information given by the spectrum between H δ and K is sufficient for the detection of O-B stars.

A first examination of the two fields situated in the Bar and covering $2° \times 4°$ has allowed about 30 new O-B stars to be detected.

Prévot observed with the RV Cass spectrograph on the 1.52 m telescope:

Some supergiants of the LMC in the Fehrenbach-Duflot list which did not yet have spectra of good quality or had no spectra at all. Of these

– G1 and G52 were recognized as galactic stars;

– G39 as a very late-type member of the LMC;

– G410 and G426 as members of spectral type A; and

– G147b, G408, G242, G3, G222, G241 were reobserved.

The star G237 is probably a galactic F type star of great velocity. This star belongs to the range of intermediate luminosity stars.

Prévot also observed southern galactic F-G supergiants for M^{lle} Rousseau's study of the colours of the cool supergiants of the LMC by 6-colour photometry.

Schmidt carried out polarization measurements within the Magellanic system.

From starlight polarization measurements within both Magellanic Clouds by Mathewson and by Ford and Schmidt a magnetic field connecting the Small and the Large Magellanic Cloud is indicated. From the data at present available it is not possible to trace the magnetic field between the Clouds with any detail and to eliminate the disturbance by the galactic foreground polarization with sufficient certainty.

Therefore further starlight polarization measurements were undertaken during 15 nights using the ESO two channel polarimeter of the 1 m photometric telescope at La Silla. 66 Magellanic Cloud stars and 47 galactic foreground stars up to 14^m were observed in the Small Magellanic Wing region and the southwestern outskirts of the Large Cloud. The reduction of the measurements is in progress.

External Galaxies

Alcaíno observed the following galaxies in the UBV system through a 22″ diaphragm, an average of three times each, with the 1 m telescope: NGC 1549, 7213, 1291, 1316, 1553, 1947, 7049, 1433, 6753, 55, 1097, 1515, 1566, 1617, 6744, 253, 300, 1365, 1672, 2442, 7090, 7424, 7793, 7552, 613, 7496; IC 5273, 5328.

M^{me}Alloin carried out spectroscopic and photometric observations of nuclei of galaxies. Good spectra were obtained with the RV Cass spectrograph on the 1.5 m telescope for the following objects:

IC 4662 – NGC 6822 – NGC 7469 – NGC 7496 – NGC 7552 – NGC 1084 – NGC 1097.

NGC 7469, a Seyfert galaxy, exhibits intense and broad emission lines.

NGC 7496 and 7552 essentially show a strong UV continuum. IC 4662 appears to be a strange object, with numerous intense and narrow emission lines superimposed on a faint continuum. Other objects have spectra of "normal" nuclei of galaxies with some emission lines ([O II], [O III], H I in some cases).

Photometric observations of these same nuclei were obtained at the 1 m telescope. The RCP 192 photometer was used with a set of seven interference filters (from 3500 to 6100 Å, with band widths of the order of 100 Å): four of them refer to the continuum and three to emission lines ([O II], Hβ, [O III] 4959 + 5007).

The measurements are being reduced together with the spectroscopic information.

Special Objects

Le Contel reports that he and his collaborators, M^lle^ Dantel, Sareyan, and Zribi, are still reducing their observations. The programme consisted of simultaneous spectrographic and photometric observations of β CMa stars and δ Scuti stars. The following stars were observed under such conditions: γ Peg, 8 Oph and 53 Pis (β CMa type stars); HR 8006, MR 515, HR 432 (δ Scuti type stars).

Havnes' observing programme was aimed mainly at investigating spectrum variations in peculiar A stars (Ap stars). The following stars were observed at highest dispersion (3.3 Å/mm):

HD 72968 (3 Hya) — 12 plates were obtained. The star is rich in lines and the lines are sharp.

The star is probably a spectrum variable but with fairly small changes in the spectrum. The period is probably 5.9935 days.

HD 125823 (a Cen) — 14 plates were obtained.

HD 148898 — 17 plates were obtained. The star has fairly broad lines and is definitely a spectrum variable. The period is probably 3.75 days; this value is, however, rather uncertain due to a large scatter in the measured equivalent widths.

HD 886 — Two plates were taken at the request of Snijders at Sterrewacht, Utrecht, who is going to study helium line profiles in this star.

The following stars were generally observed at 12.3 Å/mm:

HD 81009 — 14 plates were obtained. This star is very rich in lines and appears to show the so-called "broad, hazy component" around the Ca II K-line.

HD 110073 (Z Cen) — 15 plates were obtained. This star is peculiar, having strong λ 4121 and 4128 A. Apart from this, the star is fairly poor in lines.

HD 111133 — 16 plates were obtained. This star is very rich in lines and the lines are sharp.

HD 125489 — 12 plates were obtained. The star is listed with a high metal index $m_1 = 0.225$, $c_1 = 0.866$. At first glance the spectrum looks like that for a normal A3 — A6 star.

HD 159376 — 13 plates were obtained. A Si-4200 A star with sharp and not too many lines.

HD 161701 – 15 plates were obtained. A Hg-Si star with few but sharp lines. The star is a spectrum variable and variations in the Ca II K-line suggest a period around 7 days.

HD 162374 – 16 plates were obtained. This star is a blue straggler in the galactic cluster M7. The spectrum contains few lines. The possibility of radial velocity variations is being examined.

HD 203006 – 15 plates were obtained. A Cr-Sr-Eu star with not too sharp lines.

De Loore's programme aimed at deriving periods of light variations in three coulours (UBV) of peculiar A stars.

The following stars were observed: HR 4854 (9 times), HR 3398 (8 times), HR 3724 (8 times), HR 6179 (9 times), HR 6153 (7 times), HR 5378 (7 times), HR 8151 (10 times), DM 4093 (7 times) with the Danish 50 cm telescope.

For each programme star two comparison stars were used in the immediate neighbourhood and with nearly the same magnitude and colour.

Reduction of the observations was carried out at the Astrophysical Institute of the University of Brussels with a computer programme.

This computer programme was used to calculate the real B-V, U-B, V values of the programme stars and comparison stars, and the differences $\triangle$ (B-V), $\triangle$ (U-B), $\triangle$ V of these values for programme stars and comparison stars.

It was found that another series of observations will be necessary before accurate periods can be determined.

Hunger used the coudé spectrograph of the 1.52 m telescope to obtain 12 and 20 Å/mm spectrograms of helium stars. These include six new members discovered by Bidelman/McConnell. A preliminary analysis shows that five of them are similar to σ Ori E, with a ratio H : He of 1 : 1 (by number), while one (HD 144941) has a ratio of 1 : 10. The latter object is the first found to be intermediate between the extreme helium stars like HD 124448 and σ Ori E.

Kegel reports on his observations with the coudé spectrograph of the 1.52 m telescope: High dispersion spectra of early F-stars, in particular of α Car, η Lep, α Cir and ϱ Pup were taken for a study of the physical structure and chemical composition of the atmospheres of these stars. It is hoped that a careful analysis of the spectra will give clues to an understanding of microturbulence and eventually link this quantity to other physical parameters. The evaluation of the material has not yet been completed.

In addition, a few spectra of early-type stars were taken for B. Baschek and M. Scholz.

Imbert observed some eclipsing binaries with the coudé spectrograph of the 1.52 m telescope. For these stars of relatively short period (some days) the immediate aim of the observations was to find those which showed a line doubling in the spectrum; these stars would then be observed continuously.

5 of the 12 stars in his programme presented a double spectrum; nevertheless, the number of spectra obtained for those stars (5 to 10) was insufficient for an

accurate calculation of the orbital parameters; at least 20 spectra are necessary for this purpose.

However, a first estimate of these parameters was compiled. The data will be improved after the completion of the material (in August – September, 1972).

Maitzen reports that he used the coudé spectrograph of the 1.52 m telescope to carry out observations of HD 125248, 148898, 98088, 203006, with the aim of studying the spectrum variability of these Ap-stars: plates are being reduced and evaluated.

He installed an automated photometric observing system at the Bochum telescope and used also this telescope for various photoelectric observations, among others, of the suspected pulsating variable star HR 5491.

Seggewiss used the coudé spectrograph of the 1.52 m telescope for observations of southern WR and Of stars. He obtained the following spectra in 12.3 Å/mm dispersion:

HD 113904 = ϑ Mus	WC6 + O9.51	V = $5^{m}.69$	15 spectra
HD 151932	WN7	6.47	12
HD 152270	WC7 + O8	6.72	12
HD 151804	O8fp	5.22	9
HD 152248	O7f	6.1	3
HD 152408	O8fp	5.79	9
HD 152236 = ϱ Sco	B1.51a	4.71	3
HD 157457	K1III	5.22	2

The reduction of the material has begun.

Terzan carried out photoelectric photometry (UBV) of three variable stars: V 743 Cen, HQ Hya and DK Vir with the 1 m telescope. He reports that he obtained light curve fragments, but that new observations are necessary for a reasonable study.

Voigt used the coudé spectrograph of the 1.52 m telescope for the following programmes:

The peculiar A stars β Scl (B9p) and ι Phe (A2p)

About 30 spectra of each star with 12 Å/mm in the blue and 19 Å/mm in the green-red part were taken with camera 2. The observations will be used to look for spectral variations of these magnetic stars. In the spectrum of the star ι Phe, between 3650 and 4900 Å, some hundred lines were identified. Programmes were developed for storing the spectra on magnetic tape with the aid of an automatic microphotometer and for converting the densities into intensities with an electronic computer.

K type main sequence stars

Of the following stars spectra with 3.2 and 12 Å/mm (blue) and 5 and 19 Å/mm (green-red) were taken for differential analysis compared to sun spot spectra:

δ	Pav	G 8 V
70	Oph	A KO V
107	Psc	K1 V
ε	Eri	K2 V
HD	16160	K3 V
ε	Ind	K5 V

Joint Research with Universidad de Chile

F. Noël, Departamento de Astronomía, Universidad de Chile, Cerro Calán, reports that the observations of the catalogue groups "A" were completed during 1971 and that those of catalogue groups "B" must be completed during 1972. He continues:

– The results in time and latitude of the Astrolabe are included among the twelve observatories selected by the Bureau International de l'Heure (BIH) for an "express service" to provide accurate polar coordinates and Universal Time (UT1) to the Jet Propulsion Laboratory (JPL) of USA. These data are needed by the JPL for more precise tracking of the Mariner VIII spacecraft. The Astrolabe results for such purposes have been transmitted to the BIH in Paris using ESO's Telex at Santiago.

The paper "Seasonal Effects Observed in Time Determinations at Santiago", which contains a discussion of time and latitude results obtained with the Astrolabe from 1965 to 1970, was presented by F. Noël at the Symposium N° 48 of IAU "Rotation of the Earth", held at Marioka, Japan, in May 1971. Mr. Noël's attendance at this Symposium was possible thanks to a joint effort of ESO and the University of Chile. –

Staff Research

Galactic Structure

Ardeberg reports that the photometrical material obtained by him of stars in galactic areas (Crux-Centaurus, Scorpius) and clusters is now reduced and the analysis is well under way. The programmes were described in the Annual Report for 1970.

Ardeberg's observations as well as observations by Garnier have shown that the E regions do not have the same zero-points in V, B-V and U-B. The results differ up to 0.04 mag in V and U-B. The photometric system of the E regions is now being checked.

Havlen completed his study of the OB star distribution in Puppis between $l = 240°$ and 250°. He reports: "The existence of Pup OB1 and Pup OB2 is reconfirmed at mean distances of 2.5 and 4.2 kpc. Pup OB1 has an estimated age of 4×10^6 years and the cepheid AQ Pup seems to be a likely candidate for membership. Pup

Table 1

Visitors using the 1.52 m telescope during 1971

Observer	Observatory	Period	Hours	Programme and equipment
M^{lle} Divan M^{lle} Burnichon	Paris	Jan. 1 — 3 Jan. 8 — 14 Dec. 17 — 27	138	Spectrophotometry of stars in LMC, SMC – "Spectro-Chalonge"
Kegel	Heidelberg	Jan. 15 — 20 Jan. 22 — 24	84	F-type stars — coudé
M^{me} Grenier	Paris	Feb. 2 — 15	84	Radial velocities and spectrophotometry of G stars — RV Cass
Dubois	Strasbourg	Feb. 15 — 18	27	Junction LMC – Galaxy ("Programme Carozzi") — RV Cass Spectrophotometry of galactic supergiants ("Programme Dubois") – RV Cass
Dachs	Bochum	Feb. 19 — 25	27	NGC 2516 — coudé
Lyngå	Lund	March 5 — 10 March 22 — 24	69	Distant OB stars — one pair for Lodén — RV Cass
Chu-Kit	Marseilles	March 10 — 22	109	OB stars, interstellar Ca. Pop II stars (for G. Cayrel) — coudé
Hunger	Berlin	Apr. 3 — 13	101	H deficient O and B stars — coudé
Maitzen	Bochum	Apr. 1 — 3 Apr. 13 — 18	73	Ap stars — coudé
Havnes	Utrecht	May 3 — 21	182	Peculiar A stars — coudé
Dossin	Liège	June 3 — 22	140	Southern planetary nebulae — RV Cass (Liège — Marseilles programme)

Observer	Observatory	Period	Hours	Programme and equipment
Imbert	Marseilles	July 8 — 15 July 23 — 31 Aug. 1 — 5	99	Ecl. binaries — coudé
Seggewiss	Hoher List	July 23 — 31 Aug. 1 — 5	55	WR and Of stars — coudé
Alloin	Paris	Aug. 16 — 25	71	Seyfert galaxies — RV Cass
Le Contel	Paris	Aug. 25 — 30 Sept. 4 — 11	96	Short period variables — coudé
Voigt	Göttingen	Sept. 1 — 4 Sept. 11 — 16 Sept. 23 — 28	108	Ap stars; K dwarfs — coudé
Fehrenbach	Haute Provence	Oct. 6 — 13	44	Planetary nebulae and stars in LMC — RV Cass
Azzopardi	Toulouse	Oct. 20 — 27	60	Stars in SMC and LMC — RV Cass
Dubois	Strasbourg	Oct. 27 — Nov. 3	63	Supergiants in SMC and Galaxy — RV Cass
Muratorio	Haute Provence	Nov. 20 — Dec. 1 Dec. 3 — 11	 106 50	Stars in Magellanic Clouds (for Bardin and Prévot) RV Cass coudé

Table 2

Visitors using the 1 m telescope during 1971

Observer	Observatory	Period	Hours	Programme
Herczeg	Hamburg	Jan. 8 — 10, Jan. 14 — 21, Jan. 25 — 31 (first part of nights)	62	HV 2241
Terzan	Lyon	Jan. 8 — 10, Jan. 14 — 21, Jan. 25 —31 (2nd part of nights)	45	HQ Hya, V 743 Cen.
Bigay	Lyon	Feb. 2 — 19	105	UBV photometry of supergiants and stars in associations in LMC
Dachs	Bochum	Feb. 25 — 28, March 22 — 26, Apr. 1 — 6	130	UBV sequences in NGC 2516 and 4755 and photometry of stars in Norma
Lyngå	Lund	March 12 — 22	90	UBV and RI: sequences
Haug	Hamburg	Apr. 12 — 22	89	Hβ of B stars in Cir — Nor — Sco
Plaut	Groningen	May 31 — June 21, July 1 — 2	161	RR Lyrae and standard stars in Palomar-Groningen fields — ESO Photometer
Grenon Nicollier	Geneva	July 7 — 22, July 30 — 31, Aug. 1 — 6	94	Southern standard stars in UBV B_1 B_2 V_1 G_1 65 stars in NGC 6475, 60 red giants (for Spite), sample of nearby and high-velocity stars

Observer	Observatory	Period	Hours	Programme
Borgman Koornneef	Roden	Aug. 9 — 30	99	L and K photometry of ARA cluster — special infrared photometer
Le Contel, Sareyan, Dantel	Paris	Sept. 1 — 11	41	Short period variables — Golay photometer
Alloin	Paris	Sept. 11 — 22	114	Nuclei of radio-galaxies — Golay photometer
Alcaíno	Santiago	Sept. 25 — 29	41	NGC 6101 and galaxies
Van Paradijs	Amsterdam	Oct. 5 — 8 Oct. 11 — 20 Oct. 24 — 27	92	IR photometry of M stars
Schmidt	Heidelberg	Oct. 27 — Nov. 5	89	Stars in wing of SMC — Polarimeter
Schnur	Heidelberg	Nov. 5 — 14	47	UBV RI of stars in SMC
Appenzeller	Göttingen	Nov. 19 — 26 Dec. 1 — 9	104	Differential UBV-photometry of suspected vibrationally unstable stars in LMC
Klare	Heidelberg	Dec. 9 — 17	43	LMC and galactic stars — Polarimeter
			32	UBV sequences in SMC

Table 3

Visitors using the Objective Prism Astrograph during 1971

Observer	Observatory	Period	Hours exp. time	Programme
M^{lle} Martin	Marseilles	Jan. 1 — 5 Dec. 8 — 20	101	RV and Spectral classification plates in LMC and connection to Galaxy
Dubois	Strasbourg	Jan. 25 — Feb. 4 Feb. 15 — 24	75	Junction LMC — Galaxy (Programme M^{me} Carozzi) Radial velocity and spectrophotometry — Association Puppis I (Programme M^{lle} Jonas)
M^{lle} Jonas	Marseilles	March 2 — 7 March 17 — 28	98	RV and spectral classification plates of fields in Puppis, Ara and Centaurus
Dachs	Bochum	March 28 — Apr. 1	32	Spectral classification plates around NGC 2516 and NGC 4755 and in Norma fields
Klinkmann	Bochum	May 15 — 21	13	WR stars, identification of OB stars
Petit	Marseilles	Sept. 14 — 26	65	Mag. Clouds (for Marseilles)
Azzopardi	Toulouse	Oct. 8 — 20 Nov. 7 — 20	157	Spectral classification plates in SMC, RV and classification plates in LMC
M^{lle} Martin	Marseilles	Dec. 8 — 20	80	Radial velocity and spectral classification

Table 4

Visitors using the Danish 50 cm telescope during 1971

Observer	Observatory	Period	Hours	Programme
Neckel	Hamburg	Jan. 14 — 18 Feb. 1 — 8	116	B, V photometry of M stars
De Loore	Brussels	May 6 — 21	111	UBV of Ap stars
Grenon Nicollier	Geneva	Aug. 6 — 25	135	High velocity stars; red stars near SGP Stars in NGC 6475 sequence stars (Golay 7 colour photometer)
Sareyan Dantel	Paris Meudon	Aug. 25 — 31	50	δ Scuti and β C Ma stars — Golay photometer
Sareyan Zribi	Paris	Sept. 22 — Oct. 1	60	Short period variables — Golay photometer

OB2 is apparently younger with an age of 2 x 10^6 years and the galactic cluster NGC 2467 is found to have some common members and is therefore probably more distant than noted previously. In general the OB star distribution correlates well with the H I distribution found by Hindman and Kerr at $l^{II} = 245°$."

Havlen also completed 75 percent the H β photometry of all stars studied by Whiteoak in Ara, at l = 337°. The H β luminosity measures will help to isolate the groupings in this direction and to indicate their relative ages while at the same time defining the spiral features in relation to the spiral features in Norma. Preliminary results definitely confirm Whiteoak's nearby grouping at 1500 parsecs and also strengthen the probability of the existence of a further grouping near 2800 parsecs.

The galactic cluster NGC 6193 seems to be at the center of the nearby grouping in Ara. It is especially interesting because part of the cluster is seen behind obscuring dust lanes with which it is most likely intimately connected. UBV plates taken by Westerlund were measured and additional fainter sequence stars were observed. The irregular absorption is being sampled by means of uvby photometry. H β photometry for the brighter B stars of the cluster was obtained. Spectra for radial velocity determinations were obtained. Campusano is participating fully in all phases of this investigation. Of great interest is the cluster's relation to the nearby Of star HD 148937 which shows ejected material. This star is being studied by Westerlund and Sterken.

Garnier, Sterken and Westerlund have continued the observations of the OB and Be stars in the region of the S. Coalsack. About 60 percent of the stars have been observed. Preliminary results indicate an extremely uneven foreground absorption. The majority of the stars appear to be at a distance of 2 to 4 kpc from the sun.

Garnier, Breysacher, Sterken and Westerlund are observing in the uvby system (for the early types also in H β) the supergiants of types O – G2 recently identified and classified by Bidelman.

Ardeberg, Maurice and Rickard investigated the brigth H II region surrounding HD 101205 by means of photoelectric UBV H β photometry, slit spectra of intermediate and high dispersion, and photoelectric measurements of H α with a Fabry-Perot line scanner. The area covered is about three tenths of a square degree.

UBV H β photometry was carried out with the ESO 1 m telescope and the Copenhagen Observatory 50 cm telescope at La Silla. UBV measurements were taken for about 70 stars. For the brighter stars H β was also measured. It is evident that the area is extremely rich in blue stars. Down to B = 11.5 all stars show colours corresponding to O and B type stars.

Spectroscopy was carried out with the ESO 1.52 m telescope at La Silla. Cassegrain spectra with a dispersion of 73 Å/mm were obtained for the 40 brightest stars. This makes the spectroscopy complete down to B = 11.5. The spectra confirm the result of the photometry. Down to B = 11.5 the area contains only O and B type stars, about 80 % of them with spectral types earlier than B3.

The spectra also show quite strong nebular O II (λ = 3726 – 29) for some stars.

Coudé spectra with a dispersion of 12 Å/mm were taken for 8 stars. The interstellar K lines are strong, broad and double.

The total half width is about 40 km/s, of which a large fraction must be due to internal turbulent motion within the H II region.

The Fabry-Perot measurements of the H α line (taken with the 1.52 m telescope at La Silla) show the line to have a half width of up to 30 km/s. Assuming the temperature found by radio measurements (Wilson et al), an internal turbulent gas motion of at least 25 km/s is derived.

Photometric, spectrographic and also photographic observations are still in progress.

Rickard finished the first stage of a large interstellar line survey in the southern Milky Way. Some 70 to 80 good plates of faint OB stars were obtained with camera 2 of the coudé spectrograph. Most stars are located in the direction of radio sources (both thermal and non-thermal) where 21-cm absorption profiles are also available. Detailed studies of specific sources have already shown some anomalous radial velocity fields in the interstellar gas (B.A.A.S. **3,** N° 2, Part 1, 235, 1971).

Rickard also used the Fabry-Perot interferometer to scan the H α line profiles of 15 planetary nebulae to investigate their internal radial velocities.

The work in the South Galactic Pole region, reported in the last Annual Report, has continued. The photoelectric observations are in the uvby system: by Havlen in SA 141, by Blaauw, West and Sterken in the McCormick fields, and by Colin, Breysacher and Westerlund in the area of the ζ Sculptoris cluster. Spectra for radial velocity determinations were taken by Havlen and by Blaauw and West. The cluster stars are also used for a comparison of the m_1-index in the uvby system and the UV excess in the UBV system.

The Magellanic Clouds

Most of the programmes reported in the Annual Report for 1970 were continued. Ardeberg and Maurice with Brunet and Prévot from Marseilles completed their photometric and spectroscopic observations of the supergiant stars in the Large Cloud. The more detailed analysis of this material has begun (see preprint).

Garnier joined Ardeberg and Westerlund in the photometry of the faint blue stars in the Wing of the Small Cloud.

Ardeberg and Maurice started photoelectric and spectroscopic observations of the brightest stars in the Small Cloud.

Other Galaxies

Manfroid and Westerlund began isodensitometric studies in two colours (B and V) of selected galaxies using a material previously obtained by Westerlund.

Rickard photographed nearly all bright galaxies ($m \leqq 11^m.5$) in blue and red with the image tube camera.

Cen A — NGC 5128 radio galaxy.
Blue photograph taken through a BG-12 filter with the image tube camera.

Cen A taken through an RG 695 filter with the image tube. Effective wavelength is 8000 Å.
Note the strong infrared source near the centre of the galaxy.

Special Objects

Two novae in the Large Magellanic Cloud were studied. The results for Nova Mensae 1970b by Havlen, West and Westerlund are in press; the photoelectric and spectroscopic data for Nova Doradus 1971a and its radial velocity variations are being analysed by Ardeberg and de Groot.

The infrared object HD 45677 which will be observed spectroscopically by J. P. Swings on La Silla in February 1972, has been observed photoelectrically by Ardeberg and Garnier since August 1971 in order to study its variations during as long a period as possible.

De Groot has confirmed the spectroscopic-binary nature of HD 98922 but not yet obtained a sufficient number of spectra to determine its period. Since the system shows a large velocity amplitude, it may also be eclipsing, but some nights of observing have not yet revealed any light variations.

De Groot has also obtained complete 3-colour light curves for the new eclipsing variables HD 101799, 123732 and 120734.

Havlen has continued the study of the variation of the Ca II H and K emission in the RS Pup spectrum. More spectra are needed during the rising portion of the cepheid light curve in order to complete the study of the variation during its complete cycle of visibility. The variation in both velocity and intensity is desired in order to better establish the relationships found by Kraft among other galactic cepheids of shorter period and in an attempt to relate the phenomenon to the Wilson-Bappu effect in non-variable giants.

Havlen has also obtained preliminary results for the η Car velocity field: The available series of unwidened coudé spectra of the nebulous center of η Car show progressively larger red shifts radially away from the center. The red shifts are seen on both sides of the center indicating that the motion is probably one of expansion and not of rotation. The Ca II H and K lines in absorption, however, show a rotationally tilted structure in the center of the nebula. Such velocities have been reported before. It is the intention here to investigate as much of the velocity field as possible.

Wolf is preparing a paper of a fine analysis of an LMC supergiant with the title "Model Atmosphere Analysis of the A3Ia-0 Supergiant HD 33579 in the Large Magellanic Cloud". He carried out this analysis partly at the Universitäts-Sternwarte München and partly (as an ESO staff member) in Santiago.

He has started the observations of the SMC-supergiant HD 7583 (A0Ia-0) for a good abundance determination of a SMC object and for the purpose of an intercomparison of the physical structure of the atmospheres of galactic, LMC-, and SMC-A-supergiants.

Wood reports that his work on Balmer-Line photometry of spectrum variable stars is continuing on a reduced scale at La Silla using interference filters. He hopes to use the digital spectrum scanner for a new and concentrated effort in this field.

Wood has put much research effort in the past year into a magnetic survey of all peculiar B, A, and F-type stars south of 20° declination down to visual magnitude 5.6.

The survey is now nearly completed using the 3.2 Å/mm camera of the 1.52 m reflector coudé spectrograph. Some six new magnetic stars have been found and in one case (HR 5463) he has an estimate of a period for the magnetic variation. A paper is in preparation on the results of the survey and further observations are planned for the newly discovered magnetic variables.

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West, R. M. — ESO/CERN *conference on large telescope design. Proceedings.* (Editor) Geneva 1971.

Westerlund, B. E. — A catalogue of carbon stars in the Southern Milky Way. Astr. Astrophys. Suppl., **4**, 51–74, 1971.

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On the structure of the wing of the Small Magellanic Cloud (with J. Glaspey). Astr. Astrophys., **10**, 1–7, 1971.

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Wolf, B. — The atmosphere of the A0Ib supergiant η Leonis. Astr. Astrophys., **10,** 383–400, 1971.

Wood, H. J. — Balmer-line variability of Beta Carinae (with J. M. Hollis). Astr. Astrophys., **12,** 468-473, 1971.

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ESO Publications

ESO Bulletin No. 8 and Proceedings of the ESO/CERN Conference on Large Telescope Design held in Geneva in March 1971 were sent to more than 400 astronomical institutions around the world.

Scientific Programmes Committee

The Scientific Programmes Committee held its 7th meeting in Geneva on March 9, its 8th meeting in Paris on June 18 as guest of the Observatoire de Paris, and its 9th meeting in Roden as guest of the Kapteyn Observatory.

The 7th meeting was specially organized for discussing the problems arising from the applications for long-range observing programmes in Chile. The 8th and 9th meetings were of normal character, dealing mainly with the applications for observing time in Chile.

The main recommendations, suggestions and decisions of the SPC were:

1. Considering the long-range programmes, the SPC refrained from attributing a certain percentage of time in each observing period to these programmes, as thus more flexibility is left for the handling of short-term projects. It recommended that long-range programmes, once rated "acceptable" and "to be maintained" by the Committee, will, in principle, be allocated telescope time over several observing periods, but in each observing period the programme will be in competition with the other applications submitted.

2. Considering applications from Chilean observers, the Committee expressed the opinion that Council must be consulted for these allocations.

3. In discussing the Southern Schmidt Sky Survey it was suggested that, once the technique of producing glass copies from the original Schmidt plates has been satisfactorily mastered, ESO should start making available in the ESO countries a limited number of such copies.

4. In view of Council's decision to establish a Scientific Policy Committee for ESO, the Committee accepted "Observing Programmes Committee" as the new name for the Scientific Programmes Committee.

Borgman was nominated as a regular member of the Scientific Programmes Committee by Council in its meeting of December 1970.

The important role which the European Southern Observatory plays in European observational work was obvious during the meetings from the numerous applications for observing time, requiring more than double the amount of time actually available. It was again evident that ESO should contemplate the acquisition of more instruments up to the size of 150 cm diameter.

On June 17 a special "users' meeting" was held at Observatoire de Paris between the ESO Directorate and a number of visiting astronomers from the six Member States. Its main objects were the exchange of experience gained in the first few years of observing activity and discussion of possible solutions of problems encountered during the preparation and execution of observing programmes.

Most of the SPC members participated in this meeting.

Meteorology

During the year a total number of 221 photometric nights were recorded, i.e. nights with six or more hours of uninterrupted clear sky. This is about average for the preceding five years. The following table gives the total number of clear hours as well as the total number of photometric nights in 1966, 1967, 1968, 1969, 1970, and 1971.

	1966	1967	1968	1969	1970	1971
Possible number of observing hours	3681	3681	3690	3681	3681	3681
Actual number of clear hours	2481	2412	2197	1996	2107	2136
Possible number of observing nights	365	365	366	365	365	365
Actual number of photometric nights	252	239	223	199	214	221

During a storm on July 10 a wind velocity of about 45 m/sec was measured. Snow storms occurred once in each of the months of June, July, August and September. High winds were frequently noted in July and September.

The complete meteorological results for 1971 will be published in a forthcoming number of the ESO Bulletin.

Other Activities

Participation in Scientific Meetings

Westerlund attended a two-day conference on "Digitized Imagery" in Tucson in February, 1971.

Many of the astronomical staff participated in the ESO Conference on Large Telescope Design in Geneva in March. The Proceedings, which have already been published, were edited by West (ESO, Hamburg).

Rickard presented a paper on the "Southern Galactic Structure deduced from Interstellar Lines" at the AAS Meeting in Baton Rouge in March, 1971.

Blaauw read a paper on "Die europäische Südsternwarte" at the meeting of the Astronomische Gesellschaft at Oberkochen on April 14, 1971.

A joint meeting between the staff of CTIO, ESO and the Astronomical Departments of Universidad de Chile and of Universidad Católica was held in the ESO Headquarters in Santiago on June 2, 1971. About 25 astronomers participated and over 20 papers were presented.

De Groot, Havlen, Westerlund and Wood participated in IAU Symposium N° 49 in Buenos Aires in August, 1971. De Groot read an invited paper on P Cygni stars at the meeting.

Havlen participated in a Symposium on the "Scientific results from OAO" in Amherst on August 23–24. He presented a paper on "OB star distribution in Puppis" at the AAS Meeting in Amherst on August 25–27. Wood read a paper on "New Southern Magnetic Stars" at the same meeting.

Ardeberg, de Groot and Wood attended the IAU Colloquium N° 15 "New Directions and New Frontiers in Variable Star Research" in Bamberg on August 26–30.

Wood read a paper on "Rapid Balmer-Line Variability in Ap Stars" at the Colloquium.

Nees and Rickard participated in the meeting at Lick Observatory on "Advances in Electronic Systems for Astronomy – 1971" and in the 5th Symposium on "Image Tube Devices" in London, both in September 1971. Laustsen also participated in the last mentioned Symposium. Rickard attended a meeting in Greenbank on September 7, "Intermediate- and High-Velocity Clouds", and presented his work on interstellar lines in high latitude OB stars.

At the Trieste Colloquium on Supergiant Stars on August 31 – September 3, Ardeberg read a paper entitled "A Catalogue of Spectral Classification, Radial Velocities and UBV Photometry for Stars in the Large Magellanic Cloud" (with Brunet, Maurice and Prévot). The colloquium was also attended by de Groot and Wolf.

The IAU Symposium N° 50 "Spectral Classification and Multicolour Photometry" was held in Córdoba on October 18–24. Westerlund was the Chairman of the Scientific Organizing Committee. Other ESO members who participated were Ardeberg, who presented a paper "Spectrophotometric Investigation of IC 2944" (with Maurice and Rickard); Maurice, who read a paper entitled "A Catalogue providing MK Classification and UBV indices for Stars in the Direction of the LMC" (with Ardeberg, Brunet and Prévot); and West, who spoke on "Automatic Classification of Objective Prism Stellar Spectra".

Study Visits

Hagerbo visited Hamburg and Copenhagen in January, 1971, in order to obtain information about the electronic control systems of the ESO Schmidt and 50 cm telescopes. He attended a maintenance course on Hewlett-Packard equipment in Cupertino, California, in February.

Vanhauwaert visited Hamburg for three weeks in March – April, 1971, in order to learn the mechanics of the ESO Schmidt telescope.

Giaconi attended a three-month course in electronics in Turin in May – August, 1971.

Colloquia

Colloquia were given in our Headquarters in Santiago by M^{lle} L. Divan, Paris; Prof. B. J. Bok, Tucson; Dr. P. S. Osmer, CTIO; Dr. J. Danziger, Harvard; Dr. K. Ford, Washington; Prof. J. Borgman, Groningen; Dr. M. K. Vainu Bappu, Kodaikanal; Prof. A. Blaauw, ESO; Dr. P. Boyce, Flagstaff, and M^{lle} N. Martin, Marseilles.

Apart from the ESO staff, staff and students from Universidad de Chile and Universidad Católica attended the colloquia.

Lectures

Rickard gave a course in Galactic Structure in the Department of Astronomy of the Universidad de Chile.

Wood gave a course in spectroscopy to students from the Departments of Astronomy of the Universidad de Chile and of the Universidad Católica.

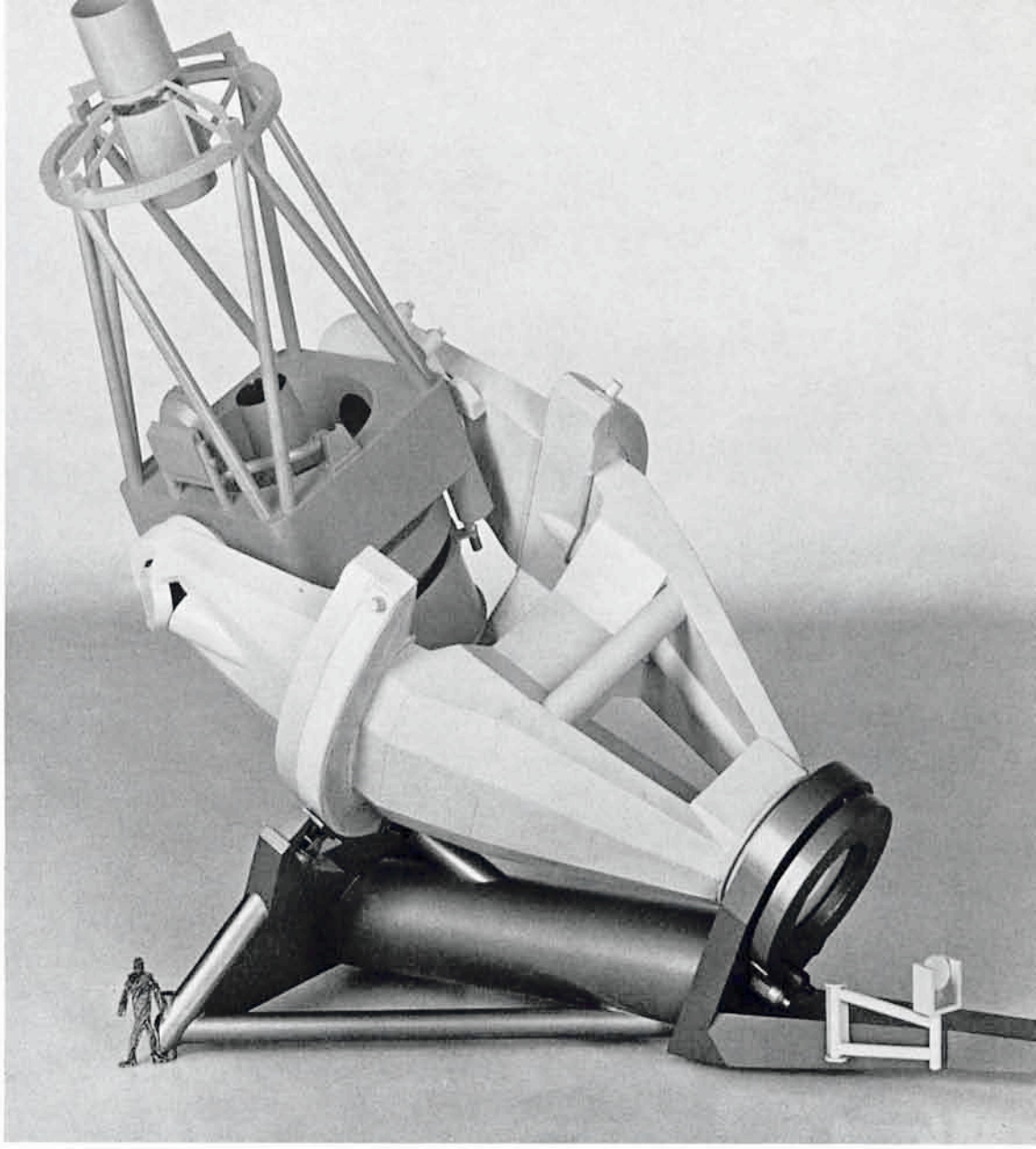
Two students from Universidad de Chile are working on their master's thesis under the supervision of ESO staff astronomers. One student from Universidad de Chile spent some weeks during the summer holidays as a vacation student on La Silla.

De Groot has given lectures in astronomy on La Silla for our night assistants.

Westerlund gave a series of lectures on the Magellanic Clouds at Steward Observatory in January 1971. He gave colloquia at the Observatory in Geneva and at the Astronomical Institute in Amsterdam. Colloquia abroad have also been given by Ardeberg in Lund, and by Wood in Buenos Aires.

Visitors to la Silla

This year about 660 visitors were received on La Silla.



Model of the 3.6 m Telescope 1971.

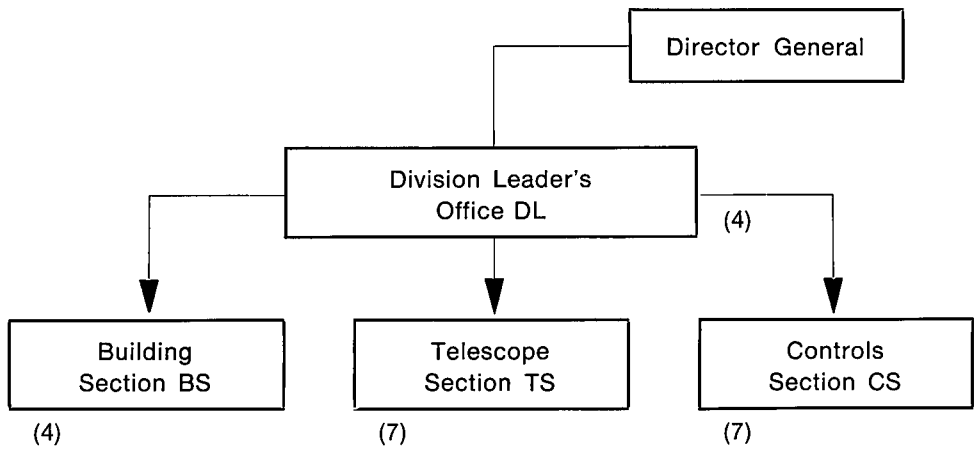
THE 3.6 m TELESCOPE PROJECT

Following the signing of the "Agreement concerning Scientific and Technical Co-operation between the European Organization for Nuclear Research and the European Organization for Astronomical Research in the Southern Hemisphere" on September 16, 1970, in Geneva, the ESO-TP Division, under the leadership of S. Laustsen, was set up on the CERN site to deal exclusively with the progress and completion of the 3.6 m telescope project.

ESO-TP Division

At the beginning of 1971, the Division was made up of a staff of twelve, six being ESO staff members and the others being partly CERN personnel, partly staff from agencies. By the end of the year the staff strength had risen to a total of twenty-

two, of whom thirteen were ESO staff members, six CERN staff members and the remaining three from agencies. The organizational structure of the Division and the number of people employed by the end of the year is shown in the organigram below.



The Division worked in close collaboration with CERN as provided for in the Agreement and, in particular, close links were forged between the Building Section and SB (CERN Technical Services and Buildings Division) and between the Controls Section and DD (CERN DATA Handling Division).

The year can be divided into three distinct periods. The first covered the month of January and was marked by the publication of the first edition of the Design Report, which appeared on February 10. This summarized mainly the design concepts adhered to prior to the establishment of the TP Division.

The second phase covered the period from February until the Council Meeting in June. Various aspects of the design were reconsidered, some inspired by the ESO/CERN Conference on Large Telescope Design held in Geneva in March. Several major design modifications were proposed to Council and accepted.

During the third period, from the Council Meeting until the end of the year, the design was pursued according to the new concepts.

Collaboration with CERN played a key role in this and has in many ways been a determining factor.

Optics

The figuring of the main mirror was completed during the year. A detailed report based on Hartmann tests for two different positions of the mirror in its cell, viz. axis horizontal in the tunnel and axis vertical in the tower, was submitted by an optical firm in France.

According to this report, the mirror is of high quality. An interferometric wave shearing test, executed by Monnet at the optical firm, is in agreement with the result of this report. Extended examination of the Hartmann test based on remeasurements of the latest Hartmann plates was started by Behr at Hamburg to prepare the acceptance of the mirror in the factory.

The figuring of the two secondary mirrors was continued.

The cells for the main mirror and the Ritchey-Chrétien-secondary were completed with the exception of some minor technical details.

Mounting

Three major modifications were introduced into the telescope design:

- By increasing the diameter of the horseshoe from 8 m to 9 m and by extending the fork prongs, the distance from the rear of the main mirror cells to the bottom of the Cassegrain cage was increased from 1,70 m to 2,20 m – a considerable gain in the area available for the Cassegrain focus.

- Provision was made for use of the telescope for infrared work by making the complete upper ring structure of the tube interchangeable.

- A common steel base for the North and South bearings of the telescope was incorporated into the design to facilitate adjustments in azimuth and elevation and to make it possible to install and remove the main mirror with the tube in the vertical position.

The new design, incorporating these features and several minor modifications, was submitted to consultants for structural calculations, and the results showed that "the structural performance of the telescope was compatible with the standards set in modern telescope design".

Controls

Drive models, simulating the dynamic behaviour of the telescope, were used in the design and testing of the servo drives. A prototype of the telescope-computer interface provided initial experience of driving the servos by the control computer.

The control computer dual system was specified. System 1, a Hewlett-Packard 2100 with an 8K memory, handles all control and supervision of the telescope, siderostat and domes. System 2 handles all computations relating to control and data acquisition. It will be a large mini-computer configuration with a 32 K memory and all the standard peripherals for operation.

System 1 has been delivered and programming work has started on control of all motor-driven operations, supervision of operation and actuation of security interlocks for the whole telescope system.

Invitations to tender for system 2 were sent out and some programming work started.

Building and Dome

Building

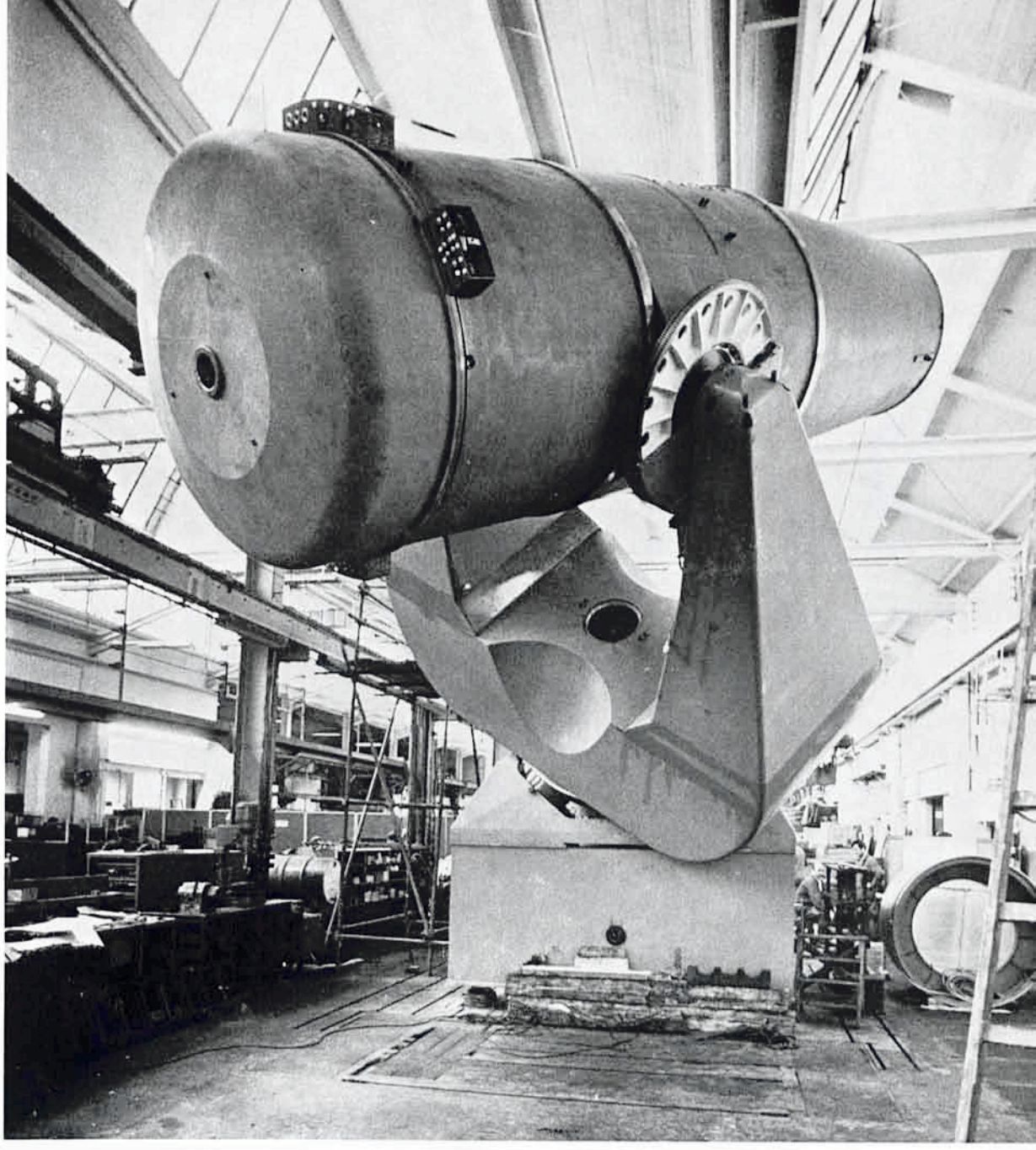
Design work and preparation of the tender were continued until the month of April on the basis of the original design. However, subsequent to the publication of the Design Report, the design concepts were criticized, in particular by French astronomers. In view of this, the Director General formed an "ad hoc" advisory

committee of European astronomers which, in its meeting of May 11 in Geneva, recommended that the TP Division work out an alternative building pre-design. This was submitted in June to Council which resolved that TP Division suspend further work on the original design and continue on the new one.

In order to implement this, a formal agreement was concluded between ESO-TP and SB Division (CERN) on July 23 whereby SB facilities and the collaboration of experienced staff became available to TP Division. A firm of outside consultants was engaged for structural calculations.

Dome

One major change was introduced into the dome design. The movement of the top unit platform was made independent of the movement of the dome. Running on separate rails, this platform can be positioned much more accurately than in the previous design. Preparation for tendering continued throughout the year.

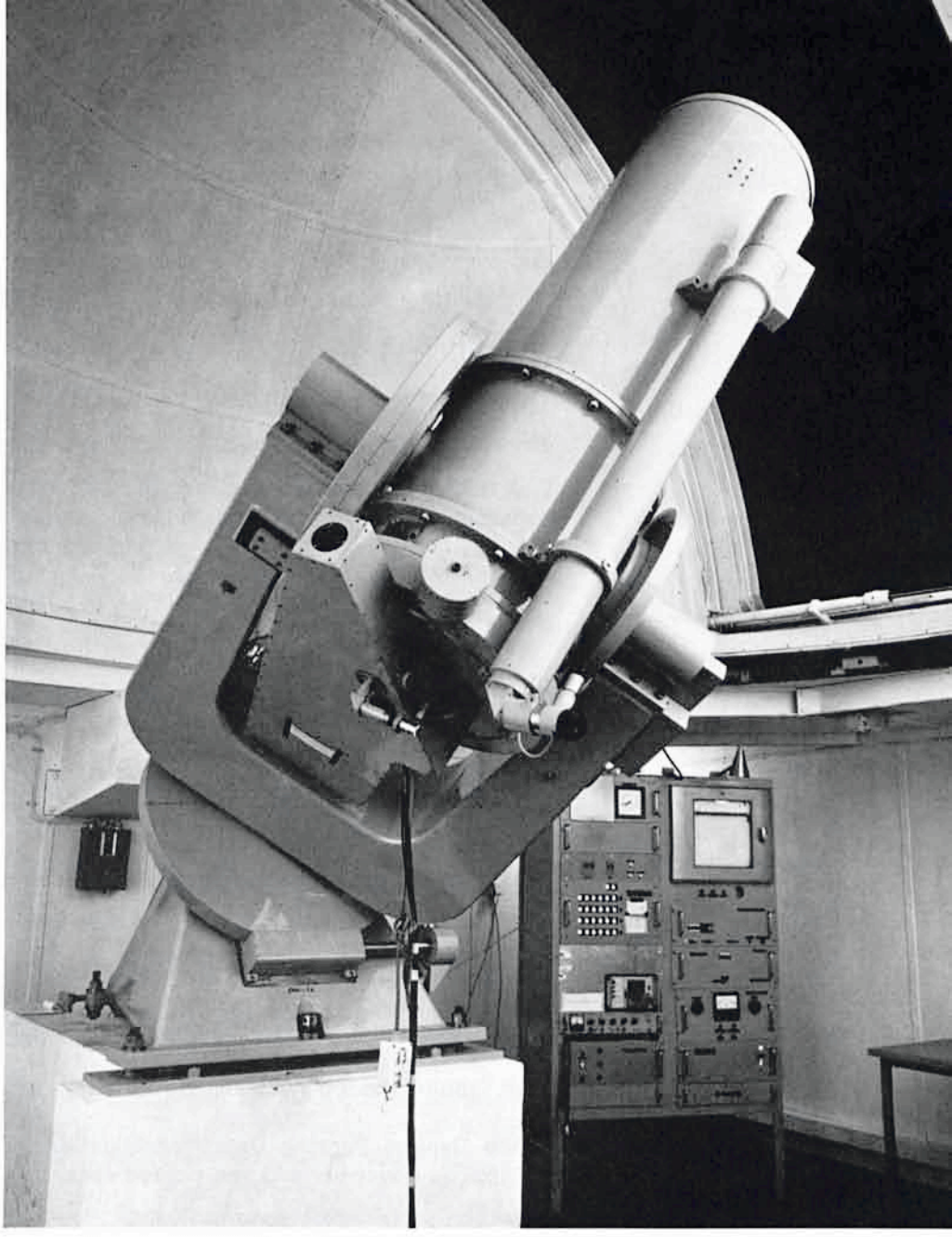


Schmidt Telescope mounted in the assembly hall of Heidenreich & Harbeck, Hamburg, in March 1971.

SCHMIDT TELESCOPE PROJECT

The Schmidt telescope was assembled for final tests in the workshops of Heidenreich & Harbeck under the supervision of its constructor Strewinski. The instrument was shipped to Chile in the second half of the year and successfully transported from the Chilean harbour Coquimbo to the Observatory at La Silla.

By the end of the year the telescope was assembled by Heidenreich & Harbeck under the supervision of Strewinski, Heckmann and Ramberg, and testing started. It is expected that the instrument will become operational in the course of 1972.



Copenhagen 50 cm Telescope with 4-channel photometer.

INSTRUMENTS AND AUXILIARY EQUIPMENT

Instrumentation in Chile

Telescopes

Generally the telescopes perfomed well throughout the year.

a) The 1.52 m Telescope

The primary mirror was realuminized on October 19–20 under the supervision of Mr. Lübeck.

The RV Cass spectrograph worked well. The two film-holders were altered so that they are interchangeable. For camera 1 of the coudé spectrograph an apparatus for pre-bending plates was made.

For each of cameras 1 and 2 plate-holders were re-modelled in the Santiago Workshop.

b) The 1 m Telescope

The telescope was overhauled in January, 1971.

The Cassegrain spectrograph, from Boller & Chivens, arrived in November 1971.

The ESO K photometer was supplied with a new lock-in amplifier, and, after revision by Prof. Borgman, works satisfactorily.

c) The Objective Prism Astrograph

It was used efficiently during the whole year.

d) The Danjon Astrolabe

It worked satisfactorily throughout the year.

e) The ESO Schmidt Telescope arrived and the mounting began. The mirror was successfully aluminized by Mr. Lübeck.

f) The ESO 50 cm Telescope arrived and the mounting was finished in November.

Auxiliary Equipment

Apart from the items referred to in connection with the telescopes we note that

a) the Fabry-Perot interferometer was successfully tested;

b) the digital spectrum scanner is nearing completion;

c) the General Purpose Data Acquisition System for the 1 m telescope was installed in November and has worked successfully since then;

d) a liquid-nitrogen plant was installed on La Silla in the middle of the year. It was used for photometric observations in the infrared in August.

Measuring Equipment

In addition to the equipment listed in the Annual Reports for 1969 and 1970 we have: two **Hewlett Packard 9100 B desk calculators** and a **Joyce-Loebl Isodensitracer.** The latter is being modified slightly to increase its stability.

The **Zeiss spectrophotometer** has been used extensively for tracing our optical filters, so far in a manual mode of operation. Devices have been ordered so that the instrument will soon be automatic in its scanning and recording action.

The **Grant machine** is functioning well. It is used extensively by staff and visiting astronomers both in the velocity measuring mode and in the microphotometry mode. A data acquisition programme makes possible the selection of spectral regions and of resolution elements for the digital acquisition of transmission values along the spectrum.

The installation of the equipment for the darkroom in the Vitacura Headquarters was finished.

Photographic Equipment

Development Work at Hamburg

The design of a photometer for the 50 cm ESO telescope was finalized and the photometer was constructed in the workshop of the Göttingen Observatory. By the end of the year it was completed and ready for transportation to Chile.

The 50 cm ESO telescope was tested in Brorfelde by Muller.

Development Work at Marseilles

Baranne participated in the formal reception of the large mirror of the 3.6 m telescope, mainly with respect to the definitive determination of the primary deformation coefficient. It has been verified that the tolerance between the primary theoretical coefficient and the realized primary coefficient would not affect the quality of the fields obtained at the various foci.

Baranne made a study for the coudé spectrograph for the 3.6 m telescope. The substance of this study was published in the Proceedings of the ESO/CERN Conference on Auxiliary Instrumentation for Large Telescopes, June 1972.

After the échelle spectrograph for the Haute Provence Observatory had been assembled, a modified ESO model was designed. The modifications and the tests were realized by Lacroix and Giordano. Breysacher of ESO made himself acquainted with the operation of the instrument during a stay at Haute Provence.

Danish National 1.5 m Telescope Project

As from April 1st, 1971, the responsibility for the execution of the Danish 1.5 m telescope project was transferred from the Directorate of the Copenhagen University Observatory to a committee appointed by Copenhagen University, under the chairmanship of Professor Bengt Strömgren.

A general outline of the project was presented by A. Reiz in the ESO Annual Report 1970, pp. 44–46.

The progress of the project during 1971 will now be dealt with under the headings: Optics, Telescope Mounting, Building and Dome.

Optics

The work on the optics, which was commenced in May 1971 at l'Institut d'Astrophysique in Liège under the responsibility of D. Malaise, has proceeded satisfactorily. At the end of the year the primary mirror was polished and its figure was smooth and regular. The central part was about one micron too high, and over the last 30 cm of the radius towards the edge, the surface rose progressively up two microns. The work on the secondary mirror, which was carried out simultaneously, was discontinued at the end of the year pending a decision whether or not a hole should be bored in the mirror. The test sphere has been polished and is ready for the testing of the secondary. Altogether, the work on the optics is on schedule and is expected to be completed before the end of 1972.

The Telescope Mounting

Negotiations with the Mitsubishi Company in Japan and Grubb Parsons in England for the manufacture of the telescope mounting (excluding the electronic drive and control system) started during the first half of 1971 and resulted in interesting price estimates. Grubb Parsons later submitted a firm offer for the manufacture of the mechanical parts, the acceptance of which was recommended to Copenhagen University by the telescope committee. Complications of a technical nature with regard to the funding of the project caused the acceptance of the Grubb Parsons offer to be postponed until 1972.

The Telescope Building

A decisive step in the planning of the building was taken during the current year thanks to the advice and support of the ESO TP Division in Geneva. As the ESO Council at its meeting in June 1969 had approved of the Danish plans to install a 1.5 m telescope on La Silla and, moreover, had decided to reserve an amount not exceeding $ 210 000 for the construction of the telescope building, ESO proposed an agreement with the telescope committee whereby the planning of the building as well as the supervision of its erection would be carried out by the Building Section of the ESO TP Division. In this way it would be possible to synchronize the erection of the building for the Danish telescope with that of the ESO 3.6 m telescope building which should result in a considerable saving.

The Dome

Negotiations with the company Bronswerk-Structural, Utrecht, The Netherlands, led to the signing of a contract for a project study, aimed at the construction of a dome of 10.5 m diameter made of reinforced fibre glass. It is expected that the project study will be completed in early 1972, leading to a firm offer for the manufacture of the dome by Bronswerk-Structural.

Construction project dormitories for technical staff, night assistants and astronomers.

BUILDINGS AND GROUNDS

The following has been abstracted from the much more extensive report for 1971 prepared by the Technical Department of ESO in Chile; this is available to Council on request.

Pelícano and La Silla

Power Supply

All three generators of the Pelícano electric plant, delivered to be manually operated, were regularly inspected and maintained.

The total time of operation has been about 16.000 hours and the total output 800.000 kWh, with a total consumption of 225 m^3 of diesel oil: 217 m^3 in the Pelícano plant and 8 m^3 in the La Silla plant. The Pelícano generators have been running manually operated. In December a study was made to install a number of controls for automatic operation, and this plan is expected to be implemented in 1972.

There were two interruptions of power in 1971: in January, an unexpected high wind loosened some of the cables making necessary a 10-hour power cut to repair the line; and in September a snow storm and ice caused three isolators to break.

Water Supply

The ground water level has been quite stable all through this year.

In December, a study was made to improve the pumping control, comprising: protection of motors, automatic operation of deep well pumps, automatic water level remote control, and installation of auxiliary tanks at intermediate pumping stations, to allow continuous pumping of water during inspections.

Two tanks with a total capacity of 16.000 liters were buried next to the treatment plant to catch part of the water used to wash the filters, for use in road sprinkling.

The quality of the drinking water has been acceptable, free from bacteria, as certified by bacteriological tests regularly carried out by the Government Laboratory in La Serena. The maintenance of the treatment equipment has been kept under the supervision of the Chilean representative of the filter and softener manufacturer.

Check valves and relief valves of the 21 km long pipeline from Pelícano to La Silla were inspected and cleaned.

The production and consumption of water in 1971 has been as follows:

	m^3	m^3/day	%
1. Production of wells	19 724	54.1	100.0
2. Pelícano Camp	4 500	12.3	22.8
3. Observatory La Silla	9 649	26.5	48.9
4. Treatment	5 575	15.3	28.3

As mentioned above, the water consumed in the treatment is afterwards used for sprinkling the road.

Sewage System

An extension of the existing network to connect the new pipes coming from the new dormitories for astronomers and for assistants was started and will be completed in 1972.

Heating and Ventilation

In 1971 the oil consumption for heating was 165 m^3.

On the northern side of the Hostel, work was started to relocate pipes under the ground: the plan is to build a tunnel for heating pipes, water pipe and electric cables.

Telescope Buildings

In the spectrographic telescope building a floor extension was made at the coudé focus to facilitate the work of the observer. On the NE corner of the ground floor arrangements were made to install a central plant for demineralized water.

The treated water is distributed from there in plastic bottles to all photographic laboratories. Regular maintenance was carried out in dome, lift, platforms and compressed air lines.

The windscreens were provided with special plastic shoes resulting in a smoother operation.

In the photometric telescope building, the new office on 3rd floor was completed, and a new liquid nitrogen plant was set up in a room on the ground floor. A water cooling plant connected to this equipment was installed outside on the east side of the building.

Routine maintenance was carried out on dome, lift, platform, etc. in this building.

The Schmidt building, empty until September, received the Schmidt telescope, for which a special mounting rig with a 10 t. crane had to be attached temporarily to the dome. A reinforced concrete block of 17,6 m^3 was built on the top of the existing pier to support the instrument, and a permanent 2 t. crane was fixed to the dome shell. In December, the instrument was on its base and the mounting rig removed from the dome.

The windscreens of the dome were also provided with plastic shoes for a better operation.

Modification of the photographic laboratories was started.

The construction of the Danish and ESO 50 cm telescope buildings, which was contracted to a local firm, was finished in March, and the respective domes, fabricated in Copenhagen, were mounted in March and August.

The telescopes were installed in May and November, respectively.

Only little maintenance work was done on the GPO building.

Construction started for extension of the Bochum building with a room of 4,25 x 6,30 m on the southern side of the existing building, to be finished early in 1972.

Living Quarters

The hostel, the dormitories, the bungalows, the old camp in La Silla, and the Pelícano camp required ordinary maintenance routine jobs.

The Beño camp was moved up from its original location (km 13,5) to La Silla, at about 200 m NE of the Technical Office.

Construction of two dormitories to accommodate 10 astronomers each was started in March 1971. Each building contains 10 apartments with entrance, hall, toilet and bedroom, 3,8 x 7,8 m = 29,6 square metres each apartment.

In November the construction of two dormitories for night assistants started. Each building contains 8 apartments of 3,4 x 6,6 m = 22,5 square metres each apartment, with entrance, hall, toilet and bedroom.

Roads

Our maintenance road equipment consists at present of bulldozer, grader, roller, tractor, excavator, water truck and dump truck.

About 200 metres of the Observatory road, from GPO to Hostel, was paved with a mixture of liquid asphalt and material transported from the quarry at km 17.

The roads in front of the Spectrographic, GPO and Schmidt buildings were paved in the same way.

About 65 % of the time was devoted to the maintenance of the private road, 30 % to the public road and 5 % for repair of the equipment.

La Serena

Bungalows

The installation of a water main pipe and the construction of a concrete pavement and two pathways were carried out by a contractor from La Serena.

No other work was done in the property.

Santiago

Headquarters Buildings

A concrete floor of 1017 square metres was made in the basement of the office building.

ESO Houses

The Director's house in Santiago was supplied with a 2500 litre fuel tank and the façade was painted.

Maintenance of heating, water and power in the Guesthouse was performed as usual. Small repairs were carried out continuously during the year, particularly after the earthquake of the 8th July, when 20 metres of wall collapsed on the NW corner of the property.

Legal Matters

The protection against and the elimination of claims for mining rights on the ESO territory was a matter of continued attention by our legal adviser in Santiago.

Administration in Chile

Growing scientific activities in Chile have had a strong impact on administration as well. In anticipation of the 3.6 m telescope project, but also because of more intensive and diversified utilization of the existing instruments, the purchase department has increased its activities considerably. More international staff members, mostly for scientific and research support activities, have joined ESO Chile and have received manifold administrative assistance. The beginning of a new phase of construction activities has involved the administration in the preparation of contracts, and legal affairs now being dealt with almost completely by ESO administrative staff have caused administration work to increase by about 50 %. There has been no increase in administrative personnel. Higher productivity was achieved through rationalization, an endeavour to be continued.

Important innovations have taken place in the personnel sector. A set of Rules and Regulations have been worked out and introduced, offering a compromise between the concept of an international organization and the need for job and social security of ESO's local personnel.

To make the new Rules and Regulations for Local Staff Members meaningful, a new personnel management system has been built up. Both have guaranteed an atmosphere of cooperation and trust in employer/employee relations. It is expected that the coming year will bring further improvements in personnel relations.

LIBRARY

This year saw a continuation of the efforts of the previous years to acquire the necessary astronomical and technical literature for a proper functioning of the ESO libraries. Almost all books, journals and observatory publications were received in the Hamburg Library, where they were classified and catalogued and sent to Chile, either by diplomatic bag (journals and urgent material), or container (monthly observatory publications).

Books and Journals

Approximately 800 volumes were acquired during 1971. The number of order requests from the staff was notably smaller in 1971 than in 1970, indicating a higher state of completeness of the library stocks. Only a few new journals were subscribed to. Towards the end of the year, the question of acquiring older issues of journals was looked into. In the early days of the ESO library, only volumes of journals from 1950 and later were purchased. It seems, however, that earlier volumes of certain journals, especially those containing large amounts of observational data, ought to be available in the ESO library stock.

Fortunately, it has so far been possible to meet most of the demands at ESO/Chile for older publications by means of the exchange system with the library of Observatorio Astronómico Nacional (Cerro Calán), that is well equipped with older astronomical literature.

A significant number of journal volumes was bound in Santiago and in Hamburg.

Observatory Publications

An extraordinary large number of observatory publications was received from all over the world. Many observatory libraries went to great trouble to be able to furnish ESO with complete or almost complete sets of their publications. This was especially true of the observatories in the ESO countries, of which only a few had not yet responded to our request at the end of the year.

New publications were regularly received.

Library Cooperation

The cooperation between the libraries at Observatorio Astronómico Nacional, AURA and ESO continued in a very satisfactory way. In Geneva, relations were established between the CERN library and the ESO-TP Division.

PERSONNEL

J. Ramberg, ESO Technical Director, retired on December 31.

P. Fjellerad, Maintenance Engineer in Chile, resigned as per August 31.

The following staff members were engaged in grades 9 or higher:

a) **Office of the Director General in Hamburg**

F. de Buck	Auditor	November 15

b) **Chile**

R. Garnier	Astronomer	January 1
J. Haahr	Electro-Mechanical Engineer	May 4
H. Scheffold	Senior Administrative Officer	September 1

B. Wolf	Astronomer	September 1
W. Müller	Construction Engineer	November 15
B. Schotel	Maintenance Engineer (Head of Domes)	November 15

c) **3.6 m TP Division, Geneva**

J. Roozeveld van der Ven	Mechanical Engineer	April 1
D. Plathner	Mechanical Engineer	December 1.

R. Clop, Mechanical Engineer, was transferred from Marseilles to Geneva on October 1.

13 staff members were engaged in Grades 8 or lower.

A list of personnel in Grades 9 and higher per December 31 is given in Appendix A to this report on p. 67.

FINANCIAL MATTERS

As already mentioned in the Annual Report 1970, the CERN budget and accounts format was adopted by ESO effective January 1, 1971.

The expenditure accumulated up to December 31, 1971, has been accordingly re-grouped.

In the comparison of actual expenses with the budget forecast for 1971 and in the 1972 budget forecast the costs of the Office of the Director General in Hamburg, the ESO Establishment in Chile and the 3.6 m Telescope Project Division in Geneva have been identified separately.

The 1972 budget forecast for the Office of the Director General also includes a first instalment for the ESO Sky Survey Project dealt with in the introduction of this Report. It is envisaged that the costs of the project will be largely covered by income from sales of Sky maps and that it will thus be financially self-supporting.

In order to complete the presentation, the early budget statements/forecasts now also contain the income and its sources.

Budget Statement 1971

Expenditure (in US $ 1000)

Budget Heading	Approved Budget	Expenses (incl. commitments and unused credits carried over to 1973) for			
		Directorate Hamburg	Establish-ment in Chile	3.6 m TP Division Geneva	Total
1 Personnel	1,953	401	1,167	194	1,762
2 Operations	1,170	194	569	209	972
3 Capital Outlays	3,893	14	1,516	374	1,904
	7,016	609	3,252	777	4,638
Loss on Exchange					133
	7,016				4,771

Income (in US $ 1000)

Budget Subheading	Estimate	Actual (incl. receivables)
90 Contribution from Member States	4,500	4,500
91 Unused appropriations from previous years	2,395	2,379
95 Miscellaneous	121	563
	7,016	7,442

Accumulated Expenditure up to December 31, 1971

(in US $ 1000)

Budget Heading		
1 Personnel		5,782
2 Operations		3,859
3 Capital Outlays		
a) Land, Buildings, Roads	7,013	
b) Instruments	4,685	
c) Architects and Consultants	1,362*	13,060
4 Astronomical and meteorological activity, South Africa		501
Unforeseen		222
TOTAL EXPENDITURE UP TO DECEMBER 31, 1971		23,424

* This concerns expenses up to December 31, 1970. From 1971 on, these expenses are included under the respective budget headings (capital outlays or operations).

Total Budget for 1972

Expenditure (in US $ 1000)

Budget Heading	Directorate Hamburg	Establish-ment in Chile	3.6 m TP Division Geneva	Total
1 Personnel	575	1,393	454	2,422
2 Operations	367	908	468	1,743
3 Capital Outlays	18	1,527	1,953	3,498
	960	3,828	2,875	7,663
ESO Sky Survey Project				207
Cost Variation Reserve				650
TOTAL EXPENDITURE				8,520

Income (in US $ 1000)

Budget Subheading	Estimate 1972
90 Contribution from Member States	6,000
91 Unused appropriations from previous years	2,300
94 Sale of Sky maps	—
95 Miscellaneous	220
	8,520

GENERAL ADMINISTRATIVE POLICY

The ad hoc Working Group of the Finance Committee for the Study of the ESO Staff Rules and Regulations, set up in 1969, continued its work throughout the year 1971 and held the following meetings in Hamburg:

6th Meeting on May 5

7th Meeting on June 8

8th Meeting on July 23

9th Meeting on September 2.

A first version of the Staff Rules and Regulations for International Staff was approved by the Council on June 9/10, 1971, for implementation effective 1/7/1971.

On a number of items, however, discussions continued throughout 1971 and further changes may be expected as a consequence of a general review carried out in CERN.

Furthermore, Combined Staff Rules and Regulations for Local Chilean Personnel were developed for implementation in 1972.

COUNCIL, COMMITTEES AND WORKING GROUPS

a) **The Council** met on June 9/10 (17th Meeting) and on November 30/December 1 (18th Meeting) in Hamburg. The President of Council in both meetings was J. H. Bannier.

b) **The Committee of Council** held its third Meeting on May 18 in Hamburg and its fourth Meeting on November 12 in Geneva. The Chairman in both Meetings was J. H. Bannier.

c) The **Finance Committee** met on May 17 in Hamburg (20th Meeting), on October 5/8 in Chile (21st Meeting) and on November 16/17 (22nd Meeting) in Hamburg. The Chairman in all three Meetings was C. Zelle.

d) **The Instrumentation Committee** met on March 8 (32nd Meeting) and on September 21 (33rd Meeting) in Geneva. The Chairman in both Meetings was Ch. Fehrenbach.

e) For the Meetings of the **Scientific Programmes Committee,** see page 35.

f) For the Meetings of the **ad hoc Working Group of the Finance Committee for the Study of the ESO Staff Rules and Regulations,** see page 63.

APPENDIX A.

Employees on Contract with ESO in Grades 9 and higher per December 31, 1971

Hamburg Office:

A. Blaauw	Director General
J. Ramberg	Technical Director
A. B. Muller	Senior Astronomer
J. Bloemkolk	Manager
G. Bachmann	Head Finance
R. West	Astronomer
R. Doorn	Head Personnel

J. Meuser	Head Purchasing and Shipping
H. W. Marck	Accountant
F. de Buck	Auditor

Chile:

B. Westerlund	Director of ESO in Chile
R. Villena	Chief Engineer
H. Scheffold	Senior Administrative Officer
H. Hyslop	Administrator
J. Rickard	Astronomer
W. Müller	Construction Engineer
M. de Groot	Astronomer
E. Maurice	Astronomer
A. Ardeberg	Astronomer
H. J. Wood	Astronomer
B. Wolf	Astronomer
B. Schotel	Maintenance Engineer (Head of Domes)
H. E. Schuster	Astronomer
M. Becker	Electronics Engineer
R. Garnier	Astronomer
J. Haahr	Electro-Mechanical Engineer

3.6 m TP Division, Geneva:

S. Laustsen	Senior Astronomer
J. Roozeveld van der Ven	Mechanical Engineer
M. Blichfeldt	Electronics Engineer
B. Malm	Astronomical Technician
D. Plathner	Mechanical Engineer
W. Bauersachs	Civil/Mechanical Engineer
R. Clop	Mechanical Engineer
P. Scharnweber	Electrical Engineer

APPENDIX B.

List of Members of Council, Committees and Working Groups per August 1, 1972

ESO Council

Belgium:	A. G. Velghe L. Poulaert
Denmark:	M. Rudkjøbing O. Obling
France:	A. Lallemand A. Alline (President)
Federal Republic of Germany:	R. Kippenhahn C. Zelle
The Netherlands:	H. G. van Bueren J. H. Bannier
Sweden:	E. B. Holmberg M. Fehrm

Committee of Council

A. Alline (France), President

J. H. Bannier (Netherlands)

J. Borgman (President of the Instrumentation Committee)

M. Deloz (Belgium)

M. Fehrm (Sweden)

P. Ledoux (President of the Observing Programmes Committee)

O. Obling (Denmark)

B. Strömgren (President of the Scientific Policy Committee)

C. Zelle (Federal Republic of Germany; President of the Finance Committee)

ESO Scientific Policy Committee

	Standing Invitation
L. Biermann	A. Alline (President of Council)
J.-C. Pecker	J. Borgman (President of the Instrumentation Committee)
B. Strömgren (Chairman)	P. Ledoux (President of the Observing Programmes Committee)
	C. Zelle (President of the Finance Committee)

ESO Finance Committee

Belgium:	M. Deloz
Denmark:	O. Obling
France:	H. Dumont P. A. Berniard
Federal Republic of Germany:	C. Zelle (Chairman)
The Netherlands:	P. J. Fierst van Wijnandsbergen
Sweden:	B. Samuelsson

ESO Instrumentation Committee

K. Bahner

J. Borgman (Chairman)

R. Cayrel

G. Courtès

Aina Elvius

Ch. Fehrenbach

D. J. Malaise

P. E. Nissen

E. H. Schroeter

ESO Sub-Committee for Spectrographs

K. Bahner

R. Bouigue

Ch. Fehrenbach (Chairman)

M. V. Migeotte

A. B. Underhill

P. Wellmann

Consultants

I. S. Bowen

B. Edlén

Y. Öhman

ESO Observing Programmes Committee
(previously "Scientific Programmes Committee")

	Substitute
J. Delhaye	J. Lequeux
E. P. J. van den Heuvel	—
E. B. Holmberg	Aina Elvius
P. Ledoux (Chairman)	P. Swings
M. Rudkjøbing	—
G. Traving	B. Baschek

ESO Working Group for a Multilateral Protocol

J. H. Bannier

L. Delrot

H. Dumont

A. Freytag

M^{me} M. R. d'Haussy

C. E. I. M. Hoogeweegen

O. Ottosson

ESO Working Group for Financial Rules and Regulations

P. A. Berniard

C. Bonnet

M. Deloz (Chairman)

P. J. Fierst van Wijnandsbergen

G. Friborg

H. Grage

S. C. J. von Welck

ADDRESSES

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