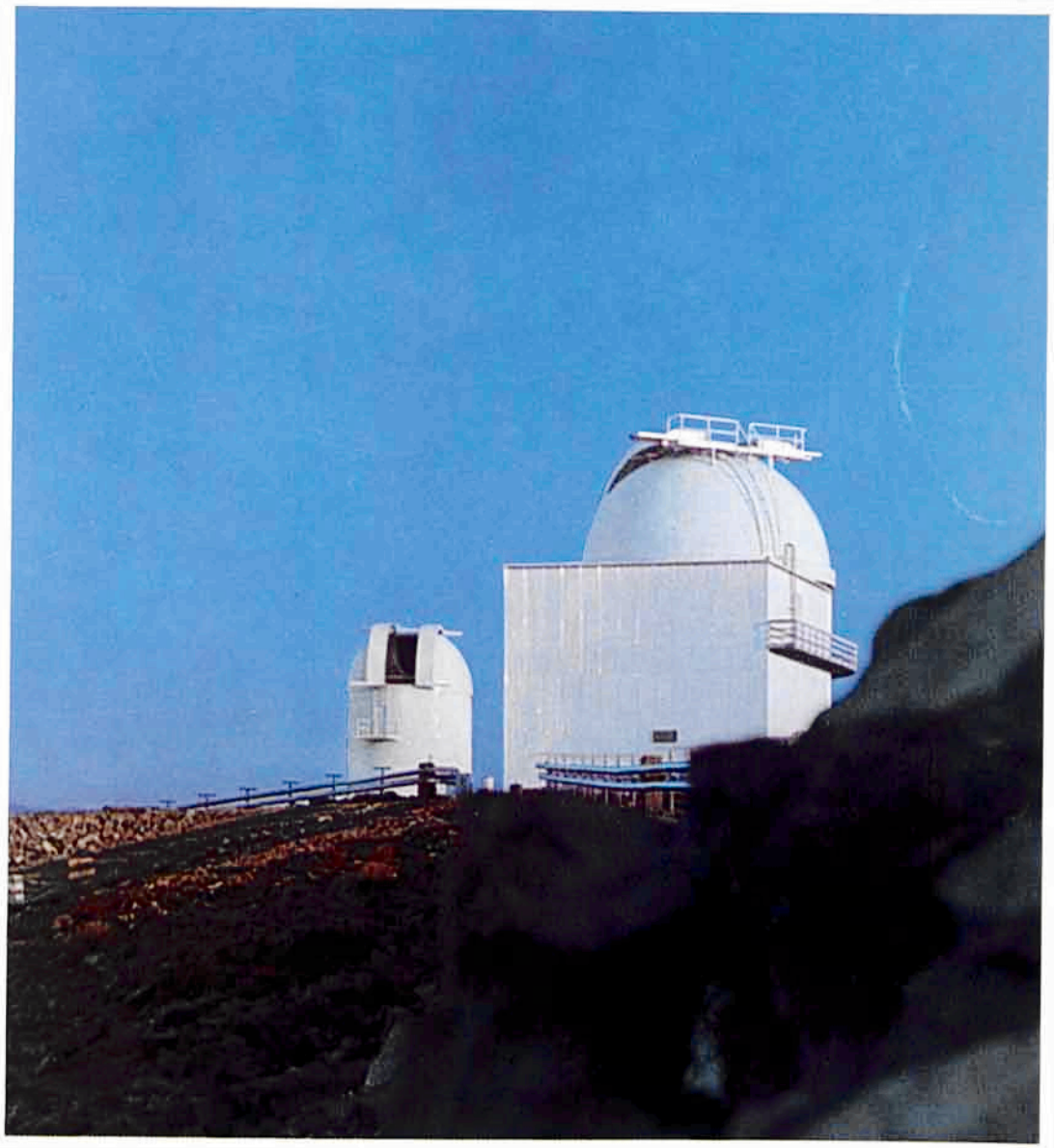
ANNUAL REPORT 1970



EUROPEAN SOUTHERN OBSERVATORY

ANNUAL REPORT 1970

presented to the Council
by the Director General, Prof. Dr. A. Blaauw

Organisation Européenne pour des
Recherches Astronomiques dans l'Hémisphère Austral

EUROPEAN SOUTHERN OBSERVATORY

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INTRODUCTION

Special Events

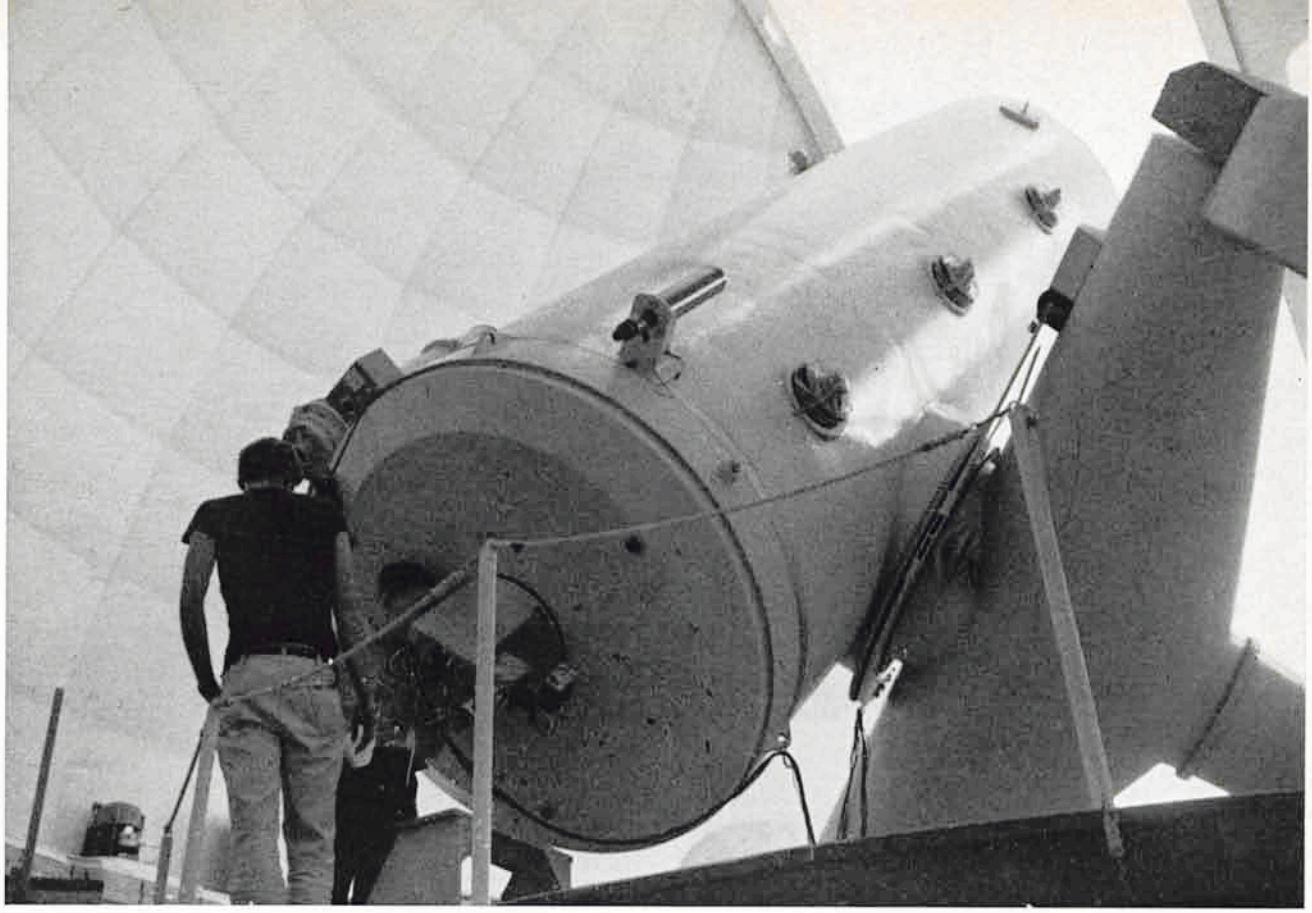
The new Director General, Professor A. Blaauw, assumed his task per January 1. He visited the establishments in Chile in March/April.

In September a contract with CERN was concluded for collaboration on the development and construction of the 3.6 m telescope. The first suggestions for this collaboration having been discussed by the ESO Council in its meeting of December 1969, the formal completion of the negotiations so soon afterward indicates the anxiousness of ESO to start this new venture and the willingness on the part of CERN to direct its interest to this new kind of activity. As it will be mentioned elsewhere in this report, the agreement led to the establishment of the ESO 3.6 m Telescope Project Division (TP-Division) at CERN immediately after the contract was signed.

Much attention was given to the desirability of creating an adequate system of Staff Rules and Regulations for our local personnel in Chile. A considerable readjustment took place of the system of non-resident allowances for the international personnel. A very important move was also Council's decision to adopt for the ESO international personnel the CERN basic salary system.

In order to be guided with regard to its general policy for the future of the Organization, Council decided to establish a Scientific Policy Committee.

An interesting development was the application of the French system of the "coopération" to ESO, by which it is made possible for young French scientists to assist at our Observatory in the context of the French services to underdeveloped countries.



The 1.52 m Spectrographic Telescope.

RESEARCH ACTIVITIES

Research Programmes

Visitors' Research

Tables 1–6 summarize the programmes undertaken by the visiting astronomers during 1970.

Galactic Structure

The Galactic plane

Denoyelle established UBV sequences in three regions in and near Vela and obtained plates with the GPO astrograph for radial-velocity measurements of the stars in the area.

Schmidt-Kaler obtained plates for spectral classification with the GPO astrograph of several Milky Way fields containing WR stars, He stars, X-ray sources and ring objects. Photoelectric photometry of neighbouring stars in the fields will give the interstellar reddening. The distances and absolute magnitudes of the special objects will eventually be obtained.

Vogt is studying an area of relatively low absorption in the direction of $l \sim 10^{\circ}$, $b = 0^{\circ}$ (new galactic coordinates) using Schmidt plates taken at Cerro Tololo Inter-American Observatory. He observed photoelectrically faint stars to serve as standards for the photographic UBV photometry.

McGruder III studied an area in Centaurus, at $l = 307^{\circ}$, $b = 0^{\circ}$ and $\pm 2^{\circ}$, for locating spiral arms. He obtained UBV measures of about 70 stars in three sequences.

Roslund observed photoelectrically in the UBV system 110 M stars brighter than $V = 15.5$ in a field of four square degrees at $l = 353^{\circ}$ and $b = +3^{\circ}$. Additional measures in R and I were made for 40 stars brighter than $V = 14.0$. The aim of the programme is to study the space distribution of various classes of M stars in the galactic center direction and to determine the spatial arrangement of the absorbing matter through the Sagittarius arm out to distances of several kiloparsecs from the sun. There is an indication that interstellar reddening of the present M stars rises abruptly when the Sagittarius arm is encountered.

Pik Sin The established photoelectric sequences in R and I in three Cleveland Luminosity Function Fields: LF 13, LF 14 and LF 15 for the study of the distribution of M type giant stars.

Chu-Kit is studying the galactic structure between $l = 280^{\circ}$ and $l = 20^{\circ}$ using the interstellar calcium lines. The spectra of the selected O and B stars are obtained with the coudé spectrograph of the 1.52 m telescope. The dispersion used is mainly 12.4 Å/mm.

The Georgelins have studied the galactic structure using the radial velocities of H II regions, obtained with a Fabry-Perot interferometer; the radial velocities of the exciting stars, obtained from plates taken with the GPO astrograph (Traversa); and the magnitudes and colours of these stars, measured photoelectrically by Garnier.

Galactic Clusters

Vogt reports that Moffat carried out photoelectric photometry of stars in three open clusters for him. He has photographed cluster regions with the GPO astrograph for spectral and luminosity classification of the brightest members.

Maitzen has obtained polarization measurements of stars in the galactic cluster IC 2944.

Lindoff observed photoelectrically and spectrophotometrically stars in several galactic clusters. He reports that the work on NGC 5738, 6025, 6708, 6400, 6613 and IC 4651 is almost completed.

High-latitude Areas

Schröder carried out photoelectric polarimetry of numerous stars in the region $b \leq -50^{\circ}$ for an investigation of the structure of the galactic magnetic field. He also obtained UBV measurements and spectra of many of these stars.

Plaut observed standard stars in field 3 ($l = 0^{\circ}$, $b = -10^{\circ}$) of the Palomar-Groningen variable star survey. He observed also photoelectrically RR Lyrae-type and cepheid variables in the same field as well as the RR Lyrae-type variable BV 1041.

Spite is studying the galactic potential field. For this purpose M[lle] Mégessier and Garnier obtained observations in B and V of about 300 stars of types later than F 5 near the South Galactic Pole.

Alcaíno obtained a photoelectric sequence of 19 stars, 10.5 – V – 15.7, in the globular cluster NGC 6541. It was used to calibrate plates obtained with the 60 inch telescope at Cerro Tololo. The cluster was found to be metal-poor. It is at a distance of over 6 kpc from the sun and about 1 kpc from the galactic plane.

The Magellanic Clouds

Azzopardi obtained a large number of plates with the GPO astrograph for the classification of stars in the direction of the Small Magellanic Cloud. Many plates of standard stars for spectral and luminosity classification were likewise obtained.

Brunet, Mianes and Prévot (in cooperation with Maurice of the ESO staff) have continued the Marseilles photometric and spectroscopic programme on the Large Magellanic Cloud. In 1970, 150 stars were observed in the UBV system by Brunet; each star was observed on the average three times. Mianes did six-colour photometry (Lick system) of selected stars of types FOIa to F8Ia in the Cloud, and of six stars in the region between the Small and the Large Cloud. Prévot has obtained 100 spectra of 60 newly identified supergiants in the Large Cloud. Most of the photometric and spectroscopic material, referring to about 400 supergiants in the Cloud, is reduced and the UBV data, the spectral types in the MK system, and the radial velocities are being prepared for publication.

M[me] Chériguène and Monnet observed 40 H II regions in the Large Cloud in H alpha light with a Fabry-Perot interferometer. The H II regions observed are in the northern and southern parts of the major axis of the Cloud and in the Bar. It is hoped that the data will permit the determination of the rotation of the outer parts of the Cloud with high precision.

M[me] Carozzi reports that on the GPO plates taken by Burnage in the region between the Large Magellanic Cloud and the Milky Way 21 stars of high velocity have been identified. Slitspectra have been obtained of 10 of these stars; 6 are of luminosity class III and 4 of class V.

Special Objects

A programme aiming at the determination of the proportions of high-velocity stars and metal-poor stars among the F 8 – K 0 stars has been undertaken by M[me] Grenier and da Silva. The selected stars are all in the direction of galactic rotation. UBV photometry was carried out for about 370 stars, and 140 of these were selected for further study. Three spectra of each of 33 of these stars were taken with the Cassegrain spectrograph (RV Cass) for the determination of their radial velocities and Fe/H ratios, and 4 to 6 spectra were obtained of each of 44 comparison stars. In addition a number of coudé spectra (dispersion 3 and 12 Å/mm) were obtained for detailed studies of some of these stars.

Bright southern late-type stars have been observed by Oja, using narrow-band and UBV filters. The aim is to improve the calibration of the intrinsic UBV colours and the absolute visual magnitudes as functions of the narrow-band criteria.

A joint photometric (uvby) and spectroscopic programme on four peculiar A stars (Si) was carried out by M[lle] Mégessier and Garnier. The stars studied were HD 223640, 7374, 187474 and 179761. The first one was obviously variable, the two following showed variations smaller than 0.02 mag and the last one no variations photometrically. The spectra obtained are still being analyzed.

Van Hoof searched for new members of the β CMa group. Of the 20 stars included in the photometric programme results are available for 11:

- 2 stars, Ψ Eri and λ Lep, do not show any variation in brightness.

- 1 star, HD 53756, is an E.B. with an excentric orbit and a period of $2^{d}.7888$ and not $4^{d}.2$ as found by G. Hill.

- 2 stars, o Vel and ϑ^2 Pup, are definitely β CMa stars with periods $3^h\ 10^m$ and $7^h\ 59^m + 2^h\ 56^m$ respectively.

- 2 stars, HD 53755 and HD 53974, show more or less periodic variations, but with periods very different from those proposed by G. Hill.

- 4 stars show variations up to $0^{m}.04$ but their periodicity seems questionable (HD 53795, HD 55857, HD 74146, HD 74196).

Van Hoof also obtained 370 spectra with the coudé spectrograph (dispersion 12 and 20 Å/mm) of 30 early B stars. Among the results obtained so far may be mentioned:

- HD 44402 and HD 54893 are β CMa stars with periods $0^{d}.12638$ and $0^{d}.14648$ respectively.

- HD 61068 changes its RV by 19 km/sec and is almost certainly a β CMa star.

- HD 63922 though having the sharp lines of a β CMa star has a constant RV.

- HD 63578 is a spectroscopic binary. Its period of $4^{d}.264$ could be derived from only 7 spectra.

- HD 74375 is at the same time the brighter component of an S.B. with a period of $132^{d}.9$ (which van Hoof could determine thanks to supplementary information from Herbig in earlier Lick results) and an intrinsic variable, the period of which has not yet been found.
- φ Cha changes its RV over 170 km/sec and is either an S.B. or a record breaking β CMa star.
- κ Vel and HD 56014 have their periods improved sensibly by van Hoof's observations.

β CMa stars, symbiotic stars, δ cepheid stars and RR Lyrae stars with very short periods were studied photoelectrically by Elst. So far light curves for SX Phe, CY Aqr and KU Cen have been reduced.

M^me^ Morguleff has observed G and K stars of magnitudes 7,5 – 11 photoelectrically in the UBV (37 stars) and uvby (26 stars) systems and as a separate programme (for M^lle^ Gerbaldi) also normal A stars and stars of types Am and Ap (20 stars). The data are being analyzed.

A photoelectric study of nearby southern cepheids was undertaken by M^lle^ Rousseau using the Lick six-colour system; the aim is to establish accurate intrinsic colours and to study the period colour-luminosity relations.

Coudé spectra of shell stars (mainly Be and WR stars) were obtained by Maitzen, and simultaneous UBV and H β observations were carried out with the Bochum telescope by Vogt and Moffat in a programme initiated by Schmidt-Kaler for a study of the time-dependence.

Maitzen obtained also coudé spectra of Ap stars; simultaneous photoelectric observations in the UBV system were obtained by Moffat and Vogt with the Bochum telescope.

Hunger obtained a minimum of four coudé spectra (dispersion 12 Å/mm) of each of the following hydrogen deficient orhelium anomalous stars: HD 64740, 93030, 96446, 120640, 124448, 125823, 135485, 168785. Fine analysis of the spectra is in progress.

Wolf obtained high-dispersion coudé spectra of the A3Ia star HD 33579 in the Large Magellanic Cloud. The analysis has begun.

Koelbloed and Takens obtained a number of coudé spectra (dispersion generally 3 or 12 Å/mm) of metallic line stars (HD 6619, 36060, 53811, 45229, 207098, 67456); supermetallic line stars (HD 6482, 65345, 87837) and high-velocity stars (HD 39364, 81783, 6269, 90362, 23249 and CoD-33°3337). Spectra of a number of subdwarfs (HD 4597, 10519, 88261, 97998, 101612 and 101614) as well as of a number of Ball stars (HD 15087, 33709, 41701, 50264, 60197, 67036, 71458, 85205, 104340, 123585, 83548) were obtained with a dispersion of 20 Å/mm. Spectra in various dispersions were obtained of HD 26169, 101065 and 18884.

Miss Underhill obtained spectra with the coudé spectrograph of several early-type stars which are being analyzed in Utrecht and at the Laboratory for Optical Astronomy of the Goddard Space Flight Center. Among the stars may be mentioned η CMa, ε Ori, HD 159132, HD 125823, and HD 120709.

Interferometer techniques were used by Louise for a high-resolution study of the physical structure of Southern H II regions. The Orion and η Carinae nebulae were observed in detail. Double profiles were frequently seen in the latter, indicating an inhomogeneous structure. The analysis of the material will soon be finished.

Schoembs observed the Crab Pulsar. He obtained more than 100 runs of observations, each integrated over 2000 ore more pulsar periods with resolutions of 0.3 ms to about 0.07 ms. A number of planetary nebulae, novae, and variables were also observed for periodic variations. The accumulated data are being analyzed.

Table 1

Visitors using the 1.52 m telescope during 1970

Observer	Observatory	Period	Hours	Programme and equipment
Prévot	Marseilles	Jan. 1 – 5 Oct. 12 – 20 Oct. 27 – Nov. 6	125	Bright stars in the Magellanic Clouds – Cass. spectrograph (RV Cass)
M^{me} Grenier, da Silva	Paris	Jan. 6 – 12 Feb. 17 – 28 March 1 – 3	169	gK stars – RV Cass
		Jan. 27 – Feb. 4 March 14 – 19	92	Metal poor stars – coudé
Koelbloed, Takens	Amsterdam	Jan. 19 – 26	47	Peculiar stars – coudé
van Hoof	Louvain	Jan. 19 – 26	16	Variables, binaries – coudé
Louise	Marseilles	Feb. 2 – 13 March 4 – 10	123	Line profiles in nebulae – Cass.; interferometer
Lindoff	Lund	March 20 – 24	46	Spectral classification of stars in open clusters – RV Cass
Schmidt-Kaler	Bochum	March 28 – 30	32	WR and Be stars – coudé
Maitzen	Bochum	April 1 – 10 partly: April 11 – 12 19 – 20; 29 – 30 May 21 – 22	106	Variable stars, Ap stars – coudé

Observer	Observatory	Period	Hours	Programme and equipment
Hunger	Berlin	April 21 – 29	39	Hydrogen deficient stars – coudé
M^me Cayrel	Paris	May 1 – 5 May 10 – 14 May 23 – 27	117	G and K stars, normal or part. abundance Na, small or large R. V. – coudé
Miss Underhill	Utrecht	June 8 – 13 June 21 – 26	105	Supergiants in Scorpion; WR stars – coudé
Chu-Kit	Marseilles	June 13 – 21 June 26 – July 9	210	Interstellar Ca – coudé
M^lle Mégessier	Paris	Aug. 18 – 26	82	Ap stars – coudé
Schröder	Hamburg	Sept. 3 – 8	47	Stars observed for polarization programme with 1 m telescope – RV Cass
Bardin	Marseilles	Sept. 25 – 30 Oct. 7 – 11	28 40	Stars in the Wing of SMC – RV Cass Supergiants in LMC – coudé
Wolf	Munich	Nov. 10 – 17	62	HD 33579, β Ori, α Car – coudé
Monnet M^me Chériguène	Marseilles	Nov. 25 – Dec. 7	96	H II regions in the Magellanic Clouds – Cass. – interferometer
M^lle Divan M^lle Burnichon	Paris	Dec. 30 – 31	17	Spectrophotometry of stars in the Large Magellanic Cloud – Cass. – special spectrograph

Table 2

Visitors using the 1 m telescope during 1970

Observer	Observatory	Period	Hours	Programme
Lindoff	Lund	Jan. 27 – Febr. 9 Febr. 24 – March 2	159	Open clusters – UBV
Denoyelle	Uccle	Febr. 17 – 24	48	Standard sequences and variables – UBV
The	Amsterdam	March 3 – 5 March 9 – 12 March 25 – 31	97	Sequences in LF fields – I, R
Garnier	Lyon	March 16 – 21 April 9 – 14	109	OB stars – UBV
Schnur	Heidelberg	April 1 – 5 April 15 – 21 April 29 – May 3	139	Stars in clusters – UBV
Moffat	Bochum	May 6 – 11	39	Novae fields; clusters – UBV
M^{me} Morguleff, M^{lle} Rousseau	Paris Lyon	May 15 – 19 May 21 – 25 May 31 – June 4 June 8 – 16	102	G and K stars – UBV, uvby and I, R
Maitzen	Bochum	May 25 – 28	14	IC 2944 – Polarimetry
Elst	Uccle	June 20 – 27 July 11 – 18	84	Variables – UBV

Observer	Observatory	Period	Hours	Programme
Roslund	Uppsala	July 4 – 11 July 23 – 30 Aug. 6 – 12	126	M stars in Sco – UBV
Plaut	Groningen	Aug. 13 – 24 Aug. 31 – Sept. 8	172	Variable stars in Palomar fields – UBV
Schröder	Hamburg	Sept. 15 – 30	97	Southern bright stars for structure of galactic magnetic field – polarimetry
Alcaíno	Santiago	Oct. 3 – 5	20	Globular clusters and galaxies – UBV
Brunet	Marseilles	Oct. 29 – Nov. 16 Nov. 23 – 26	172	Stars in the Large Magellanic Cloud; Nova Graham – UBV and 6-colour photometry
Mianes	Lyon	Nov. 23 – 26 Dec. 10 – 16	73	Stars in the Large Magellanic Cloud – 6-colour photometry
Wolf, Schoembs	Munich	Dec. 3 – 10 Dec. 23 – 29	88	Crab Pulsar, short period variables – special equipment

Table 3

Visitors using the Objective Prism Astrograph during 1970

Observer	Observatory	Period	Hours (exp. time)	Programme
Burnage	Marseilles	Jan. 1 – 5 Jan. 6 – 13	59	Fields in the Large Magellanic Cloud
		Oct. 1 – 9	18	Fields in the Small Magellanic Cloud
Denoyelle	Uccle	Febr. 3 – 9 Febr. 24 – 28 March 1 – 2	56	Fields in Vela
Vogt	Bochum	March 3 – 8	29	Milky Way fields
Schmidt-Kaler	Bochum	March 9 – 11	10	Milky Way fields
Traversa	Marseilles	May 1 – 11 June 1 – 11	42	Milky Way fields
Azzopardi	Toulouse	Aug. 8 – 11 Aug. 22 – Sept. 3	88	Spectrophotometry of stars in the Small Magellanic Cloud
		Oct. 19 – 27 Nov. 18 – 29	112	Fields in the Large Magellanic Cloud
M^{lle} Martin	Marseilles	Dec. 22 – 31	50	Fields in the Large Magellanic Cloud and between the Cloud and the Galaxy

Table 4

Visitors using the 15 cm telescope during 1970

Observer	Observatory	Period	Hours	Programme
van Hoof	Louvain	Jan. 4 – 6 Jan. 8 – 10 Jan. 12 – 17 Jan. 19 Jan. 22 – 25	108	Variables
Elst	Uccle	June 14 – 16 June 27	10	β Can. Maj. stars

Table 5

Visitors using the Bochum telescope during 1970

Observer	Observatory	Period	Hours	Programme
M^{me} Grenier	Paris	Jan. 1 – 4	29	8th to 13th mag stars – UBV
Elst	Uccle	June 17 – 18	20	β Can. Maj. stars – UBV
		July 18 – 20	20	SX Phoe
Garnier	Lyon	Aug. 18 – 26 Aug. 31	100	Ap stars and spectroscopic binaries – uvby
M^{lle} Mégessier	Paris	Sept. 1 – 8	34	GKM stars in SA 141 – B, V
Garnier	Lyon	Oct. 1 – 14	45	GKM stars in SA 141 – B, V
Plaut	Groningen	Sept. 8 – 27	67	UBV photometry of standard stars in Palomar variable star fields
Schröder	Hamburg	Oct. 15 – 23	40	UBV photometry of stars on polarization programme
Oja	Uppsala	Nov. 1 – 15	133	Narrow band photometry of late-type stars

Table 6

Visitors using the 50 cm Danish telescope during 1970

Observer	Observatory	Period	Hours	Programme
Oja	Uppsala	Nov. 16 – 26	68	Narrow band photometry of late-type stars

Joint Research with Universidad de Chile

F. Noël, Departamento de Astronomía, Universidad de Chile, who is in charge of the joint astrolabe project between ESO and Universidad de Chile, reports that the observations of the catalogue groups B have been continued, and it is expected to be completed during 1971. Preliminary individual corrections for some FK 4 stars were presented to the XIVth General Assembly of the IAU at Brighton, England, in the paper "Corrections for some FK 4 stars deduced from Astrolabe observations at Santiago, Chile".

The time and latitude results, for the investigations of the earth rotation and polar motion, have been published by the International Polar Motion Service in its Monthly Notes and by the Bureau International de l'Heure (BIH) in its Annual Report. The results of Cerro Calán are used with maximum weight by the BIH for the computation of the Universal Time and polar coordinates.

Failures in the Ebauches integrating chronograph produced disturbances in the development of the programme during this year. A new electronic counter and a digital recorder made by Hewlett-Packard were provided by ESO. These new instruments have been installed recently in the chronograph, and its performance is expected to be more reliable.

Staff Research

The Galactic Plane

Galactic Structure

Ardeberg has continued the study of an area of 6 square degrees in Scorpius, centered on R. A. = 17^h13^m, Dec. = $-33°15'$ (1950). He has observed photoelectrically in the UBV system 450 stars of spectral type earlier than A 5, with $B \leq 13$ mag, and 150 bright stars with types later than A 5. In a low absorption part of the area he has observed 150 stars with $B \leq 16$ mag.

Polarimetry has been carried out of 30 bright, reddened OB stars.

Plates have been taken with the GPO astrograph for spectral classification as well as for the determination of radial velocities. In addition slit-spectra have been obtained for about 20 B and A stars.

Ardeberg has also obtained coudé spectra (12 Å/mm) of 10 distant OB stars in the Crux-Centaurus region. In the same field he has observed 55 OB stars photoelectrically.

Havlen has carried out H β photometry and obtained slitspectra (73 Å/mm) of stars in the association Pup OB 2. The aim is to test the reality of the association and to study the possible membership of AQ Pup in the association.

Preliminary photometry indicates that the OB stars are at considerably greater distances than the cepheids.

Westerlund has continued the observations (photoelectric and spectrographic) of the OB and Be stars in an area of about 100 square degrees centered on the Southern Coalsack. Photoelectric observations of about 150 stars with V = 12 have been obtained.

Westerlund has also obtained several spectra (73 Å/mm) of stars previously observed photoelectrically in a distant association in Norma.

Rickard has begun a study of distant OB stars in the galactic plane with the aim of comparing the line profiles in the interstellar lines with other data (radio and optical) and of obtaining the Ca/H and Na/H ratios in the interstellar gas. So far 40 good spectra (12 Å/mm) have been obtained.

Individual Galactic Clusters

Ardeberg has observed 50 stars in the high-latitude cluster, Mel 227, photoelectrically in the UBV system. He has obtained coudé spectra (20 Å/mm) of 10 stars. Objective-prism plates (110 Å/mm) from CTIO are also available. Ardeberg has also obtained coudé spectra (12 Å/mm) of stars in the high-latitude cluster ε Sculptoris. Uvby and UBV photometry of stars in the region of this cluster is being carried out by Colin, Breysacher and Westerlund.

Several galactic clusters in the Crux-Centaurus Area are being investigated by Ardeberg, Rickard and Westerlund as part of a study of the galactic structure in this direction. Photographic material for the majority of these clusters has previously been obtained by Westerlund, and p. e. sequences are available for many of them.

Havlen has carried out uvby and H β photometry of stars in NGC 6193. He has obtained spectra for classification and radial-velocity measurements of some members of the cluster. A UBV sequence has been extended to faint stars for use with photographic material.

Westerlund has continued the analysis of the photoelectric and photographic material of the highly reddened cluster in Ara, detected by him some years ago.

High-latitude Areas

Ardeberg has carried out uvby photometry of 100 stars in a $4^\circ \times 4^\circ$ field centered in the South Galactic Pole and done polarimetry of 30 of these stars. The stars are selected from objective-prism plates (100 Å/mm) previously obtained at CTIO.

Havlen has observed all stars brighter than $V = 13.5$ in a field of one square degree in SA 141. He has obtained spectra (73 Å/mm) of all stars brighter than $V = 12$ in the area.

Rickard has obtained spectra (73 Å/mm) of several stars at high latitude in the direction of a High-Velocity Cloud. A preliminary inspection of the spectra has given no indication of interstellar lines.

West (ESO, Hamburg) carried out spectrographic and photoelectric observations of stars in McCormick proper motion fields as part of a joint programme with Blaauw. He obtained over 60 good spectra of F-stars fainter than 11 mag and a large number of plates, mainly for spectral classification, with the GPO astrograph. Uvby-photometry was done in 5 of the McCormick fields near the South Galactic Pole.

As part of a programme on Selected Areas at Lund Observatory, Ardeberg has established sequences in SA 164, 165, 188 and 205. Photographic plates in UBV as well as objective-prism plates are available.

The Small Magellanic Cloud

Ardeberg and Westerlund have carried out photoelectric photometry in the UBV system of a number of stars in the field near NGC 419 ($\sim 1^h10^m$; $-73°10'$) with magnitudes between V = 13 and 16 for a determination of their membership in the Cloud.

De Groot has observed some P Cygni type stars mainly at a dispersion of 73 Å/mm. This should yield radial velocities of the different types of absorption and emission lines and give equivalent widths of some of the strongest lines.

Havlen has observed the long-period cepheid HV 821 for velocity variations and has done UBV photometry of stars in its neighbourhood.

As a follow-up of the survey for blue stars in the Wing of the Small Cloud by Westerlund and Glaspey photoelectric photometry and spectrography (73 Å/mm) of stars in selected associations, clusters and fields are being undertaken by Ardeberg and Westerlund to a limiting magnitude of V = 16.5. Ardeberg has done polarimetry of the 8 brightest OB stars in the Wing.

The Large Magellanic Cloud

Ardeberg is studying NGC 1910 and an adjacent area in the Bar of one square degree. He has established a sequence to V = 16 in the latter area and observed nearly 300 stars photoelectrically. The limiting magnitude is V = 16.2 in NGC 1910 (110 stars) and V = 13.5 for the remainder. Slitspectra (73 Å/mm) have been obtained of the 10 brightest stars. GPO astrograph plates (unwidened) are used for classification purposes.

Ardeberg and Maurice collaborate with the Marseilles group in the investigation of the supergiants in the LMC. Ardeberg has obtained UBV photometry of 115 stars in the Marseilles list and Maurice collaborates in the spectrographic work.

De Groot is observing the known P Cygni type stars. In the Large Cloud some of the stars are bright enough to be studied at a dispersion of 20 Å/mm.

Westerlund has continued the work on the associations in Constellation III and on other selected associations for which a photographic material, obtained at Mount Stromlo Observatory, is available.

Several U, B, V sequences to a limiting magnitude of about V = 16.5 are now available.

Westerlund and Colin, initially in cooperation with Dossin, have obtained high-dispersion spectra of 30 Doradus for studies of the velocity distribution in particular in its nucleus. The spectra show marked velocity differences over short distances.

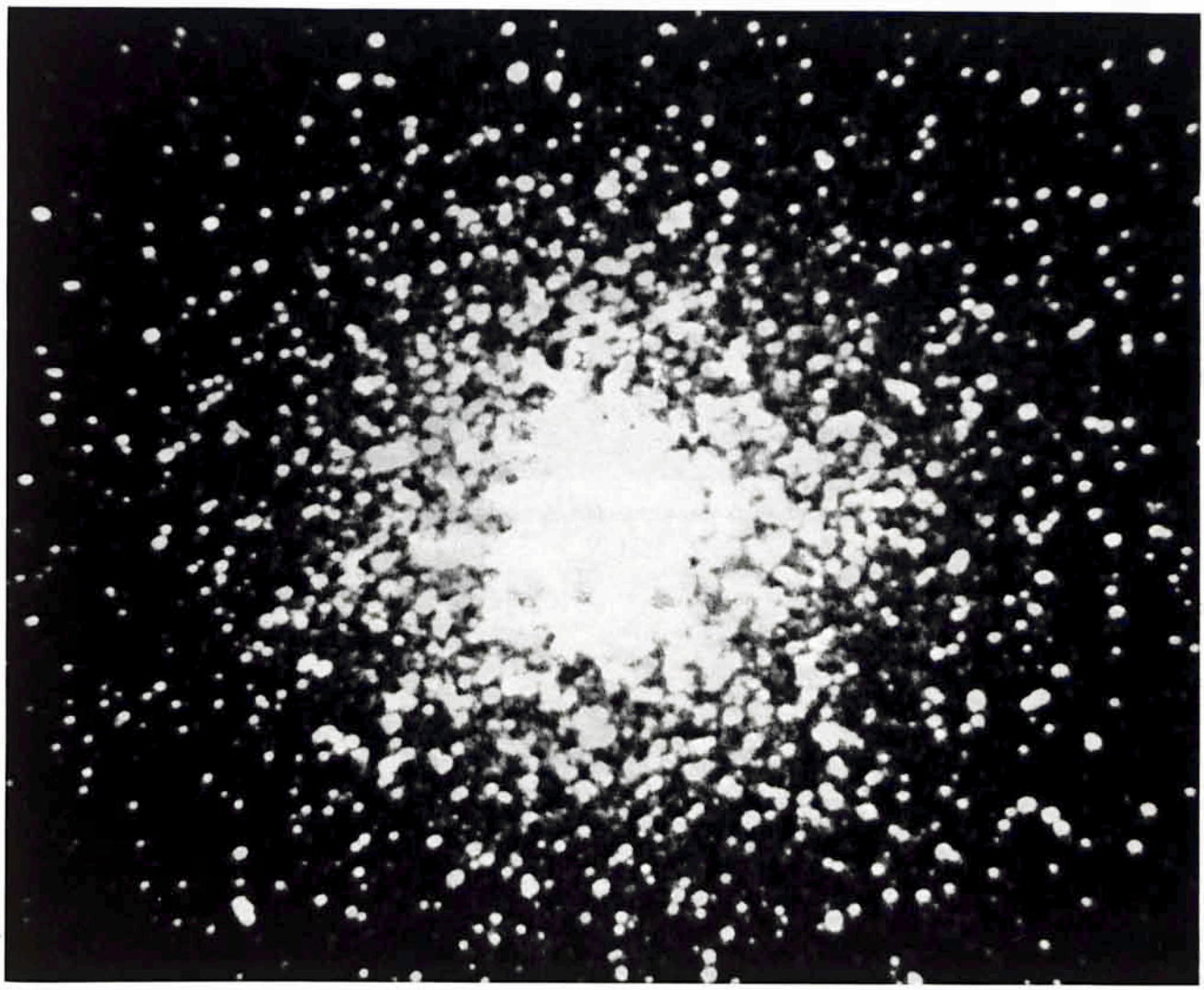
Low dispersion (73 Å/mm) spectra have been obtained of the supernova remnants N 49 and N 63 A as well as of nebulosities and stars in their neighbourhood.

Other Galaxies

During the second half of 1970, Rickard (ESO-Chile) tested three image intensifiers of the type ITT – 4708 by photographing a large number of bright southern galaxies. The existing Zeiss camera was used as a mounting to attach the image tube device to the 1.52 m telescope at the Cassegrain focus. The photos demonstrate some of the results obtained during four test periods in 1970.

The image tube camera is still under development. Problems not associated with the image tube itself delay the possibility of its use by visitors at this time. Hopefully these problems will be solved in 1971.

A complete description of the image tube camera will appear in an ESO Bulletin when it is ready for visitors' use.



47 Tuc Globular Cluster. Filter: BG-28. Exp.: 1^m. 1.52 m telescope; Zeiss camera with ITT 4708 image tube; experimental photograph.

30 Dor Largest HII region in LMC. No filter. Exp.: 15^{s}. 1.52 m telescope; Zeiss camera with ITT 4708 image tube; experimental photograph.

Special Objects

Ardeberg has obtained light-curves in UBV for 3 eclipsing binaries CX Agr, ST Agr and RV Gru.

De Groot is studying a number of spectroscopic and spectroscopic-eclipsing binaries. The stars are being observed photoelectrically as well as with the highest possible dispersion with the coudé spectrograph.

Havlen has detected CaII H and K emission on coudé spectra (12 Å/mm) of the long-period galactic cepheid RS Pup. The phenomenon is being followed for studies of possible variations in intensity and velocity with phase. (See figure on p. 28.)

NGC 6302 Peculiar Planetary. Filter: RG-2. Exp.: 1m30s. 1.52 m telescope; Zeiss camera with ITT 4708 image tube; experimental photograph.

Havlen and Westerlund have obtained widened and unwidened spectra in high dispersion (3 and 12 Å/mm) of η Car and continue to observe it regularly. The widened spectra are studied for line intensity variations, the unwidened are used by Havlen to study the velocity field.

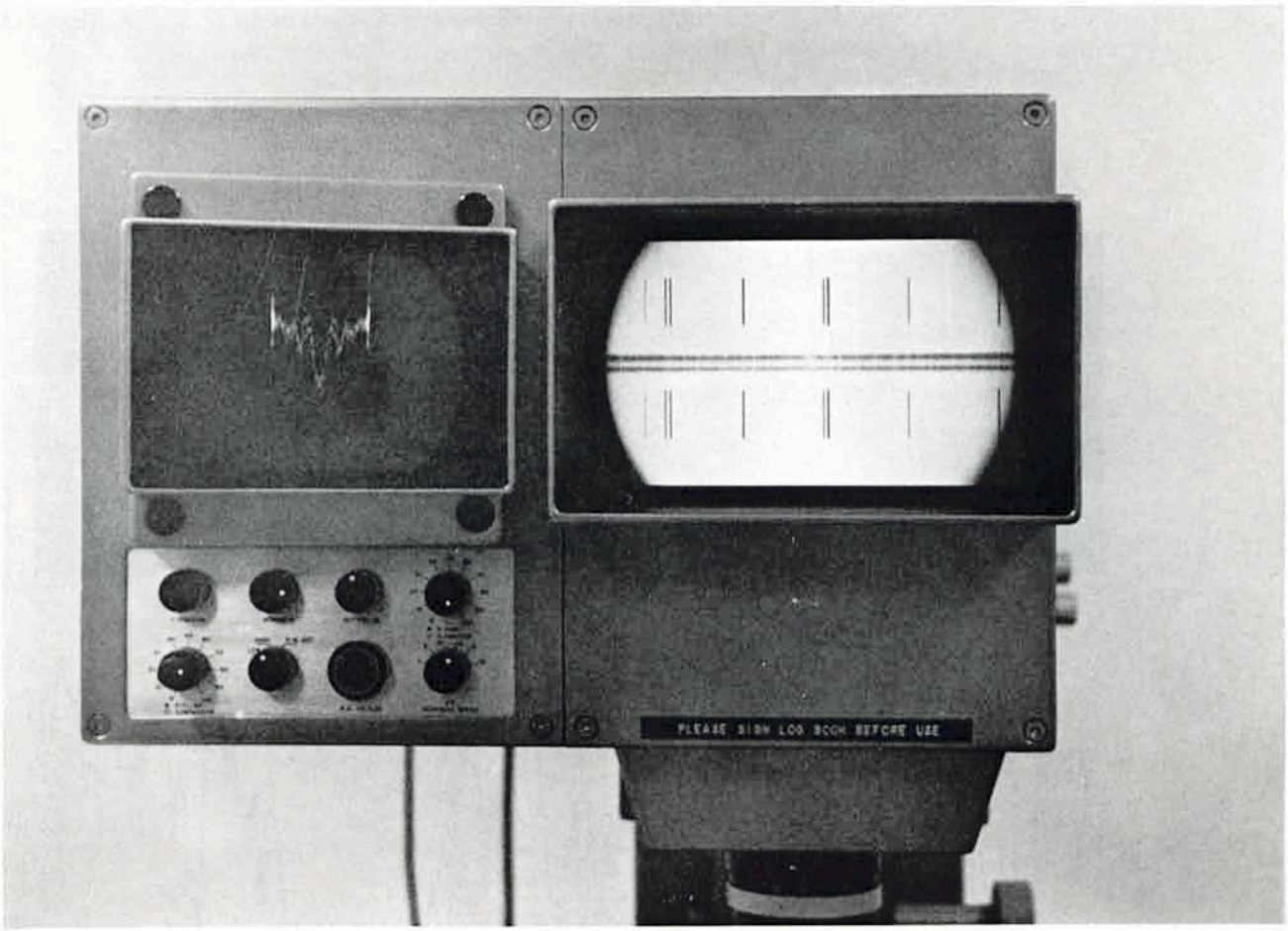
Line identification and velocity analyses are also being carried out for the three bright novae 1970: Serpens, Aquilae and Scuti.

Nova Mensae 1970 b in the Large Magellanic Cloud was observed spectrographically and photoelectrically during several nights; the data are being analyzed by Havlen, West and Westerlund.

NGC 1487 Peculiar Galaxy. No filter. Exp.: 4m. 1.52 m telescope; Zeiss camera with ITT 4708 image tube; experimental photograph.

Westerlund has obtained several spectra (12 Å/mm) of HD 148937, the nucleus of the peculiar nebulosities NGC 6164–5. The star has previously been followed during several years at Mt. Stromlo Observatory, then with lower dispersions.

ESO participated in a programme of simultaneous observations of SX Phe organized by J. Stock of Cerro Calán Observatory, Universidad de Chile. A prestudy of the polarization of the object was done by Wood with negative results. On October 19, simultaneous observations were done at Cerro Tololo and Cerro La Silla; the results from La Silla are light curves in H β light.

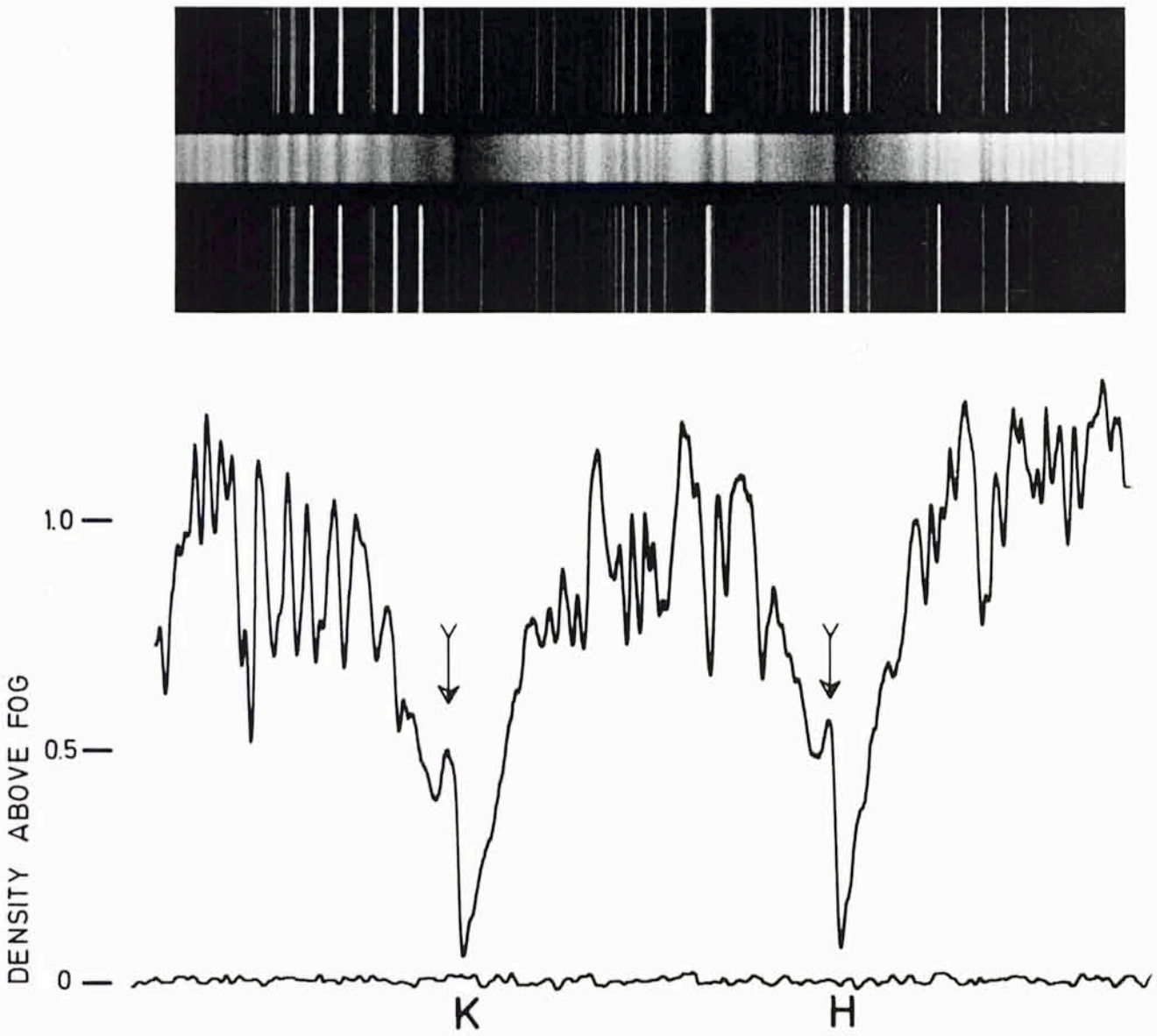


A Zeeman spectrogram displayed on the ESO/Chile Grant machine.

Muller (ESO, Hamburg) observed SX Phe photoelectrically in the UBV system during a more extensive period in October. The data are being analyzed at present.

Wood is observing Ap stars for the detection and study of stellar magnetic fields using a Babcock-type Zeeman system on loan from KPNO, Tucson.

He is also observing Ap and spectrum variable stars for time variations using H β, H γ and K-line interference filters.



The above illustration shows a portion of the spectrum of the cepheid RS Pup (P = 41.4 days) taken at a phase of 0.986 and with the transitory emission in the H and K lines of CaII. The original dispersion on the plate was 12.3 Å/mm. Such emission is well known among cepheids. Its appearance is generally restricted to times during the rise to maximum of the cepheid light curve and varies in duration according to the cepheid's period. Variations in intensity and velocity have also been correlated with the cepheid phase.

Publications by ESO Staff

Ardeberg, A.

Photoelectric photometry of early-type stars in a field in Ophiuchus. Arkiv Astron., **5,** 387, 1970 (with S. Wramdemark).

Photoelectric photometry of luminous B-type stars in a Milky Way field in Cepheus. Arkiv Astron., **5**, 391, 1970 (with K. Särg).

Blaauw, A.

The European Southern Observatory and its collaboration with CERN. CERN Courier, Vol. 10, No. 8, August 1970.

De Europese Zuidelijke Sterrenwacht in Chili. Hemel en Dampkring, Vol. 68, 97–105, 1970.

Remarks on local structure and kinematics. IAU Symposium No. 38 (The Spiral Structure of Our Galaxy) p. 199–204, 1970.

De Groot, M.

Mass loss from P Cygni. Mass loss from stars, p. 26, 1970 (ed. M. Hack).

Maurice, E.

Absorption interstellaire dans la direction du Grand Nuage de Magellan. C. R. Acad. Sc. Paris **270**, 1504, 1970 (with Ch. Fehrenbach, J. P. Brunet and L. Prévot).

Etoiles à grandes vitesses dans la direction du Grand Nuage de Magellan. C. R. Acad. Sc. Paris, **271**, 490, 1970 (with Ch. Fehrenbach, J. P. Brunet and L. Prévot).

Rickard, J. J.

Line profiles of interstellar K lines observed in distant OB stars. Bull. Am. Astron. Soc., **2**, 339, 1970.

West, R. M.

An investigation of the 3600–4000 Å region in G5–K5 stars by means of objective prism spectra of intermediate dispersion. Bulletin of the Abastumani Astrophysical Observatory, No. 39, 29–97, 1970.

Mass loss and evolution in close binaries. Proceedings of the IAU Colloquium No. 6. Copenhagen University Observatory, 1970 (co-editor: K. Gyldenkerne).

Westerlund, B. E.

The stellar content of the Magellanic Clouds. Vistas in Astronomy, **12,** 335, 1970 (ed. Beer).

Wood, H. J.

The G-band variations of Beta Doradus. Astron. J., **75**, 999, 1970 (with J. K. Estes).

Radio observations of α^2CVn. Astrophys. J., **161**, L 129, 1970 (with J. D. Trasco and M. S. Roberts).

Spectrum variability in β Carinae. Bull. Am. Astron. Soc., **2**, 226 (1970).

ESO Publications

ESO Bulletin No. 7, Communications No. 7 and Annual Report 1969 were sent to more than 400 astronomical institutions around the world. The corresponding mailing list was thoroughly revised.

Scientific Programmes Committee

The Scientific Programmes Committee met twice, in Bonn on April 29 and in Liège on November 11, as guest of the Universitäts-Sternwarte and of the Institut d'Astrophysique respectively. The meeting in Bonn was partly attended by H. von Alvensleben of the Bundesministerium für Bildung und Wissenschaft. At these occasions visits were paid to the Hoher List Observatory, to the radio telescope in Effelsberg and to the laboratories of the Institut d'Astrophysique.

The main item at both meetings was the discussion of the applications for observing time in Chile. In the 2nd meeting no allocations were proposed to the Directorate but a rating of the scientific value of the applications was given instead, serving as a base for the Directorate to draw up a suitable and justified allocation schedule. Also during the 2nd meeting long range programmes were proposed. The special character of such programmes made it advisable to have these discussed in a special meeting early in 1971.

The SPC, among other things,

a. recommended to distribute well in advance of each SPC meeting the reports of the Director in Chile on the current programmes and instrumentation;

b. supported the proposal of the Directorate to change the Rules for Visiting Astronomers with respect to daily allowances;

c. recommended to give high priority to the Sky Survey Programme after the Schmidt telescope has come into regular use;

d. recommended to gain experience with a yearly division of observing time into six months intervals;

e. recommended the replacement of Walraven by Borgman as regular member of the Scientific Programmes Committee in view of Walraven's stay in South Africa.

Meteorology

The meteorological conditions were slightly better than during 1969. In the following table is given the total number of clear hours as well as the total number of photometric nights in 1966, 1967, 1968, 1969 and 1970. A photometric night is defined as a night with six or more hours of uninterrupted clear sky.

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

The complete meteorological results for 1970 will be published in a forthcoming number of the ESO Bulletin.

Other Activities

Participation in Scientific Meetings

The AURA and ESO astronomers in Chile met on Cerro Tololo in February for discussion of current programmes and instrumentation development.

Rickard presented a paper on Interstellar K Lines at the meeting of the American Astronomical Society in Boulder, Colorado, in June.

Ardeberg, Blaauw, de Groot, Maurice, Muller, Ramberg, West and Westerlund participated in the General Assembly of the International Astronomical Union in Brighton, in August. Ardeberg and West became members of the Union. West presented a paper on automatic classification of G5–K5 objective prism spectra. Westerlund was elected President of Commission 45 and a member of the Organizing Committee of Commission 33 for the next three year period.

Ardeberg participated also in the IAU Colloquium (No. 11) on Automation in Optical Astrophysics in Edinburgh and Westerlund in the IAU Symposium (No. 44) on External Galaxies and Quasi Stellar Objects in Uppsala.

Havlen presented a paper on RS Puppis at the meeting of the American Astronomical Society in Tampa, Florida, U.S.A, and attended the 5th Texas Symposium on Relativistic Astrophysics in Austin, Texas, in December.

West presented a paper on Nova Mensae 1970 b at the AAS meeting in Tampa, Florida, U.S.A., in December.

Colloquia

Colloquia have been given in our Headquarters in Santiago by J. Stock, Cerro Calán; Miss A. Underhill, Utrecht; L. Plaut, Groningen; J. Wood, ESO; B. Wolf, Munich; T. Oja, Uppsala; and R. Schoembs, Munich.

Lectures

F. Dossin, J. Rickard and B. Westerlund gave each a series of lectures on Spectroscopy, Galactic Structure and Galaxies, respectively, in the Department of Astronomy at the University of Chile.

M. de Groot has given lectures in Basic Astronomy on La Silla as well as in our Santiago Headquarters for our local staff.

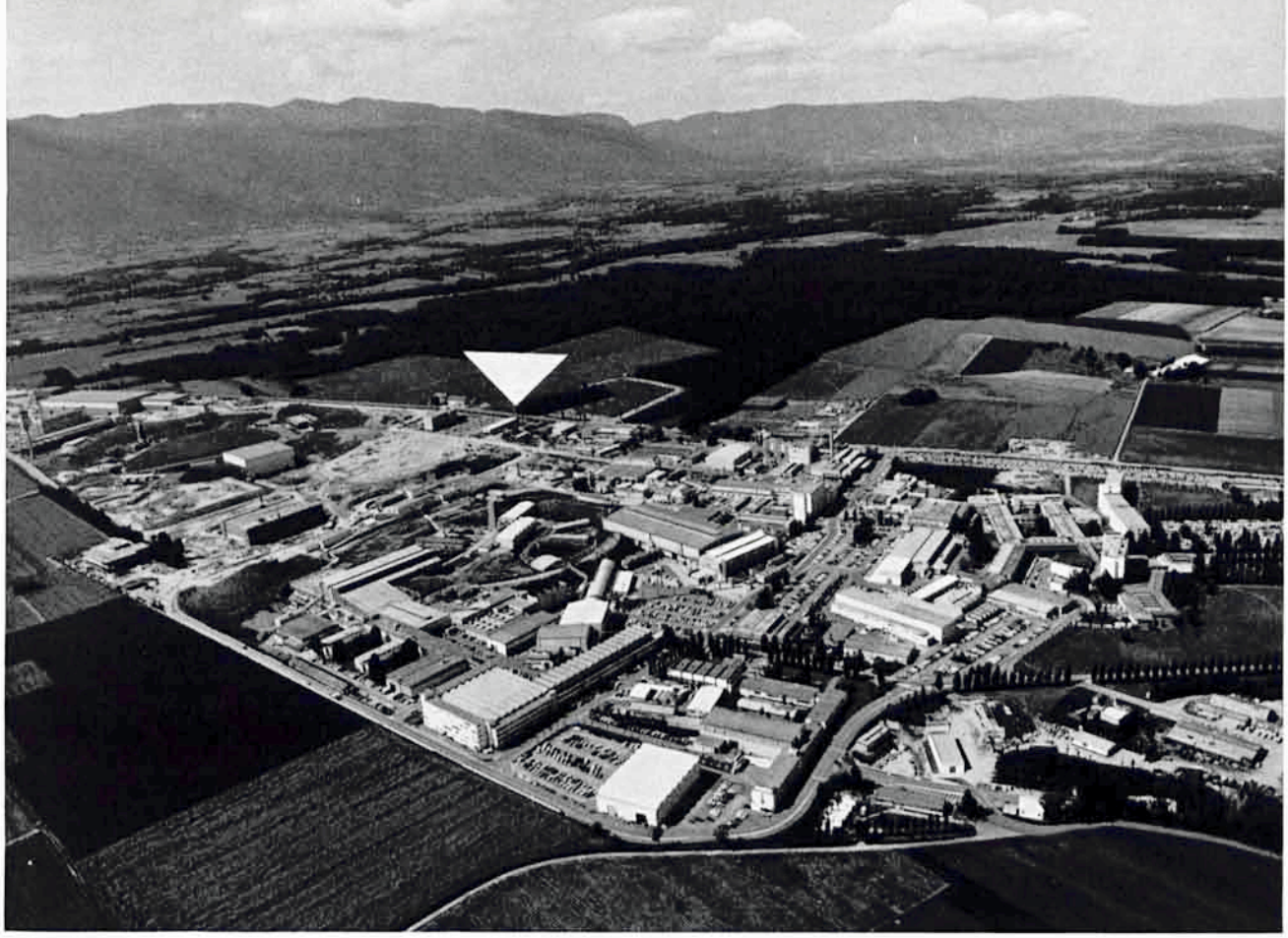
R. West gave a series of 6 lectures at the Abastumani Observatory and at the University of Tbilisi, Georgia, USSR, in September-October.

Visitors to La Silla

During the year about 500 visitors were received on La Silla. Most of our visitors were students from colleges and schools in the provinces of Coquimbo and Atacama.

Exhibition

ESO shared with AURA a stand "Observatorios Astronómicos" at the "Exposición de Peñuelas" in La Serena in February.



Air view of the CERN area where the ESO Telescope Project Division has been established (see arrow).

THE 3,6 m TELESCOPE PROJECT

Creation of the ESO TP Division. Agreement with CERN

The thorough discussion of the 3.6 m telescope project at the meeting of the Council on December 15 and 16, 1969, had made it clear that a new way of proceeding had to be found in order to realize the project within a reasonable time.

Before the meeting referred to, the Directorate had approached some competent European firms with the aim of finding out the general terms on which they would be willing to engage themselves in the project.

Furthermore, the ESO Directorate had taken up contacts with the Directorate of CERN and also made a first approach to ESRO in order to explore the possibilities of collaboration on the telescope project with one of these organizations – the leading thought being that ESO might profit from the facilities of these two large organizations and from their wide experience in projects of similar scope and nature.

As the result of the discussion at the meeting of the Council on December 15 and 16, 1969, the Council authorized the Director General to further explore a collaboration with CERN. The Director General should also fully investigate the possibilities of cooperation with industry.

At the same occasion the Council came to the conclusion that, whichever the final form for the realization of the project might turn out to be, ESO had to establish a group of astronomers, engineers, etc. for conducting the project through all its phases. As a first step in this direction, the Council accepted the proposal of the Directorate to create a few staff positions for the further development of the project.

During the first half of 1970, the negotiations with CERN continued and encountered a very collaborative attitude on their part.

Renewed contacts were also taken up with industrial firms, but it became clear that the project could not be entrusted to any of them at this stage; they could not commit themselves to an undefined project of this type, but would appreciate to be approached when the project had developed so far that it came to construction.

The Director General proposed to the Council at its meeting on June 11 that the 3.6 m telescope project be handled by a special Telescope Project Division. The proposal was mainly based on the document "Memorandum on Further Development of the ESO 3.6 m Telescope Project" of May 11, 1970, prepared under the supervision of Laustsen of the Hamburg staff in close collaboration with the Technical Director. Previous to the meeting of the Council this document had been discussed by its advisory committees, viz. the Instrumentation Committee, the Finance Committee and the Committee of Council. The discussion of the Council at its meeting on June 11 resulted in the decision to set up the ESO 3.6 m Telescope Project Division (TP Division), according to the proposal submitted by the Directorate.

The main task of the Division would be to define the project, to provide basic drawings and technical specifications, to negotiate about contracts with industrial firms, to follow and supervise the work of the firms, to participate in the assembling of the telescope and, not less important, to follow the telescope to Chile to take part in its definitive assembling and to be responsible for its being put into operation.

The discussions between ESO and CERN had resulted in a draft contract which was also discussed by the ESO Council at its meeting on June 11. Also this document had before the meeting of the Council been submitted to the relevant advisory committees. It described the character and the legal aspects of the collaboration and specified the services to be rendered by CERN.

On September 16 the agreement covering collaboration between the European Southern Observatory and the European Organization for Nuclear Research was signed at CERN by the Director Generals of ESO (Professor A. Blaauw, left) and of CERN (Professor B. P. Gregory, right).

The Council unanimously decided that collaboration with CERN in the realization of the 3.6 m telescope project should be sought according to the principles as presented in this draft agreement.

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" was signed in Geneva on September 16, for CERN by the Director General B. P. Gregory, and for ESO by its Director General A. Blaauw.

The small group, under the leadership of Laustsen, already established at the ESO Office of Hamburg for the development of the 3.6 m telescope project, moved to Geneva in October, and during the last months of the year the "ESO TP Division" at CERN was gradually built up. At the end of the year, twelve people were employed on the project. Six of these were staff members of ESO, the others partly personnel of CERN, partly of agencies in Geneva.

Telescope

Optics

The figuring of the optics in the works of REOSC proceeded according to schedule during the year, and the firm regularly presented to ESO progress reports.

The shaping of the main mirror was nearing its completion at the end of the year. The Chairman of the Instrumentation Committee together with Couder followed the different phases of the optical work of the mirror.

The figuring of the three flat mirrors of the telescope was finished and the work on the two convex mirrors started.

A small group of ESO experts consisting of the TP Division leader and Monnet, Bahner, Baranne and Behr was formed with the task of testing the telescope optics in the works of REOSC independently of the tests performed by the firm. A special interferometer was developed by Baranne, Malaise and Monnet for the ESO tests.

Mounting

The design work of the bureau of Dr. Strewinski was not continued during the year in order that this bureau could concentrate on the work on the Schmidt telescope.

Two engineers at CERN made a study of the telescope on the basis of Strewinski's predesign, and from the middle of the year they started the further design.

Control

The control group continued defining the tasks for the telescope control and making a layout of the whole control system. The work on drive control was continued partly in collaboration with firms.

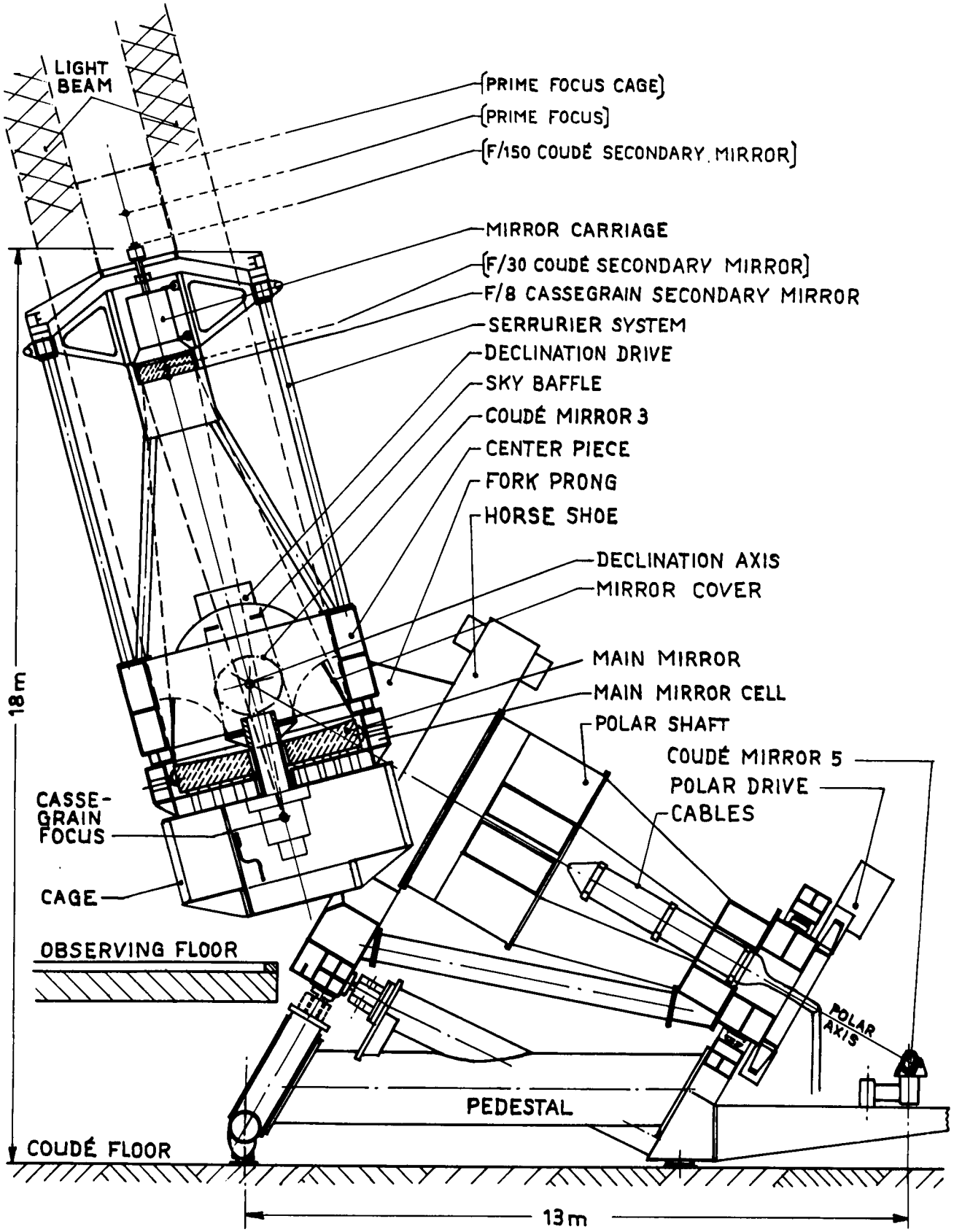
Building and Dome

The design of the telescope building continued during the year; it was not possible to bring it to an end because of uncertainties concerning the final telescope design.

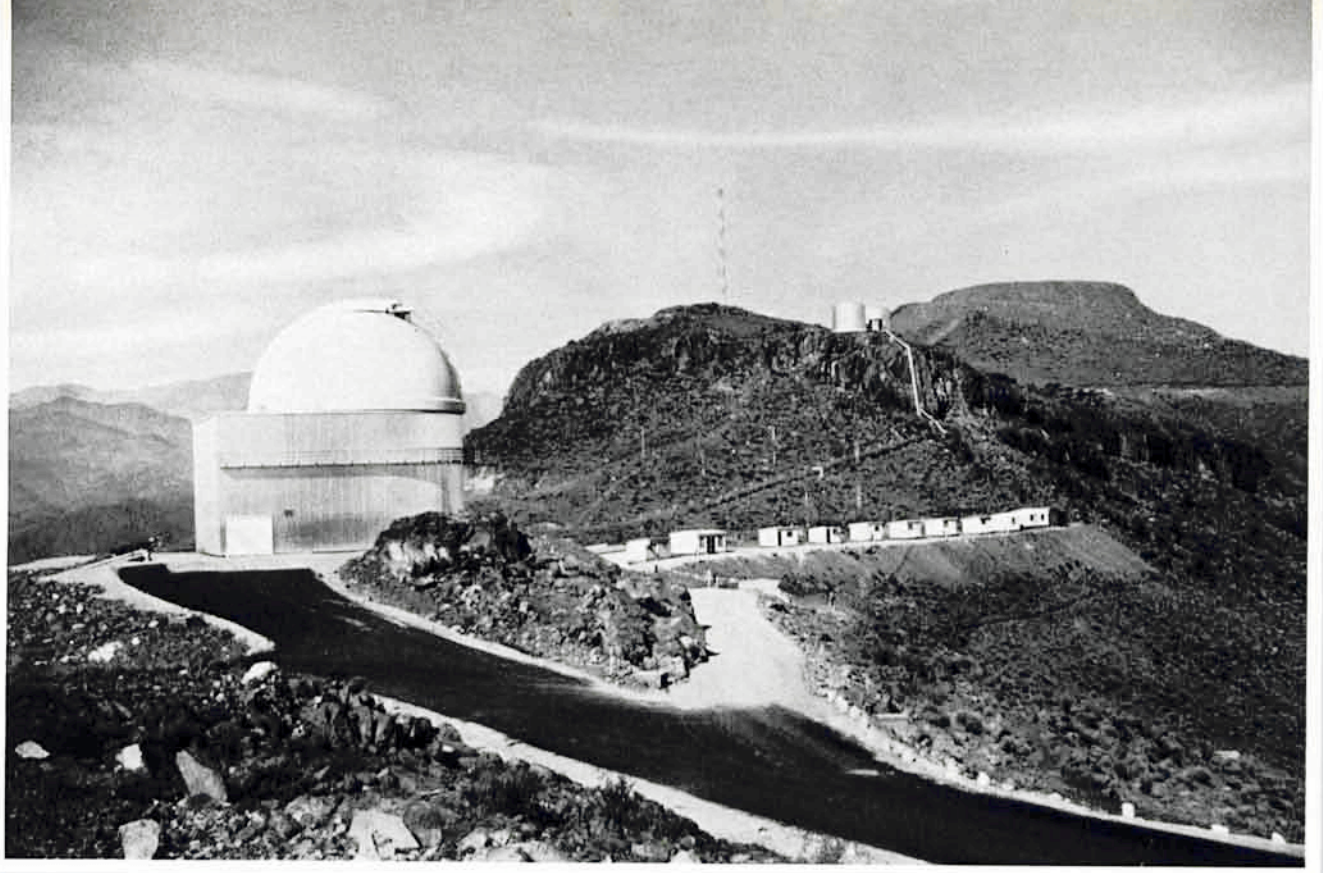
No further work was done on the dome.

Report on the Project

As one of its first main tasks the TP Division started drawing up a project description giving a technical specification of telescope, building and dome as planned, a time schedule for the realization of the project and an estimate of its financial implications. This project report was finished in provisional form in February 1971.



Section of the 3.6 m Telescope.



Building for the Schmidt Telescope on La Silla.

SCHMIDT TELESCOPE PROJECT

Optics

The optics for the Schmidt telescope was finished by the firm of Zeiss, Oberkochen, in October. Ramberg, and Behr, consultant to ESO, examined the optics in the works of Zeiss on November 11 and 12. According to their provisional visual and photographic tests the quality of the optics seemed to be within the tolerances as defined in ESO's contract with Zeiss. Zeiss handed over a report on the optics in the form of two detailed test certificates. This report was presented to the Instrumentation Committee at its meeting on December 1, 1970. The Instrumentation Committee appointed a special group of experts consisting of Behr, Couder, Malaise and Monnet for studying the report and giving their comments. The next step of the ESO Directorate after having received these comments will be to have the main mirror of the optics tested in its cell at Zeiss.

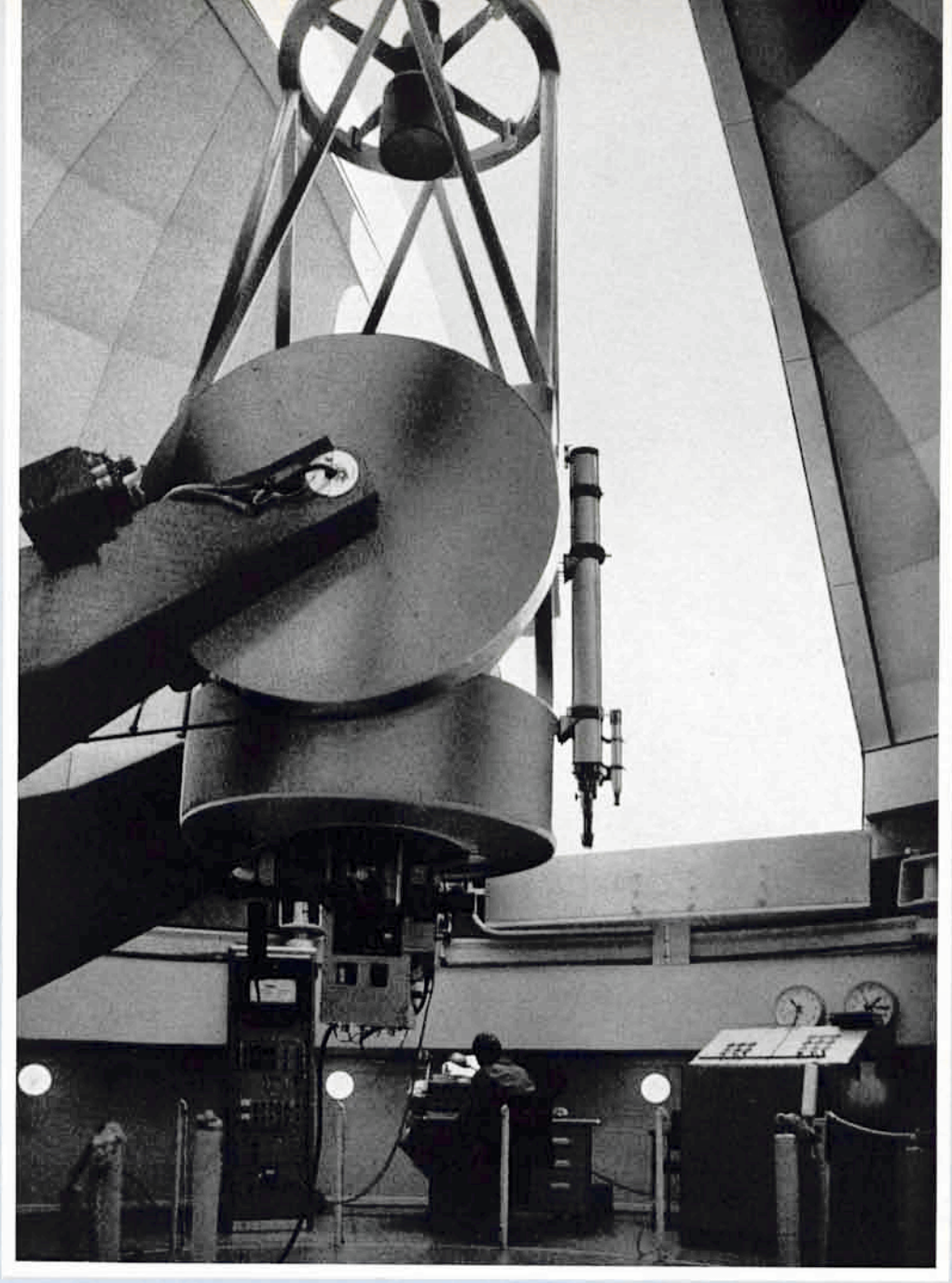
The report mentioned only concerns the optics of the telescope proper, i. e. the main mirror and the corrector plate. The objective prism ordered from the firm of

Zeiss was almost finished at the end of the year. Some minor imperfections were still to be corrected.

Mounting

In spite of the strong pressure continuously put by the ESO Directorate on the firm of Heidenreich & Harbeck and particularly on the bureau of Strewinski, the completion and delivery of the mounting of the Schmidt telescope was further retarded. At the end of the year it seemed to be realistic to assume that the telescope can be shipped to Chile at about the middle of 1971.

The Director General prepared a clarification of the financial relations with the bureau of Strewinski.



The 1 m Photometric Telescope

INSTRUMENTS AND AUXILIARY EQUIPMENT

Instrumentation in Chile

Telescopes

Generally, the telescopes performed well throughout the year.

a) The 1.52 m Telescope

The readjustment of the coudé cameras was carried out in September by REOSC technicians. They corrected or improved also several other features. Vin, Haute Provence, did the final focussing tests.

b) The 1 m Telescope

A Cassegrain spectrograph for this telescope was ordered from Boller & Chivens, Pasadena, to be delivered in 1971.

c) The Objective Prism Astrograph

New controls were installed by Bourlon and Moreno and a new prism mounting by Vin and Burnage.

d) The 15 cm Telescope

The new photometer became ready for use.

e) The Danjon Astrolabe

A new electronic counter and a digital recorder were acquired to replace units that had commenced to fail frequently.

Auxiliary Equipment

a) Image Tubes, ITT 4708

The cameras worked very well for direct photography. The Zeiss camera for the Cassegrain focus of the 1.52 m telescope was modified for image-tube work.

b) Pulse-counting Electronics

Preliminary tests were successful but the final testing had to await the arrival of the high speed counters.

c) The Fabry-Perot interferometer

It was made ready for tests upon arrival of the ordered filters, photomultiplier (Bendix Channeltron) and some mechanical parts. This instrument will provide about 0.1 Å resolution of emission lines in two spectral ranges, 3500–4200 Å, and 6200–6800 Å.

d) A digital spectrum scanner was built for the Nasmyth focus of the 1 m telescope.

e) The equipment mentioned under b), c) and d) will be operated with the **General Purpose Data Acquisition System (GPDAS).** The Hewlett-Packard computer 2114 B and most other parts arrived in the end of the year.

f) In order to eliminate difficulties with fluctuations in the voltage on La Silla, a **stabilizing plant** was designed. Due to the long delivery times it was expected to be in use at the earliest in August 1971.

g) New coldboxes were made or were under construction to replace those in use on the photometer of the 1 m telescope. In particular the one for the infrared sensitive tube (RCA 7102) had not worked very satisfactorily.

Measurig Equipment

The measuring equipment was the same as listed in the Annual Report for 1969. The automation of some units had begun.

a) The Grant machine was installed in March 1970. It was used frequently to provide strip chart tracings of spectra and for measurements of radial velocities.

The **HP 2114 B computer** for the automation of the Grant machine arrived in July; its mag tape unit came in September.

b) The HP 2114 B computer itself became capable of processing **Assembly and Fortran programmes.** A conversion programme exists to read data tapes produced on La Silla in Friden Flexowriter code to tapes compatible with the HP computer (ASC II code).

c) The **new reticule** for the Hilger-Watts-Ferranti measuring machine was received. It was mounted after necessary repairs of guide and microscope.

Photographic Equipment

The equipment for the darkroom in the Vitacura Headquarters began to arrive. We hope to be able to have the darkroom in full operation in July 1971.

Development Work at Hamburg

In the end of this year a begin was made with the design of a photometer for the 50 cm ESO telescope. The aim is to construct a photometer with easily interchangeable diaphragms and filters, with a Peltier type coldbox and with easy possibilities for use with a data acquisition system.

Development Work at Marseilles

The optical group of the Marseilles Observatory continued its activity of the preceding years.

1) Optical and mechanical parts for the RV Cass spectrograph and the coudé spectrograph were prepared and executed.

2) Baranne studied the problem of the alignment of the 3.60 m telescope.

   A new design was presented for the siderostat of the 3.60 m telescope, adapted to the modified building.

3) The camera ITT of the RV Cass spectrograph realized according to the designs of the Marseilles group was received in December and aligned at the Observatory. Adjustment difficulties were caused by misaglignment of the corrector, requiring delicate treatment on account of the large central obstruction. The necessary modifications were realized by the group. The camera was to be delivered in March 1971.

4) Various parts of the Echelle Spectrograph were assembled at the Marseilles Observatory. They include the three supports for the optics, the camera f/2 C. E. (to which some important modifications were made), the slit assembly and the "platine de réglage".

   This spectrograph may be assembled in Chile in the course of 1972. It will work just with a plane field objective ordered from CERCO, Paris, upon request of the La Silla staff; thus there will be time to realize the installation necessary for the good operation of an electronic camera.

Danish National 1.5 m Telescope Proposal

A. Reiz reports as follows:

"Plans for a Danish 1.5 m reflecting telescope date back to the early sixties. When considering the location for such an instrument, it was from the outset obvious that the observing conditions in Denmark were too limited to justify the erection of a telescope of such dimensions inside the country. With the assumption that Denmark would soon join the European Southern Observatory it was natural to think of the ESO territory as the right site for the instrument; in such excellent conditions supported by the existing ESO facilities the capabilities of the telescope would be utilized in the best possible way. Judging the project from the viewpoint of ESO one could argue that the instrument because of its size and design would add considerably to the already existing ESO telescopes on La Silla.

After Denmark had become a regular member of the Organization in 1967 the project was presented to ESO, and at its meeting in June 1969 Council approved of the Danish plans to install on La Silla a reflecting telescope with an opening of 1.5 m. Furthermore, Council decided to reserve an amount not exceeding $ 210 000 for the construction of the telescope building, subject to the condition that ESO would have the right to a certain percentage of observing time (50 % for the first 5 years).

Following this decision the detailed planning of the project was started in the fall of 1969. In our efforts to carry out these plans we have received most valuable help from the Kitt Peak National Observatory, which has made available to the Copenhagen Observatory drawings of the 60-inch reflecting telescope installed at the Inter-American Observatory on Cerro Tololo. This instrument has been the prototype for the Danish telescope. Further we have enjoyed the constant and stimulating support of astronomers at the ESO office and in the ESO countries.

The following account of the development of the project covers the years 1969 and 1970 and is mainly concerned with the general lines of the optical and mechanical design.

The optical design will be of the Ritchey-Chrétien type: a Cassegrain-type aplanat – the first two Seidel errors, spherical aberration and coma equal to zero – with curved field. Both mirrors, of diameters 154 cm and 61.5 cm, are hyperbolic, the excentricities being 1.173 and 8.28 respectively. There will be one focal position only, an f/8.5 Cassegrain focus, hence the scale is 16 arc seconds per mm. The focal ratio of the primary mirror is f/3.5.

With the addition of a correcting element of the Schmidt type, made of FK 5 glass, which is highly transparent to radiation of wavelengths down to 320 nm, a flat field of critical definition of a diameter about 18 cm or 48 arc minutes can be obtained. Inside this field the image spread does not exceed 0.5 arc seconds for the wave length range 340 nm to 660 nm. Such a system will be advantageous for direct photography; incorporating a suitable device for checking the collimation between the two mirrors photographic astrometry of faint stars could be attempted.

The mirrors will be made of Zerodur, a zero-expansion glass-like substance developed by the firm of Jenaer Glaswerk Schott & Gen., Mainz, W. Germany.

As already mentioned the mechanical design of the telescope will closely resemble that of the 60-inch installed at the Inter-American Observatory on Cerro Tololo; hence the instrument will be of the asymmetric type.

The main differences in comparison with this telescope derive from the fact that the present instrument has been planned for use in the f/8.5 Cassegrain focus exclusively. Consequently, the secondary mirror is permanently fixed, which permits a relatively simple and mechanically quite stable arrangement for its mounting. With the exclusion of the coudé focus the flat coudé mirrors are eliminated. The removal of the last one from the polar axis implies considerable simplification with respect to the bearings.

With the focus located 95 cm behind the vertex of the primary the distance between the two mirrors is equal to 351 cm. Hence the telescope tube is rather short, and the diameter of the dome can be kept as small as 10.5 m.

The support systems for the primary mirror are conventional: the axial support will be by means of twelve individual counterbalanced pads, and the radial support by means of another twelve counterbalanced units applying both push and pull.

The tube will be of a Serrurier truss, designed to bend an equal distance at each end under gravitational loading and so preserve optical collimation.

For the drive and control system a device very similar to the one developed for the ESO 50 cm telescope will be used. The diurnal drive, for counteracting the earth's rotation, is provided by the traditional worm and wheel. However, for slewing, setting and tracking one single torque motor will be used; its speed, which can be varied within wide limits, is controlled by means of a computer, incorporated as an integral part of the control system. This will simplify and speed up telescope operation, make for more accurate setting and driving, and facilitate the incorporation of an automatic guider. It should be added that the use of a tele-

vision system has been contemplated, which will both facilitate the identification of faint objects and make remote operation of the instrument possible.

The Zerodur mirror blanks were ordered early in 1970. The figuring of the optics, for which D. Malaise, Institut d'Astrophysique, Liège, Belgium, will be responsible, is scheduled to start in May 1971.

In addition to the aforementioned contribution from ESO for the construction of the building, financial support for the construction of the telescope and dome have so far been granted by the Carlsberg Foundation, Copenhagen, and the Danish Natural Sciences Research Council."

Hostel La Silla from South.

BUILDINGS AND GROUNDS

The following has been abstracted from the much more extensive report for 1970 prepared by the Technical Department of ESO in Chile; this is available to Council on request.

La Silla

Power, Water and Heating Installations

Both the power plant of Pelícano and the one on La Silla were overhauled in the course of the year. 720 000 kWh were generated and 192 m^3 of diesel oil were consumed for the generation of power.

The three submerged water pumps were taken out from their wells for overhauling of the motors, and certain parts of the pumps replaced. In May, June and July the ground water level in Pelícano was lowered considerably by intensive pumping

from the open pit, due to water consumption for the construction of the road to the CARSO Observatory.

In Pelícano the three horizontal cylindrical tanks of 6 m^3 each, which were mounted before the installation of the 100 m^3 reservoir, were connected to this one, to create the possibility of emptying the main reservoir for inspection, cleaning or repairs. These tanks as well as those installed elsewhere were cleaned and provided inside with an anti-rust coating. The control system for the softening of the water was improved. Production and consumption of water in 1970 were as follows:

	m^3	m^3/day	%
Total well production	20 200	55.4	100.0
Consumption in Pelícano	5 200	14.3	25.7
Consumption on La Silla	10 200	27.9	50.6
Consumption in water treatment	4 800	13.2	23.7

Bacteriological analyses were done for us twice a month by the Chilean Government laboratory in La Serena.

Problems connected with the sewage system in Pelícano were solved by the installation of a new, 170 m 4-inch pipeline towards the filtering bed in the centre of the valley.

One of the boilers of the heating plant on La Silla was repaired and improved after a break-down. The old pumps in the heating system of hostel and telescope buildings were replaced. Heating equipment for dormitories and bungalows was installed in new housing and put into operation in the course of the year. The total consumption of diesel oil for heating was 156 m^3.

Roads

Both the public road outside our territory and the private road on our territory required regular maintenance. For the public road our equipment was used 30 % of the time, for the private road 60 %, and for the remaining 10 % it was under regular repair. The road maintenance was particularly heavy in connection with the use of parts of the public road by a mining company installing its new yard and because of the use for the construction of the road for our neighbouring Observatory CARSO. In connection with the construction of the ENTEL relay station some new road on La Silla had to be constructed. The parts of the roads on La Silla covered with an asphalt layer had to be regularly kept in proper condition.

Buildings

The telescope buildings required regular maintenance on dome, slit, windscreens, elevators, platforms, ventilators, heaters, etc. An attempt was made to maintain constant temperature of 20° C in the coudé room of the spectrographic building by means of a thermostatically controlled ventilation system. The construction of two new buildings, one for the 50 cm telescope of Copenhagen University and one for the ESO 50 cm telescope, started in July; they were completed for about 60 % of the contract by the end of the year.

Quebrada Pelicano

Hostel, dormitories and bungalows were generally kept in good running order. Some difficulty was experienced in attempts at preventive maintenance, in connection with the fact that only a few hours per day are available for this work, in view of the required silence during the sleeping hours of day-workers and night-workers. Some office space was provided for in the hostel for use by the resident astronomers.

The "Old Camp" on La Silla, dating from the earliest establishment of the Observatory, remained in full use although these wooden cabines hardly meet standard requirements any more. In Camp Pelícano only light repairs were carried out. The wooden dormitories in Camp Beño were provided with electric power and water in connection with the use by labourers for the 50 cm telescope building constructions.

First plans were drawn up for the erection of improved living quarters for the night assistants. A new study was undertaken for finding a proper distribution of activities between La Silla and Camp Pelícano at the base of the mountain.

La Serena

Some improvements were made to the old bungalow (bungalow No. 1) owned by ESO. At the adjacent same site, the construction of three prefabricated bungalows was started. Two of these were finished in the course of the year; the third one not yet in connection with the necessity of removal of a high tension power line still located above the site. Electric power for these bungalows was supplied; water supply was not yet provided.

Santiago

Repairs of the roof of the headquarters building at Vitacura were carried out after considerable delay. Some small changes were made to the measuring rooms on the ground floor. The garden was much improved and somewhat extended by our own personnel.

Regular maintenance was done in the guesthouse. In the Director's house the electrical installations were overhauled.

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.

LIBRARY

ESO has four libraries:

An observational library with the major astronomical journals, handbooks, observatory publications, charts, etc. A number of elementary and intermediate level textbooks have been bought for the benefit of the night assistants. — *La Silla*

The aim is a complete astronomical library. Until now, most astronomical literature, published after 1950, has been acquired. Some of the major journals extend further back. — *Santiago*

A small technical-astronomical library. — *Geneva*

A small, but sufficient astronomical library with the more important journals, handbooks, observatory publications, etc. — *Hamburg*

During 1970, the building-up of the libraries continued at a somewhat faster rate than in the previous years, and 280 volumes of journals and around 500 books were added to the stock. With the exception of observatory publications, the state of the libraries may, as a whole, be considered acceptable for astronomical research at the end of 1970.

In the second half of the year, an exchange of observatory publications has been established with about 200 observatories, and many back issues have already been received. After being sorted, they will be divided among the libraries in the beginning of 1971.

ESO now subscribes to around 100 astronomical and technical journals. Almost all journals for the libraries in Chile are received in the library in Hamburg and forwarded with diplomatic bag to ensure a rapid distribution. A similar procedure is followed with important books etc. As a result, the Santiago library has been frequently visited by Chilean astronomers who in this way had access to the newest literature at an earlier date than before.

About 200 volumes of journals were bound in Santiago.

Subscriptions to the weekly airmail editions of six major European newspapers have been made for the libraries in Santiago and on La Silla.

A "Book Request" form has been used throughout the year to facilitate the ordering of new books. More than 300 requests were received from the staff and subsequently effectuated.

On June 1, 1970, Mrs. M. Ardeberg changed from part-time to full-time librarian in Santiago because of the growing amount of work. The building-up of the libraries was supervised by R. M. West from January 1, 1970.

The cooperation between the libraries at Observatorio Astronómico Nacional (Cerro Calán), AURA and ESO continued and has proven to be most useful for all parts.

PERSONNEL

A. Blaauw assumed his task as Director General per January 1.

D. Vuyk resigned from his post as Director for Administration and Construction in Chile as per April 15.

F. Dossin, Astronomer in Chile, left ESO in August to resume his duties at the University of Liège.

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

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

R. West	Astronomer	January 1
G. Bachmann	Chief Finance	October 12

b) **Chile**

M. de Groot	Astronomer	January 27

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

W. Bauersachs	Civil/Mechanical Engineer	October 1.

The following staff members were transferred from the Office of the Director General to the new office of the 3.6 m Telescope Project Division:

S. Laustsen	Senior Astronomer
M. Blichfeldt	Electronics Engineer
B. Malm	Astronomical Technician
P. Scharnweber	Electrical Engineer.

8 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. 63.

FINANCIAL MATTERS

Estimated and Actual Expenditure

In December 1970 the ESO Council decided to adopt the CERN budget format providing for a more specific presentation of expenditure and income according to their nature under the main headings:

Personnel
Operations
Capital Outlays.

Further, within each heading, the new format shows separately the costs of the ESO Directorate in Hamburg, the ESO Organization in Chile and the ESO 3.6 m TP Division in Geneva.

Since this new format is implemented effective January 1, 1971, the accounts for 1970 are still presented as in previous reports:

Budget Items	Budget 1970 (Amounts in US $ 1000)	Actual Expenditure 1970
I. Capital Expenditure		
A. Land, Buildings, Roads	1.265	31
B. Instruments	750	374
C. Consultants	100	–
TOTAL CAPITAL EXPENDITURE	2.115	405
II. General and Overhead Expenses	1.750	1.577
III., IV. Astronomical and Meteorological Activity	200	136
V. Maintenance Roads, Buildings, Instruments and Installations	180	191
Unforeseen	40	7
	4.285	2.316

Expenditure in 1970 was again much lower than estimated due to the delay in the development and construction of the 3.6 m telescope building and dome.

The accumulated Expenditure up to December 31, 1970,

can be summarized as follows:

Budget Items	Accumulated Expenditure up to December 31, 1970 (Amounts in US $ 1000)
I. Capital Expenditure	
A. Land, Buildings, Roads	5.972
B. Instruments	4.155
C. Consulting Engineers and Architects	1.463
TOTAL CAPITAL EXPENDITURE	11.590
II. General Overhead and General Expenses	5.781
III. Astronomical and Meteorological Activity, South Africa	501
IV. Astronomical and Meteorological Activity, Chile	505
V. Maintenance Roads, Buildings, Instruments and Installations	340
Unforeseen	88
TOTAL EXPENDITURE UP TO DECEMBER 31, 1970	18.805

The total Budget for 1971

was fixed at an amount of US $ 6.961.000 detailed as follows in accordance with the new budget format (amounts in US $ 1000):

Description	Directorate Hamburg	Operations in Chile	3.6 m TP Division Geneva	Total
Personnel	206	1.356	420	1.982
Operations	180	1.049	178	1.407
Capital Outlays	–	1.308	2.264	3.572
	386	3.713	2.862	6.961

Of the credit for capital outlays to the amount of $ 3.572 are foreseen for

Land, Buildings, Roads	$ 1.656
Instruments	$ 1.916
	$ 3.572

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 1970 and held the following meetings in Hamburg:

2nd Meeting on February 5

3rd Meeting on March 9

4th Meeting on May 21

5th Meeting on November 17.

The main task of the Group during the year under report has been the study and formulation of the ESO Staff Rules and Regulations for international staff. The Rules and Regulations for Chilean workers will be worked out and finalized in the year 1971. The Rules and Regulations for both ESO international staff and local staff are adapted in their totality to the CERN Staff Rules and Regulations, however with due regard for the special nature of the ESO establishments in Chile.

With the increase of administrative staff in Europe and in Chile late in 1970, various administrative procedures were developed, on which can be reported more fully in 1971. The establishment of the ESO 3.6 m Telescope Project Division at Geneva and the growing work load and responsibilities in the administrative field led to some reorganization of the Directorate, the functions of the Hamburg office being more clearly separated into the divisions under the Manager and the Technical Director plus some remaining directly under the Director General.

In agreement with the decision taken by Council in its 10th Meeting at Brussels on July 2 and 3, 1968, the ESO Office at Hamburg rendered administrative services to the Board of Directors of the European journal Astronomy and Astrophysics.

COUNCIL, COMMITTEES AND WORKING GROUPS

a) **The Council** met on June 11 (15th Meeting) and on December 9 (16th Meeting) in Hamburg. President of Council was J. H. Bannier. No changes occurred in the memberships in Council.

b) **The Committee of Council** held its first Meeting in Hamburg on May 6. A second Meeting was held on November 17. No changes occurred in the composition of this Committee during the year under report.

c) **The Finance Committee** met on March 10 at Hamburg (17th Meeting), on May 22 at Hamburg (18th Meeting), on October 28 at Hamburg (19th Meeting). In the 17th Meeting C. Zelle succeeded K. F. Scheidemann as Chairman.

d) **The Instrumentation Committee** met on June 2 in Hamburg (30th Meeting) and on December 1 in Geneva (31st Meeting).

e) For the meetings of the **Scientific Programmes Committee,** see page 30.

APPENDIX A.

Employees on Contract with ESO in Grades 9 and higher per December 31, 1970

Hamburg Office:

A. Blaauw	Director General
J. Ramberg	Technical Director
A. B. Muller	Senior Astronomer
J. Bloemkolk	Manager
G. Bachmann	Chief Finance
R. West	Astronomer
R. Doorn	Chief Personnel
J. Meuser	Chief Purchasing and Shipping

Chile:

B. Westerlund	Director of ESO in Chile
R. Villena	Chief Engineer
H. Hyslop	Administrator
J. Rickard	Astronomer
P. Fjellerad	Maintenance Engineer
E. Maurice	Astronomer
M. de Groot	Astronomer
A. Ardeberg	Astronomer
H. E. Schuster	Astronomer

3.6 m TP Division, Geneva:

S. Laustsen	Senior Astronomer
W. Bauersachs	Civil/Mechanical Engineer
M. Blichfeldt	Electronics Engineer
B. Malm	Astronomical Technician
P. Scharnweber	Electrical Engineer

France:

R. Clop	Mechanical Engineer

APPENDIX B.

List of Members of Council and Committees per August 1, 1971

ESO Council

Belgium:	A. G. Velghe M. Deloz
Denmark:	A. Reiz O. Obling
France:	A. Lallemand A. Alline
Federal Republic of Germany:	R. Kippenhahn C. Zelle
The Netherlands:	J. H. Oort J. H. Bannier (President)
Sweden:	E. B. Holmberg G. Funke

Committee of Council

A. Alline (France)

J. H. Bannier (Netherlands), President

M. Deloz (Belgium)

Ch. Fehrenbach (President of the Instrumentation Committee)

G. Funke (Sweden)

A. Reiz (Denmark)

B. Strömgren (President of the Scientific Programmes Committee)

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

ESO Finance Committee

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

ESO Instrumentation Committee

K. Bahner

A. Behr

A. Couder

G. Courtès

R. Coutrez

Aina Elvius

Ch. Fehrenbach (Chairman)

M. V. Migeotte

L. Neven

A. Reiz

B. Strömgren

A. Wallenquist

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 Working Group for Buildings

A. Blaauw (Chairman)

J. Dommanget

E. B. Holmberg

P. Lacroute

A. Reiz

ESO Scientific Programmes Committee

	Substitute
J. Borgman	A. van den Heuvel
J. Delhaye	J. Lequeux
E. B. Holmberg	A. Elvius
B. Strömgren (Chairman)	A. Reiz
P. Swings	P. Ledoux
G. Traving	B. Baschek

ESO Working Group for Publication Problems

A. Blaauw (Chairman)

G. Funke

P. Lacroute

A. G. Velghe

H. H. Voigt

ADDRESSES

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ESO Headquarters Chile	Alonso de Córdova 3107, Vitacura. Casilla 16 317 – Santiago 9, Chile. Telephone: 28 50 06. Telex: 3520048. Telegrams: ESOSER – Santiago de Chile.
ESO Guesthouse	Gustavo Adolfo 4634, Santiago de Chile. Telephone: 48 42 54 (near cross-roads Avenida Christóbal Colón and Amerigo Vespucio, then through Félix de Amesti).
ESO Local Office La Serena	Casilla 27 D. Balmaceda 595, La Serena, Chile. Telephone: 11 67, 11 77. Telegrams: ESOSER – La Serena.

The ESO Observatory on La Silla can best be reached by mail, telegrams etc. via Santiago Headquarters (address see above).

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