ANNUAL REPORT 1973

EUROPEAN SOUTHERN OBSERVATORY

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presented to the Council
by the Director-General, Prof. Dr. A. Blaauw,
in accordance with article VI, 1 (a) of the ESO Convention

E R R A T U M

A regrettable error has slipped into the article on the ESO 3.6 METRE TELESCOPE PROJECT DIVISION (page 45). In the second sentence of that article it is said that the contract for the domes, etc. was awarded to Sulzer of Switzerland. This is not the case; the contract was awarded to Krupp, Germany. Therefore, the second sentence should read: "It will be recalled that the contract for the building was awarded to Interbeton B.V. of the Netherlands, for construction and assembly of the main structure of the telescope to Creusot-Loire of France, for the main gears to MAAG Gearwheel Company of Switzerland, for the domes, etc. to Krupp G.m.b.H. of Germany and for the air-conditioning to Sulzer of Switzerland."

Please accept our apologies for the error.

The Editors

Organisation Européenne pour des
Recherches Astronomiques dans l'Hémisphère Austral

EUROPEAN SOUTHERN OBSERVATORY

Cover Picture:

The map shows the European observatories, most of them in the ESO member states, that participated in the ESO visiting astronomers programme during the period January, 1970 to January, 1974. The numbers on the map are grouped by country and represent each an observatory, the location of which is given hereafter:

1 = Uppsala, 2 = Stockholm, 3 = Lund, 4 = Copenhagen, 5 = Aarhus, 6 = Kiel, 7 = Hamburg, 8 = Berlin, 9 = Göttingen, 10 = Bochum, 11 = Bonn (Observatory Hoher List, Daun/Eifel), 12 = Heidelberg, 13 = Tübingen, 14 = Munich, 15 = Groningen, 16 = Amsterdam, 17 = Leiden, 18 = Utrecht, 19 = Ghent, 20 = Mons, 21 = Brussels, 22 = Louvain, 23 = Liège, 24 = Paris (Meudon), 25 = Strasbourg, 26 = Lyons, 27 = Toulouse, 28 = Montpellier, 29 = Marseilles, 30 = Saint-Michel, Haute-Provence, 31 = Nice, 32 = Geneva, 33 = Vienna, 34 = Warsaw.

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INTRODUCTION

General Developments and Special Events

Developments in Chile during 1973 were of more than usual significance to the Organization in the external sphere, where the political events of September had temporary side-effects. During the political disturbances, the La Silla establishment continued to function normally, but the La Serena office closed very briefly; there were longer interruptions of work in Santiago, communications were broken and generally uncertain conditions prevailed for a few days.

Subsequently, conditions improved. The previous black market conditions and big fluctuations in exchange rates largely disappeared as a result of drastic measures taken by the new Government. However, a growing gap developed between wage and price increases. ESO has been helped over this difficult period by the continuing cooperation of the Chilean Government and the local authorities.

The research at La Silla Observatory and the other ESO establishments continued to evolve generally along the lines of preceding years. Statistics of telescope use by visiting astronomers are given in this Annual Report as before. It will be seen that the demand for the 1 m and 1.52 m telescopes remained very heavy. The account of research work does not, as in previous years, deal separately with ESO staff and visiting astronomers, but gives an integrated description. We add this time some statistics on the number of institutes that have participated in the visiting astronomers programme during the years 1970 to 1974.

The Schmidt telescope, although not yet fully operational, already provided good quality sky survey plates in the Quick Blue Survey test programme. The first plates were taken in spring, and by the end of the year nearly 100 of them had been shipped for processing to the Sky Atlas Laboratory in Geneva.

A cooperation agreement was started with the Uppsala University for systematic scanning of the Schmidt plates for objects of particular interest.

A new computerized drive control system was installed at the 1 m telescope by the Controls Group of the TP Division giving an ease and precision of control not before achieved.

The 3.6 m telescope, a central item in the ESO programme, moved on towards its inaugural day scheduled for 1976. In the Creusot-Loire plant at Saint-Chamond, near Grenoble, the major components of the mechanical structure approached completion. Good progress was also made with the construction of the dome at Krupp's in West Germany.

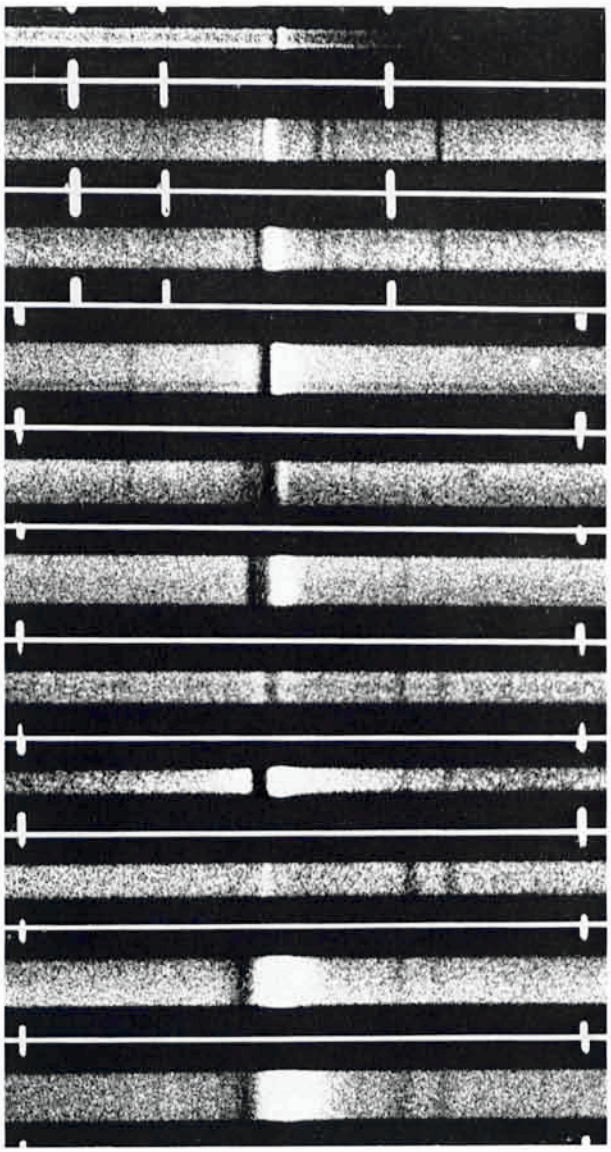
At La Silla, construction on the telescope building site began in June; by the end of the year the foundations were almost completed.

At the TP Division, Geneva, further progress was made on the construction of an assembly hall, mechanical workshop and optical laboratory to be occupied mainly by the group working on the design and assembly of the 3.6 m telescope, and it was expected that the new buildings would be completed around mid-1974.

Although the legal status of the ESO establishments in Chile had been defined since 1963 in the Agreement (convenio) with the Government of Chile, the status of ESO establishments in Europe long remained open. In 1973, however, a Working Group of the Council was appointed to resolve this situation. By the end of the year it had nearly completed its task, leading to the procedure of ratification, by the member states, of a Multilateral Protocol on the Privileges and Immunities of ESO, which was expected to be under way by the beginning of 1975.

In the financial and administrative areas, developments included a change-over from the dollar to the German mark as the budget currency.

Restructuring and closer integration between the Chile and Europe establishments, and within each of these two areas was a main theme of the important resolution passed by the ESO Council in December.



Strong Hα emission features of varying properties of some extreme southern hemisphere A and B supergiants. HD 7583 is the brightest star of the Small Magellanic Cloud. The dispersion is 31 Ålmm for the first three spectra, but 12.3 Ålmm for the rest of the spectra. The spectrograms were taken with the coudé spectrograph of the ESO 1.52 m spectroscopic telescope during 1972 and 1973.

RESEARCH ACTIVITIES

Visiting Astronomers

As in previous Annual Reports, we shall give an account of the research programmes for which telescope time was allocated to visiting astronomers, together with a table of observing dates. We continue a type of statistics, presented for the first time in the Annual Report 1972, concerning requested and allocated observing nights, and we add this time some four-year statistics on the numbers of institutes that participated in the visiting astronomers programme.

Statistics of Telescope Use

The system of two half-yearly terms, from April 1 through September 30, and October 1 through March 31, remained unchanged. It is recalled that the allocation periods are identified by reference numbers, used, e. g., in the Applications for Observing Time at La Silla. The periods under consideration are listed in Table 1.

Table 1

Specification of the periods for which observing time was allocated to visiting astronomers

Reference number	Period from noon	to noon
11	April 1, 1973	October 1, 1973
12	October 1, 1973	April 1, 1974

For the large telescopes a break-down of the requested and allotted observing time per telescope and per country, together with the "pressure factors", as introduced in the Annual Report 1972, is presented in Table 2. These factors represent the requested numbers of nights divided by the allocated numbers as they would be if distributed in proportion to the financial contribution. The small telescopes (ESO 50 cm, Copenhagen 50 cm part-time, Bochum 60 cm part-time) are combined. The table also shows the requests for the Schmidt telescope.

Although the Schmidt telescope was not yet fully operational, it was already possible to produce good quality sky survey plates in the Quick Blue Survey test programme. The requests from the member countries, especially the German institutes, show a lively interest in this instrument. During observing periods 11 and 12 it was possible to satisfy a number of such requests.

The double astrograph for objective prism radial velocity work has again been used by French astronomers exclusively. Requests are currently being received from other countries for the use of this instrument as an astrograph—i. e., without objective prism. This possibility is under study and the result may be to interest other member countries more in the use of this instrument.

Table 3 presents the accumulated numbers over the four-year period March 2, 1970 to April 1, 1974. Requested and allocated numbers of nights are given for the 1.52 and 1 m telescopes separately and for these two telescopes combined, together with the pressure factors. The last column refers to the Grand Prism Objectif.

It will be noted that the pressure factor for all member states combined over the period April 1, 1973 to April 1, 1974 remained the same as it was for the average over the last four years, March, 1970 to April, 1974, namely 2.0.

Table 2

Numbers of nights allocated to visiting astronomers; comparison with requested numbers for the 1.52 m and 1 m telescopes; pressure factors for the 1.52 and 1 m telescopes combined; for the period April 1, 1973 to April 1, 1974 (allocation periods 11 and 12)

	1.52 m telescope		1 m telescope		1.52 and 1 m telescopes combined		Pressure factors	0.5 and 0.6 m telescopes combined	Grand Prisme Objectif	Schmidt telescope
	Req.	All.	Req.	All.	Req.	All. (%)		Allocated	Allocated	Requested
Belgium	56	29	—	—	56	29 (7)	1.6	81	—	5
Denmark	56	7	54	40	110	47 (11)	5.6	—	—	—
France	122	78	47	28	169	106 (25)	1.2	—	97	4
Fed. Rep. of Germany	105	55.5	120.5	70	225.5	125.5 (30)	1.6	172	—	20
The Netherlands	93	33.5	121	47	214	80.5 (19)	5.0	23	—	10
Sweden	35.5	11.5	41	22	76.5	33.5 (8)	1.7	24	—	5.5
Total	467.5	214.5	383.5	207	851	421.5 (100)	2.0	300	97	44.5
ESO staff		140.5		145		285.5		165	—	—
Maintenance, visiting astronomers of other countries	22	10	47	13	69	23		19	—	—

Table 3

Number of nights allocated to visiting astronomers and comparison with requested numbers for the 1.52 m, 1 m and GPO telescopes; pressure factors for the 1.52 and 1 m telescopes combined. Period: March 2, 1970 to April 1, 1974 (allocation periods 4 through 12)

	1.52 m telescope		1 m telescope		1.52 and 1 m telescopes combined		Pressure factors	Grand Prisme Objectif	
	Req.	All.	Req.	All.	Req.	All. (%)		Req.	All.
Belgium	128	89	43	20	171	109 (6.3)	1.2	—	—
Denmark	80	18	80	51	160	69 (4.0)	2.0	—	—
France	810	459	451	164	1261	623 (36.0)	2.2	555	463
Fed. Rep. of Germany	362	188.5	497.5	298	859.5	486.5 (28.2)	1.5	23	20
The Netherlands	138	69.5	426	220	564	289.5 (16.8)	3.2	—	—
Sweden	140.5	57.5	231	93	371.5	150.5 (8.7)	2.1	—	—
Total	1658.5	881.5	1728.5	846	3387	1727.5 (100.0)	2.0	578	483
ESO staff		600.5		633		1233.5			
Maintenance, visiting astronomers of other countries	22	10	47	13	69	23			

The Annual Reports over the period January 1, 1970 to January 1, 1974, i.e. including the present one, allow the presentation of the following statistics on the basis of the tables listing the separate visitors' missions (see Tables 4—9 of the present Report).

(a) In the course of that four-year period, 31 institutes in the ESO countries and 5 institutes from outside these countries participated in the visiting astronomers programme. (It may be recalled that two-thirds of the nights are scheduled for visiting astronomers.) The map reproduced on the cover of the present Report depicts their location (see also page 2). It is gratifying to note that virtually all astronomical institutes in the ESO member states are represented.

(b) Altogether, in these four years, 224 missions of visiting astronomers to Chile were recorded from the member states and 14 from abroad. In these numbers we counted separately the observing sessions with the different telescopes. In many of these missions, more than one visitor participated. Naturally, these numbers of missions differed much according to the size and the interest of these institutes. There were 4 institutes with more than 15 missions, 4 with from 11 to 15, 7 with from 6 to 10 and 21 with less than 6 missions.

(c) The numbers of useful hours reported by visiting astronomers over this four-year period were 6984 for the 1.5 m (spectrographic) telescope, and 5846 for the 1 m (photometric) telescope. The total number of allocated nights being 881 and 846, respectively, the over-all average number of useful hours per night was 7.9 for spectroscopic work, and 6.9 for photometric work.

Research by Visiting Astronomers and ESO Staff

Tables 4—9 summarize the programmes undertaken by visiting astronomers and Tables 10—13 the programmes undertaken by ESO staff astronomers. For each programme the actual number of useful observing hours is given.

Many of the programmes listed in the tables are continuations from 1972; others are still in the stage of reduction and analysis. In the following, some of the achievements during 1973 are summarized.

Galactic Structure

Havlen's continuing studies of the OB stars in Puppis have confirmed that the original members of the association Pup OB3 are in the same distance interval as the long-period cepheid RS Puppis. Most of the OB stars in the neighbourhood of this association, taken from the Stephenson-Sanduleak Catalogue "Luminous Stars in the Southern Milky Way" (LSS), appear, however, to spread out to greater distances along the line of sight. Moreover, a number of clusters, some of them noted by Moffat and Vogt, appear to be more distant. Possibly a distance of about 4 kpc from the sun is reached.

Of the OB stars between the associations Pup OB2 and Pup OB3 about one-half show H alpha emission. These stars appear to form groupings indicative of association with expanding hydrogen shells (supernova remnant?). Also noticeable here is a strong concentration of OB stars below the galactic plane, from b = -2° to -6°, and including NGC 2439 and Hf 15.

Table 4

Visitors using the 1.52 m telescope during 1973

Observer	Observatory	Period	Hours	Programme and equipment
Chériguène and Deharveng	Marseilles	Jan. 1—13	94	Fabry-Perot interferometry of H II regions — own Cass interferometer
Danks	Mons	Jan. 17—27	83	Be stars — coudé
Andersen	Copenhagen	Feb. 5—16 April 23—May 10	92 60	Spectroscopic binaries — coudé Eclipsing binaries — coudé
Laval	Marseilles	Feb. 23—March 1	63	Spectral classification of existing stars in H II regions — RV Cass
Moffat	Bochum	March 5—15	98	Stars in young open clusters — RV Cass
Rickman	Stockholm	March 21—26	52	Peculiar cluster stars — RV Cass
v. d. Heuvel	Utrecht	March 30—April 10	89	Ap stars and X-ray binaries — coudé
Koornneef	Groningen	May 11—28	34	Infrared photometry of the Ara cluster — KLM photometer
Borgman	Groningen	May 16—25	41	Infrared photometry of Galactic Centre — KLM photometer
Hearnshaw	Paris-Meudon	June 12—21	75	Dispersion of late-type stars — coudé
Sterken	Ghent	June 22—25	20	Extreme supergiants — coudé
Gleizes	Montpellier	June 27—July 9 July 20—27	127	Spectrographic observations of weak planetary nebulae — RV Cass
Terzan	Lyons	July 27—Aug. 6	78	Investigation of RR Lyrae stars in globular clusters — Zeiss camera

Observer	Observatory	Period	Hours	Programme and equipment
de Graauw and van de Stadt	Utrecht	Aug. 10—17	93	Infrared Heterodyne Detection — special equipment
Seggewiss	Daun/Eifel	Aug. 10—22 Sept. 2—8	132	Blue stragglers in open cluster IC 4756, RV curves of DV Aqr, DX Aqr and HD 159176 — coudé
Kaufmann	Berlin	Sept. 8—19	77	Early-type stars with He and/or other abundance anomalies — coudé
Bournichon and Prévot	Paris Marseilles	Oct. 11—21	73	Spectral classification of 40 O-type stars — spectrograph Chalonge
Haefner	Munich	Oct. 23—31	78	Non-stationary phenomena in stellar atmospheres — coudé
Hardy	Santiago	Nov. 3—6	21	Galaxies — Boller and Chivens spectrograph
Dubois	Strasbourg	Nov. 16—22 Nov. 25—30	93	Supergiants in the SMC — RV Cass
Welin	Uppsala	Nov. 30—Dec. 8	62	Late-type supergiants of LMC — coudé
Düerbeck-Gieren	Hoher List	Dec. 8—14 Dec. 18—21 Dec. 29—Jan. 1	84	Eclipsing binaries and cepheids — coudé

Table 5

Visitors using the 1 m telescope during 1973

Observer	Observatory	Period	Hours	Programme
Karlsson	Lund	Jan. 1—3	16	UBV photometry of B stars (225° — 270°)
Nissen	Aarhus	Jan. 11—22 June 7—19	160	4026 He I line strengths in B stars — special echelle spectrophotometer
Alcaíno	Santiago	Jan. 25—30 Dec. 1—5	66	UBV photometry of galaxies
Denoyelle	Uccle	Jan. 30—Feb. 5	34	UBV photometry of faint OB stars
Maitzen	Bochum	Feb. 7—24	91	7-colour photometry of Ap stars
Sundman	Stockholm	March 2—10	73	UBV photometry: for interstellar extinction and of peculiar cluster stars — standard direct current
Rickman	Stockholm	March 26—30	37	UBV photometry of peculiar cluster stars
Åberg	Uppsala	April 5—17	76	UBV photometry of stars in Vela, and of two eclipsing binaries in globular clusters
Gammelgaard	Aarhus	April 17—27	77	6180 band photometry in lineary polarized light — special spectrophotometer
Schnur	Heidelberg	May 2—11	52	UBV photometry of stars in Norma
Materne	Hamburg	May 28—June 7	51	UBVRI polarimetry of selected objects — polarimeter
Haug	Hamburg	June 23—30	53	UBV photometry for establishing sequences in the Galactic Bulge area

Observer	Observatory	Period	Hours	Programme and equipment
Krzeminski	Warsaw	July 9—11 July 20—23 Aug. 22—28 Aug. 31—Sept. 1	53	UBV photometry of variable white dwarfs. Photometry of X-ray binaries, early-type stars near positions of variable X-ray sources. "High-speed" photometry of variable white dwarfs
Kwee	Leiden	July 26—Aug. 7 Aug. 21—31	128	UBV photometry of 17 short-period Galactic Population II cepheids
Lohsen	Hamburg	Aug. 17—21 Sept. 12—16 Dec. 7—9	68	Photometry of visual eclipsing binaries with visual companion — area scanner
Grenon	Geneva	Aug. 7—17	62	G & K giants at the southern Galactic Pole and O-type stars in the Milky Way — Geneva system
Rakosch	Vienna	Sept. 5—14	65	Observations of close visual binaries — area scanner
Metz	Munich	Oct. 23—31	54	Non-stationary phenomena — Polarimeter
Lub	Amsterdam	Oct. 31—Nov. 8	45	I. R. photometry of M-type stars in SGP area
Appenzeller	Göttingen	Nov. 12—24	102	UBV photometry of X-ray binaries
Brunet-Maurice	Marseilles	Dec. 9—27	131	UVBGRI-UVB of supergiants O-B LMC — photometer PAM 1 Lyons

Table 6

Visitors using the ESO 50 cm telescope during 1973

Observer	Observatory	Period	Hours	Programme
Söderhjelm	Lund	Jan. 1—Feb. 9	189	Eclipsing variables with apsidal motion
Denoyelle	Uccle	Jan. 24—30	36	Photoelectric sequences
Sundman	Stockholm	Feb. 9—March 17	171	Sequences in Milky Way fields and UBV photometry of 300 stars for interstellar extinction
Rickman	Stockholm	March 18—21	27	UBV photometry of peculiar cluster stars
De Loore	Brussels	April 1—16	58	UBV photometry of AP and X-ray stars
Schnur	Heidelberg	April 21—May 2	40	UBV photometry of stars in Norma
Krzeminski	Warsaw	May 3—9 May 29—June 4 Aug. 6—8 Sept. 25—Oct. 3	142	X-ray binaries, variable degenerate dwarfs
Sterken	Ghent	May 9—June 13	97	uvby photometry of extreme supergiants
Walter	Tübingen	June 13—23 July 5—7 July 13—15 July 18—Aug. 1	231	Photometry of Algol Systems RWAra, XZ Sgr, V 505 Sgr, X Gru
Haug	Hamburg	June 30—July 12	70	Photometry for determination of the interstellar absorption in Norma
Rakosch	Vienna	Aug. 22—31	70	Close visual binaries — area scanner

Observer	Observatory	Period	Hours	Programme and equipment
Lohsen	Hamburg	Aug. 31—Sept. 5 Oct. 3—23 Nov. 3—Dec. 7 Dec. 14—17	445	Eclipsing binaries with visual companions — area scanner
Elst	Brussels	Sept. 5—25	136	UBV observations of the short-period variable SX Phe
Schoembs	Munich	Oct. 23—31	74	Non-stationary phenomena — Special study of eclipsing binary VV Ori
Düerbeck-Gieren	Hoher List	Dec. 17—24 Dec. 17—Jan. 1	178	

Table 7

Visitors using the Objective Prism Astrograph during 1973

Observer	Observatory	Period	Hours	Programme
M^{me} Amieux	Nice	Jan. 1—March 1	183	Radial velocities in LMC: radial velocities and spectral classification of stars in some galactic clusters
M^{lle} Laval	Marseilles	March 1—31	73	Galactic clusters, Sco OB I
Azzopardi	Toulouse	Oct. 16—Nov. 5	250	Hγ measurements and spectral classification — filters K. H search for hot stars in the LMC — filters K
Burnage	Haute-Provence	Nov. 16—Dec. 6	121	Search for member stars of the LMC — normal

Table 8

Visitors using the Bochum 61 cm telescope during 1973

Observer	Observatory	Period	Hours	Programme
Elst	Brussels	Sept. 22—24	15	UBV observations of SX Phe, spectral scanning (Bochum Scanner) of SX Phe, and UBV observations of BS Agr
Vigneau	Toulouse	Dec. 12—Jan. 1	160	UBV of members of the SMC

Table 9

Visitors using the Danish 50 cm telescope during 1973

Observer	Observatory	Period	Hours	Programme
Sundman	Stockholm	April 1—27	142	uvby observation for determination of the interstellar extinction in the Milky Way from Carina to Centaurus
Sterken	Ghent	May 29—June 1 June 29—30 July 1—27	11 111	uvby photometry of extreme supergiants

Table 10

Staff astronomers using the 1.52 m telescope during 1973

Observer	Hours	Programme and equipment
Danziger	42	Galaxies and supernova remnants — Boller and Chivens image tube spectrograph
De Groot	184	Spectroscopic binaries, P Cygni-type stars and special objects — coudé and RV Cass
Havlen	22	Stars in Pup OB 3 and NGC 6193 for radial velocity determinations — RV Cass
Jørgensen	85	Spectroscopic binaries — coudé
Manfroid	11	H II regions — Fabry-Perot interferometer
Maurice	80	Stars for calibration of equivalent widths and spectral-type standards — RV Cass
Rickard	43	Extra-galactic nebulae — Boller and Chivens image tube spectrograph
F. Spite	186	Weak-line G-type stars — coudé; and Stars near the South Galactic Pole — RV Cass
M. Spite	67	Metal-deficient halo stars — coudé
Westerlund-Muratorio	38	Stars in Puppis and Crux — RV Cass
Westerlund-Dennefeld	8	Supernova remnants — Boller and Chivens image tube spectrograph
Wolf	238	Extreme A and B supergiants — coudé

Table 11

Staff astronomers using the 1 m telescope during 1973

Observer	Hours	Programme and equipment
Ardeberg	43	UBV observations of stars in SMC wing, in NGC 1910, in Pis 20 and the supernova in NGC 5253 — standard photometer
Blaauw-Havlen	20	Hβ of AFG stars in McCormick fields — standard photometer
Garnier-Westerlund	103	UBV observations of stars in the SMC wing, in N55 in the LMC and in Crux and Norma — standard photometer
De Groot	97	UBV observations of the supernova in NGC 5253, of RV Crv, of V1017 Sgr, of some X-ray binaries and of P Cygni type stars in SMC, and LMC — standard photometer
Havlen	141	UBV, Hβ observations of OB stars and clusters, in Pup and Ara and of AFG stars in SA 141 I — standard photometer
Vogt	17	Short-period variables — standard photometer
Wood	15	Ap variables and cepheids, spectrum variables — spectrum scanner

Table 12

Staff astronomers using the 50 cm telescope during 1973

Observer	Hours	Programme and equipment
Garnier	44	UBV photometry of stars in Crux — standard photometer
De Groot	17	UBV of eclipsing variables; RV Crv — standard photometer
Havlen	6	UBV photometry of stars in Norma and Calibration stars — standard photometer
Manfroid	32	UBV photometry of stars in Crux — standard photometer
Westerlund-Lelièvre	27	UBV photometry of medium-latitude F and G stars — standard photometer

Table 13

Staff astronomers using the Bochum Telescope during 1973

Observer	Hours	Programme
Havlen	50	UBV observations of OB stars and cluster stars in Puppis

Denoyelle's investigation of the distribution of OB stars between $l = 258^{\circ}$ and $l = 284^{\circ}$ indicates the possible existence of a link between the Carina arm and the Vela feature at a distance 2 to 4 kpc at $l = 275^{\circ}$. He also notes that the sharp spiral arm edge at $l = 283^{\circ}$ might not be so definitive as previously believed, and that there are some doubts about the reality of the association Vela OB1.

Investigations in Vela have also been undertaken by Åberg, who has established a UBV sequence consisting of 34 stars, magnitude range 7.5—V—16.5, at $l = 276^{\circ}$, $b = 0^{\circ}$.

In the Carina-Crux-Centaurus region 650 stars were observed in the UBV and uvby systems by Sundman and Rickman. Spectra (73 Å/mm) were obtained of 33 stars. Many of the stars observed had previously shown peculiar colours or peculiar spectral features; others are in fields where less conspicuous clusters have been found.

Schnur's UBV measurements of 155 stars in a 0.5 square degree field in Norma have added to the definition of the two spiral arms (at distances of about 1.6 and $\geq$ 3 kpc in the Norma-Ara direction. He has photometrically identified over 25 OB stars, half of which are in the nearer arm and half at distances over 3 kpc. In Ara Havlen locates the two clusters NGC 6204 and Hogg XXII, which have nearly overlapping distributions on the sky, at 1.9 and 2.6 kpc, respectively. They are thus in the distance intervals of the associations Ara OBI and Ara OBII, respectively.

To the former association belongs also the cluster NGC 6193 with its remarkable emission nebula and dust clouds, and the Of star HD 148937 with its expanding shells.

Additional information regarding the galactic structure in Norma as well as in Sagittarius is to be expected from the extensive observations by Haug; over 650 UBV observations were made of OB stars in these regions.

M^{lle} Laval's continued studies of the stars in the Sco OB1 association have added two very young and reddened O stars to its northern group. There are now 5 stars of spectral type O5—O7 in this group, having colour excesses over one magnitude. These stars are most likely responsible for the general excitation of the nebula IC 4628. The region contains several thermal radio-sources as well as H 109 α line objects. The densest radio source, G 345 + 1.4 ($N_e \sim 800$ atoms cm^{-3}) which appears as an H alpha knot is, however, too far from these stars to be ionized by them. Recent infrared observations (40—350 μ) indicate that there may be an infrared source coinciding with it; it may contain a still invisible massive star and represents thus the youngest part of the nebula. The radio sources in the nebula have ages of probably less than 10^5 years whereas the southern group, with the cluster NGC 6231, is about 5×10^6 years old.

An investigation of the interstellar K lines along a large part of the southern Milky Way has been finished by Rickard. He has examined observations of

more than 300 interstellar components seen in 168 southern stars for information about galactic structure and turbulent motions in the interstellar gas.

The main conclusions are:

(a) Several large gas features are distinguishable: The Carina arm, the "Centaurus Link", the Norma-Centaurus feature, and the Sagittarius arm. The distance to the Norma-Centaurus feature is determined to be 3 — 4 kpc. Peculiar negative velocities are evident in Norma from $l = 320^{\circ}$ to 330° A possible connection between these motions and several SNR's is suggested.

(b) The "cold cloud" of H I (at $l = 345^{\circ}$ to $l = 25^{\circ}$, $b = \pm 6^{\circ}$) has associated K-lines, which are used to estimate its distance to be 800 to 1000 pc.

(c) Peculiar velocities, both positive and negative, of the order of 40 km/s are found in many parts of the Sagittarius arm, beginning at a distance of about 1000 pc. The negative velocity lines are seen in stars over the longitude ranges $l = 340^{\circ}$ to 0° and 7° to 17°. The positive velocity lines are seen only in the range 8° to 28°.

(d) The correlation between the negative velocity K lines and 21-cm H I absorption lines is qualitatively quite good and confirms that these peculiar motions are a large-scale phenomenon.

Nissen's observations of the equivalent width of the λ 4026 He I line, with an echelle spectrophotometer for a large number of B-type stars, has shown that the mean helium-to-hydrogen ratio of young Population I stars in the solar neighbourhood is 0.09. The same mean value is found for stars in the Sco OB2 and Ori OB1 associations. For the distant Sco OB1 association it seems, however, that the mean helium-to-hydrogen ratio is slightly lower than 0.09.

In Materne's continued observations of the wavelength dependence of polarization of starlight a special check for variability of the polarization was made. A Mira-type star appeared to be a very interesting object in this connection.

Gammelgaard studied the interstellar absorption bands at λλ 4430 and 6180. His λ 6180 index was observed in its dependence on the position angle of the electric vector of the light; the aim is to study the galactic magnetic field in the local spiral arm in the directions of Orion and Monoceros. The λ 4430 index serves to correct the variation of the λ 6180 absorption with galactic longitude for abundance effects.

In the extensive programme on spectrographic studies of southern planetary nebulae by M^{me} Andrillat, Fehrenbach and Swings a total of 69 spectra has now been obtained. Preliminary results have been presented by Dossin and Vreux (see Mémoires de la Société Royale de Liège—Colloque des Nébuleuses Planétaires, **5**, 63, 1973).

Some of the high-latitude programmes reported in the Annual Reports 1971 and 1972 (Havlen, Spite, Terzan, Thé) have been continued.

Standard Stars

In the programmes on Standard Stars Garnier has now over 20 individual measurements in the UBV system of stars in the different E-regions. Generally, the agreement with the values given by Cousins and Stoy are good: the differences in the colour indices do not exceed 0.02 magnitudes. As the E-regions are deficient in very blue stars, Garnier has selected a number of OB stars to serve as Secondary Standards for this colour group.

Maurice has obtained over 220 spectrograms of 110 stars (14 Wolf-Rayet stars and 96 normal stars) in the programme on Standard Stars for MK spectral classification with the RV Cass spectrograph.

Infrared Photometry

Accurate KLM photometry of the 6 brightest stars in the heavily-reddened cluster in Ara (Westerlund 1) was carried out by Koornneef. Previous results, indicating that 4 of the brightest stars may be M supergiants, were confirmed. Additional data in the 10 μ atmospheric window were obtained. Borgman observed at 3.6; 8.1; 9.6 and 12.2 μ with a liquid helium-cooled detector a number of sources including the galactic centre region. He succeeded in measuring the depth of the 10 μ silicate absorption feature of 4 sources in the galactic centre. It turned out that each of these sources is affected by approximately the same absorption, indicating that the absorption may take place in a cloud in which the 4 sources are embedded. Among the other sources which he observed is η Carinae. The diameter of η Carinae as a function of wavelength has been established; the results are being worked out by Andriesse and Borgman.

The Chilimap project on La Silla started towards the end of the year. It is a joint Kapteyn Observatory-ESO Project, aiming at an infrared sky-survey of the southern hemisphere, starting with a wavelength of 5 microns. A special 50 cm diameter meridian telescope with photometer and detection and recording system has been built by the Kapteyn Observatory. It was installed by Karsten and Ploeger, from Roden, and Wood, ESO/Chile. The instrumentation includes preamplifiers, lock-in amplifiers, sidereal clocks, special strip-chart recorders, a 7-channel analog magnetic tape unit and a programmable telescope control unit. The equipment was installed by Karsten and Ploeger. Beam-switching is done by the wobbling secondary mirror, operating at a frequency of 370 Hz. The scanning of the sky is done by a small saw-tooth-like motion in elevation (declination) and the rotation of the Earth. For the 5 μ survey Indium-Antimonide detectors are used, cooled with liquid nitrogen. Preliminary observations of the brightest known infrared sources were begun by Karsten and continued by Wood. The main aim so far has been to test the instrument and the site.

The Magellanic Clouds

Many of the programmes reported in the Annual Report for 1972 have been continued. Fehrenbach and his group are using the GPO astrograph to determine the radial velocities of stars in the densest parts of the Large Cloud. For this a filter is used to limit the spectral range to H gamma — H delta, only.

Azzopardi used two interference filters, centred at λλ 4370 and 3940 Å, to search four fields in the Small Magellanic Cloud for members down to a limiting magnitude of 14.5. About 300 objects (OB stars and supergiants) were identified as probable members.

Vigneau showed about 100 of these stars and 40 stars from the lists of Florsch and Sanduleak photoelectrically in the UBV system. About 80 per cent of these objects are confirmed as members.

Prévot has obtained spectra (220 Å/mm at Hγ) of 18 O-type stars in the Large Cloud, the stars are from the lists of new hot members discovered by Martin and Rousseau.

M^{me} Chériguène has obtained radial velocities for 22 H II regions in the central regions of the Large Cloud using an H-alpha Fabry-Perot interferometer. These observations complete observations from 1970, when the H II regions in the southern and northern parts and in the Bar were studied, and will lead to an improved value of the systematic velocity of the Large Cloud of 34 km sec^{-1} and an improved rotation curve.

External Galaxies

Alcaíno has continued his photoelectric observations in the UBV system of external galaxies. Using four different diaphragms, 88; 44; 11 and 5 seconds of arc in diameter, he has observed over 20 objects; and using one diaphragm, over 10 additional objects.

Rickard has used his image tube photographs of galaxies in a number of colours to select objects for spectrographic work. Spectra of NGC 1097 show large velocity shifts among the various "hot spots".

An interesting spiral structure in its nuclear region has been found as the hot spots turned out to be two regular spiral arms of H II regions. On plates taken with very good seeing, nearly two dozen individual emission regions can be counted. The new image tube spectrograph has been used to obtain spectra in the red of these arms. It is hoped that an accurate rotation curve can be derived.

Special Objects

F. and M. Spite report that in their programme on abundance determinations a number of spectra have been obtained of stars chosen from various lists. Some of the spectra have been registered with the digitized ESO Grant machine and the results on magnetic tapes have been processed at the Centro de Computación of the Universidad de Chile. Processed data have been plotted on various machines (the Meudon plotter, the Facultad de Medicina plotter) while awaiting the routine work on the recently-arrived ESO plotter. Worth while mentioning is the extremely metal-deficient star HD 128279 for which several spectra in the blue and in the visible regions have been obtained, digitized and reduced in wavelength and intensity. Another Population II star, HD 184711, which is also very metal-deficient, is being analyzed. Most of the metallic lines of these stars are so faint that they are barely detectable and measurable. A

special technique is being developed for adding in a proper way the digitized and reduced data of several spectra of the same star. In the resulting composite spectrum, the lines are expected to appear with a better signal-to-noise ratio. The corresponding computer programmes are well under way. They will permit a semi-automatic reduction of spectra, digitized on the ESO Grant machine (or, with small modifications, on any digitizing microphotometer).

Wolf has finished the analysis of HD 7583 and published the results. This year he has obtained coudé spectra of a number of extreme galactic A and B supergiants: HD 91619, B5Ia; HD 92207, AOIa; HD 96919, B9Ia; HD 99953, B21a; 100262, A21a; HD 162236, B1.5Ia-O; HD 160529, A2Ia-O; HD 167264; BOIa; HD 167607, B9Ia-O; HD 168625, B8Ia-O; Hiltner 766, B1.5Ia-O; and HD 169454; BIa-O.

Long- and short-term radial velocity variations in these objects are being investigated. All the supergiants observed so far show emission components in H α and some of them also in other lines like H β and He 5875. The intensity variations of these emission components are being studied.

Sterken, in a joint programme with Wolf, has observed the same stars photoelectrically in the Strömgren 4-colour system over a three-month period. Highest attention among these objects was given to HD 160529. Variability in this star was detected in 1972 and is now confirmed. The range of variation in V is 0.16 mag and in v-u 0.18 mag, whereas y-b and b-v are rather constant.

Definitely varying are also the following stars: HD 91619, 92207, 96919, 100262, 152236, 168607, 168625 and Hiltner 766. HD 99953 and 169454 might be variables — more observations are needed — whereas HD 167264 is probably non-variable photometrically.

Spectra of HD 160529 have been taken in 1970, 1972 and 1973. Some of the spectra taken in March, 1973, show a pronounced splitting of the absorption lines not observed in the earlier spectra but seen again in July, 1973.

The curve-of-growth analysis of HD 160529 was presented by Campusano, Universidad de Chile, in his thesis.

The observations of HD 160529 have continued. The star is very useful for the study of hydrodynamic problems in extended atmospheres. It shows radial velocity variations of large amplitudes (v = 40 km/s) indicating variable high velocity fields in its atmosphere. Depth-dependent large-scale motions are especially indicated by a pronounced variable line splitting of the Fe II, Ti II and Cr II lines. Besides H α and H β there appear at certain times and correlated with the line splitting also some Fe II lines in emission, which are known to appear in nova-like stars. These phenomena indicate strong chromospheric activity in this star.

Düerbeck carried out spectroscopic observations of the following Be stars for a study of the Balmer and Paschen emission lines (number of spectra in

brackets): π Agr (6), α Col (6), K Ori (1), ε PsA (2), β Psc (2), HR 1423 (1), He 1789 (2), HR 1934 (3), HR 4830 (1).

Seggewiss obtained 9 spectra of HD 151932 (WN 7): The star shows very clearly that the expansion velocity of the envelope (deduced from the violet-displaced absorption edges) increases with decreasing ionization and excitation energy of the ions (He I, II, N III, IV, V).

Welin obtained 30 coudé spectra of galactic emission-line F and B stars and of 3 F supergiants in the Large Magellanic Cloud. He also obtained 3 spectra in high dispersion of Comet Kohoutek.

Magnetic Stars

In the joint programme of Weiss and Wood on magnetic, photometric, and spectrophotometric properties of selected southern Ap stars the analysis of the coudé Zeeman plates continues.

Reductions of the uvby Hβ photometry of the same stars have been completed. Nightly variations of about 10 per cent in the H β strength were found in HR 6742. Further observations of this star have been obtained by Wood, using the ESO spectrum scanner to investigate the H β and G band variations. The digital spectra are being reduced.

At the suggestion of Dr. Mihalas of J. I. L. A., Wood obtained Zeeman coudé plates at 5900 Å of the 9-day He variable a Centauri in an attempt to detect the magnetic field during the phase of He maximum. Thus far two 2-night runs have failed to yield satisfactory results, possibly due to the slowness and reciprocity failure of the 103 a-F plates.

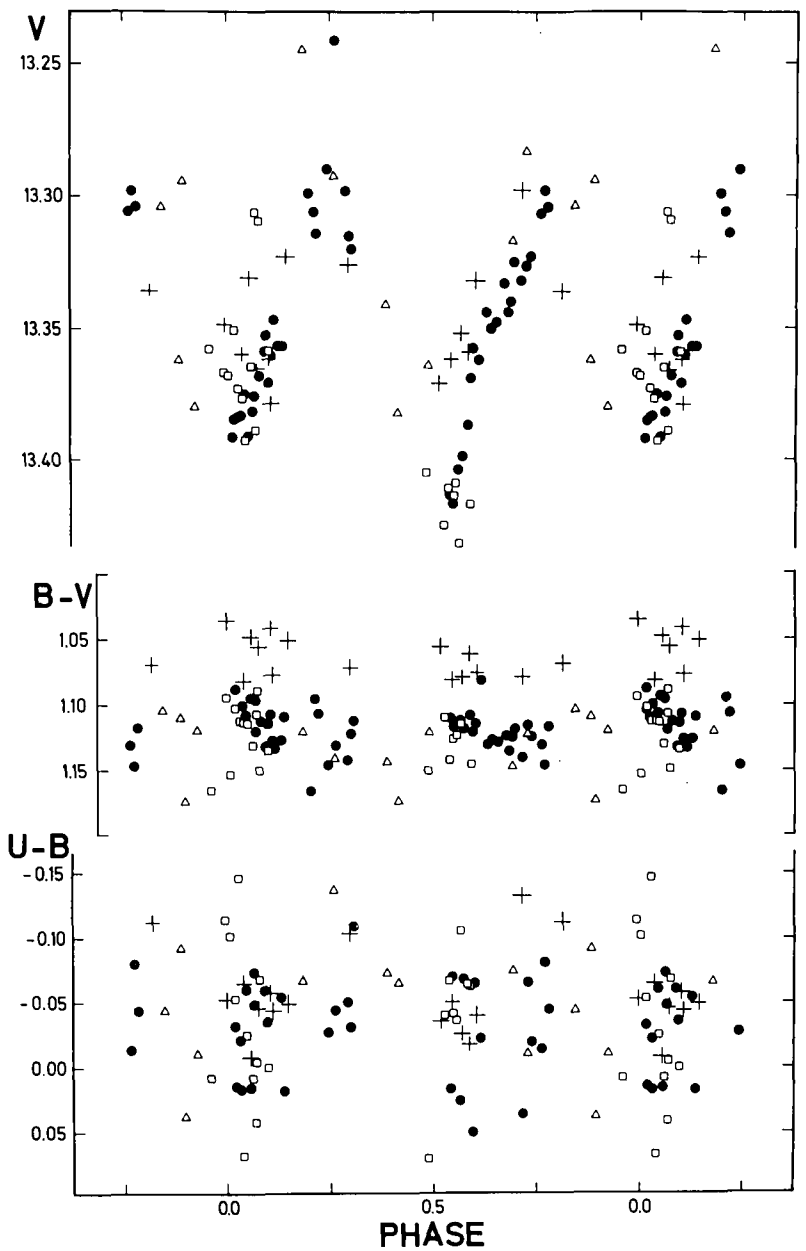
Wood is also studying Canopus. The correlation of the line strengths with Zeeman shifts is studied on the hypothesis that the field is spotty and that magnetic-line intensification should result. A preliminary test on the known magnetic star HR 5463 shows an expected correlation of line intensification and Zeeman shift on the La Silla plates. This preliminary study was carried out by Prof. Cardona of the Universidad Católica de Chile from tracings obtained on the ESO Grant machine. Digital microphotometry of the more than 20 Canopus plates has now been obtained and is being automatically reduced at the Centro de Computación of the Universidad Católica.

Wood has used the Boller and Chivens image-tube spectrograph to obtain Cassegrain infrared Zeeman plates of M supergiants at 8500 Å. A compositing technique is being developed by Vogel in the laboratory in Santiago to overcome the possible systematic errors introduced by fiber displacements. Five spectra are taken of each star, with slightly different grating settings. These spectra are then composed into a single negative in which fiber displacements average out.

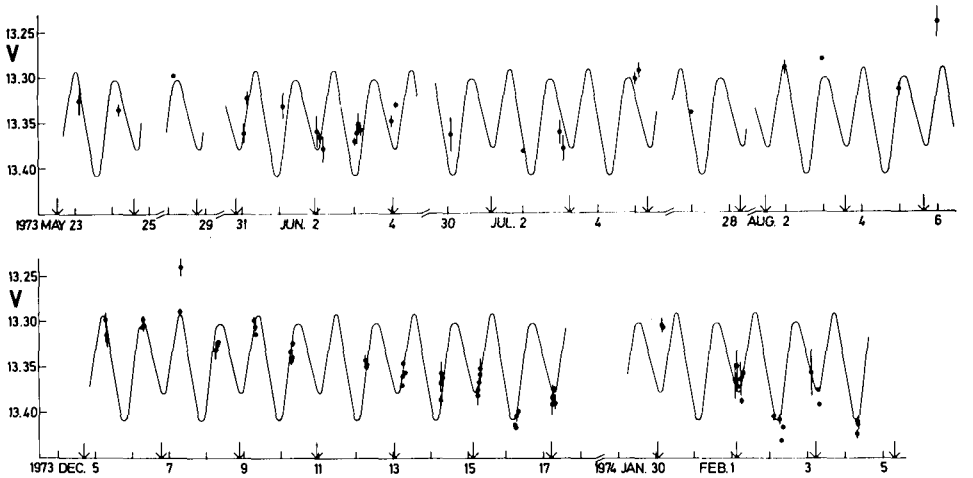
X-ray sources

Krzeminski carried out UBV photometry on two dozen stars brighter than V = 15.0 mag, contained inside the 3 U Catalogue error box for the pulsating binary X-ray source Cen X-3. The optical counterpart of Cen X-3 was found (IAU Circular No. 2612). This faint early-type star (V = 13.36,

B-V = +1.05, U-B = 0.00) shows a double-peaked light curve with minima separated by one-half of the X-ray orbital period. One of these minima coincides in time with a predicted X-ray eclipse. The amplitude in V amounts to about 0.07 mag. Spectra of the identified optical companion to Cen X-3 were obtained by Rickard with the ESO image tube spectrograph on the 1.5 m telescope. From the spectra he concluded that the star may be a normal BOIb star. Mass estimates for the compact member range between 4.3 and 0.7 solar masses, depending upon the orbital inclination as well as on the spectral classification of the companion. A class of BOIII is not excluded.



Light and colour curves of Cen X-3 folded with a 2.08712-day period. Plus signs denote La Silla observations, other symbols observations obtained at Las Campanas.



Visual light curve of Cen X-3. The X-ray occultation centre is denoted by arrows.

A possible identification of the X-ray source GX 354 + 0 was obtained by Krzeminski in cooperation with Garrison, David Dunlap Observatory. Photometric and spectroscopic observations of CD—33° 12119 = AS 231 were obtained at Las Campanas Observatory, La Silla, and Cerro Tololo Interamerican Observatory. The star was found to be extremely heavily reddened, peculiar and variable and it is a possible identification of the X-ray source GX 354 + 0 (IAU Circular No. 2569). Preliminary reductions give V = 10.20 non-variable; B-V = 2.10, with 0.1 mag range of variation; U-B = 1.20, with 0.3 mag range of variation. Time scale of variation is of the order of minutes. Spectrum resembles A-type supergiant, but with P-Cygni emission in Balmer lines and very strong interstellar features. The 3 U Catalogue position of the X-ray source (E. Schreier, private communication) is 1.3 N and 20°E.

Direct and Zeeman spectra were obtained by van den Heuvel of magnetic stars, a blue straggler and two suspected binary X-ray sources (HD 153919 ≡ 2 U 1700—37 and HD 77581 ≡ 2 U 0900—40). The 26 spectra of HD 153919 were measured with the ESO Grant machine in Santiago and showed this star to be a spectroscopic binary with the same period and phase as the X-ray source 2 U 1700—37, thus confirming the identification suggested by Liller. The results on HD 153919 were published:

(a) in IAU Circular No. 2526 (April, 1973);

(b) as a paper entitled "The Spectrum, Orbit and Magnetic Field of HD 153919 (2 U 1700—37)", by G. Hensberge, E. P. J. van den Heuvel and M. H. Paes de Barros in Astron. & Astrophysics **29,** 69 (1973).

The spectra of HD 77581 (10 blue and 13 red) have been analysed and show an orbit of considerable eccentricity (e = 0.22). The profile of H α shows systematic variations as a function of phase, similar to the ones observed by Cygnus X-1.

The spectra of the blue straggler HD 162374 were measured and analysed and a paper on the results will be presented to Astron. & Astrophys. in 1974.

The X-ray binary HD 1539119 was also observed frequently by Krzeminski, using UBV or λ 4686 Å continuum interference filters to see the long-term behaviour of the light and colour curves in comparison with the X-ray data.

He also made similar observations of Sanduleak 160 : 2 UO 115—73.

Variable stars

A number of investigations of eclipsing binaries have been carried out:

Andersen observed the following systems with double-lined spectra at dispersions of 20 and 12 Å/mm in order to determine accurate spectroscopic elements for derivation of the precise absolute dimensions of the components: TU Mus (O8), CV Vel (B2), V539 Ara (B3), V760 Sco (B8), χ_2 Hya (B8), V1647 Sgr (A0), RS Cha (A7), SZ Cen (A7 III), RZ Cha (F5), and TY Pyx (G0).

He reports that the spectroscopic material obtained is complete for six of these (TU Mus, CV Vel, χ_2 Hya, RS Cha, RZ Cha and TY Pyx). For the first four the plates have been measured, for the last two, measurements are under way, as is the reduction for all systems. The spectroscopic observations of four of the systems (CV Vel, χ_2 Hya, RS Cha, and TY Pyx) will be supplemented with photometric data from the literature. For TU Mus and RZ Cha, uvby light curves have been obtained by Danish observers with the Danish 50 cm telescope at La Silla and are also under reduction and analysis.

Düerbeck obtained a complete light-curve for VV Ori, carrying out UBV H β photometry. Simultaneous spectroscopic observations gave 67 spectra for the determination of radial velocities and equivalent width changes.

Grønbech Jørgensen obtained complete light-curves for V1647 Sgr, ζ Phe, UX Men and RT Scl (the first two in collaboration with Gyldenkerne, Copenhagen University Observatory). He also worked on the determination of times of minima of eclipsing binaries with apsidal motion in order to improve the periods.

Both Lohsen and Rakosch observed close visual binaries using the area scanner on the 50 cm and the 1 m telescopes.

Lohsen reports that the major part of his observing time was used for the Trapezium in Orion, which contains the eclipsing binary BM Ori. The light curve is almost completely covered. A second star in the Trapezium was found to be fainter by about $0^m.8$ in one single night, most probably an eclipsing variable. He also spent much time observing AA Cet. The companion is of about $7^m.5$ and about as bright as AA Cet in minimum, the separation is about 8″.1. The standard deviation of one Δm-measurement (~ 50 s) is $0^m.01$ to $0^m.02$ in the Strömgren system. Only survey observations were made of HR 6773, which has a variable radial velocity and is suspected to be an eclipsing binary. Due to considerable Δm (~ $2^m.5$), no minima could be detected by visual inspection of the profiles. Observations of Comet Kohoutek were also made with the scanner but were handicapped by the faintness and fast motion of the comet and the zenith distance limit of the dome.

Seggewiss obtained 48 coudé spectra of DV Aqr (A3) and 44 of DX Aqr (A2) for the determination of their orbital elements.

He obtained also 34 spectra of the very massive spectroscopic binary HD 159176 (07 + 07) for determination of orbital elements, mass, etc. (reductions started in cooperation with de Groot).

Seggewiss furthermore obtained 30 spectra of blue stragglers in the open cluster IC 4756; the aim is to test the cluster membership and the binary hypothesis, together with 18 spectra of main sequence and giant star cluster members.

Gieren gathered simultaneous photoelectric and spectrographic observations of the cepheid variable AH Vel:

A complete and very dense covering of the whole cycle of the 4.23^d cepheid was obtained in u, b, v and H beta. Two comparison stars were used for the differential measurements. Photometric standard stars were measured every night. Preliminary reductions show that the extinction coefficients agree closely with those reported by Ardeberg and that the night-to-night differences are small; a high accuracy in the results can thus be expected. 49 spectrograms of AH Vel were obtained on IIa-O plates with a dispersion of 12.3 Ä/mm. The spectra are satisfactorily distributed over the pulsation cycle. Moreover, 10 plates of radial velocity standards were taken. All plates were calibrated with the ETA-spectrograph. The reduction of the spectra is under way. About 300 lines were selected for radial velocity measurements; they are carried out with the Abbe comparator of the Hoher List Observatory. The purpose is to study level effects in the atmosphere of AH Vel. The system-velocity may clarify the question whether AH Vel is a binary or not. Since brightness and radial velocity measurements were obtained simultaneously, an accurate phase relation can be established. This and the fact that light and rv-curves are very well measured should lead to an accurate radius of the star by application of the Wesselink method.

Another aim of the programme is to look for small-scale variations in the light curves of AH Vel which are predicted for cepheid variables by recent theoretical models.

Population II cepheids with periods between 1 and 3 days were observed by Kwee in a programme begun in 1972. With the 1973 observations the programme has now been completed up to 70 %. Complete or nearly complete phase-cover of the light curve (i. e. 90 % or more) has been secured for V 917 Aql. DU Ara, VX Cap, HQ CrA, EK Del, UX Nor, V 716 Oph, V 745 Oph, and V 527 Sgr. Phase-cover of 30-70 % was obtained for VZ Aql, V 465 Oph, V 839 Sgr, V 2022 Sgr, and RT TrA. Of the variable star V 477 Oph 26 observations were made which indicate that this star is most likely an RR Lyrae variable with a period of about 0.67 day. In a short note the results on V 477 Oph have been published in the Information Bulletin on Variable Stars (Commission 27 of the IAU, Bulletin No. 829).

The reductions of the present observations are now in progress. The results for the instrumental constants and the second order extinction coefficients turned out to be slightly different from those for the 1972 series of observations. As the present observations are more numerous and of better quality

than those of 1972, the latter are re-entered in the reduction process together with the present material.

It is of interest to quote the following from Dr. Kwee's report: "The standard error of one observation in v-l, b-v or u-b varies for the different nights: for good nights it is about 0.01 mag, but on some nights it even amounts to 0.04 mag. The major contribution to this error is from macro-fluctuations of the extinction. A closer inspection of the extinction coefficients as a function of time showed that on no night was the extinction constant. All nights showed time-variations of the extinction coefficients; even up to 50 % of its mean value. Therefore, one can conclude, that if one defines a "photometric night" as a night during which the extinction coefficient remains fairly constant, then one finds that no single night during my observation periods in 1973 as well as in 1972, deserves this definition" (both periods in winter).

The AI Velorum star SX Phe and the RR Lyrae star BS Aqr were observed by Elst in order to derive a more accurate second beat-period for the former and define accurately the beat-period in the latter. Spectro-photometric observations of SX Phe were made in order to study the suspected binary structure of this object.

The Algol systems RW Ara, XZ Sgr, V505 Sgr and XGru were observed by Walter who obtained 1551 observations in four colours, covering most parts of the light curves. Although the observations are not yet sufficient to permit determinations of both the dimensions of the components and the nature of the gas stream complications, photometric gas stream effects are clearly seen in the light curves of all four systems.

Haefner, Schoembs and Metz obtained photometric, polarimetric and spectroscopic data for the following objects of different classes: π Aqr (Be), SX Phe (AI Vel), δ Cet (Cep), SZ Tau (Cep), RR Pic, (Nova 1925), S Mon (nonvar.) Z CMa (novalike) and W CMa (irr).

Some indications of rapid variations in the Balmer lines and polarization of π Aqr were found and the analysis has been concentrated on this object.

Krzeminski has observed a dozen white dwarfs, white dwarf suspects and subdwarfs, chosen from Lowell and Luyten proper motion surveys, in the UBV or in the integrated light in order to detect light variability. In cooperation with Hofstadt a time-series monitoring was developed and applied to a few stars with 3 or 5 secs. sampling. Definitive variations of a few hundredths of magnitude were detected in LTT 7406 and G26—9, but data have not yet been analysed for periodicity.

Joint Research with Universidad de Chile

F. Noël, Departamento de Astronomía, Universidad de Chile, Cerro Calán, reports on The Impersonal Astrolabe Project during 1973:

The observations of fundamental groups and the collaboration with the Bureau International de l'Heure and the International Polar Motion Service has been continued throughout 1973.

The computations for the first Astrolabe Catalogue of Santiago were completed this year. The individual corrections in alpha and delta for 325 FK4 Suppl. stars are already computed. The catalogue will be ready for publication at the end of 1973. An estimation of the FK4 error obtained from these individual corrections largely confirms the first results of this kind obtained by another method and published in 1969 (A. J., v. 74, No. 7, pp. 954—957).

A new programme of observations of catalogue and fundamental groups will begin at the end of this year, so new series of corrections for the programme stars will be obtained during the following years. These series of corrections spaced in time will contribute to investigate the proper motion system of the FK4 in the southern hemisphere.

Two experts in the field of Time and Latitude Service and in the Astrolabe project visited this year the National Observatory of Cerro Calán: H. M. Smith, Head of the Greenwich Time Service, from August 13 to 16, and S. Yumi, Director of the International Polar Motion Services at Misuzawa, Japan, from September 9 to 21.

An atomic frequency standard (Cesium beam) was installed by Universidad de Chile at the Time Service of Cerro Calán. This standard, operated as an atomic clock, will be the new time reference for the Astrolabe observations.

During the 15th General Assembly of the IAU at Sydney, Mr. F. Noël, Head of the Astrolabe project, was designated member of a working group created by Commission VIII for the compilation of a star position catalogue based solely on Astrolabe observations. This catalogue should be ready before 1975, a deadline proposed by the compilers of FK5.

L. Campusano of the Universidad de Chile completed his thesis for Licenciado en Astronomía: "164 G Scorpius: Una Estrella Supergigante (A21a) Peculiar en el Brazo Espiral Sagitario de Nuestra Galaxía" under the direction of Wolf. On September 29 Campusano left for continued studies on an ESO fellowship at Paris Observatory, Meudon.

ESO assisted E. Hardy of the Universidad de Chile in a study visit to Europe in May. He participated in the International School on Cosmology in Sicily and thereafter spent about three weeks at Hamburg Observatory working with Dr. Tammann on problems related to the extragalactic distance scale.

Publications by ESO Staff

Ardeberg, A. — On the Spectral Gradient Around Wave-Number 2.34. Astron. Astrophys., **29**, pp. 151—154.

Photoelectric UBV Photometry in Four Areas of Intermediate-High Galactic Latitude (with K. Särg and S. Wramdemark). Astron. Astrophys., Suppl. **9**, pp. 163—181.

Ardeberg, A., and de Groot, M. — A Photometric Study of Nova Doradus 1971a in the Large Magellanic Cloud. Astron. Astrophys., **26**, pp. 53—64.

The 1972 Supernova in NGC 5253. Photometric Results from the First Observing Season. Astron. Astrophys., **28**, pp. 295—304.

Ardeberg, A., and Maurice, E. — Spectral and UBV Data for 583 Stars (Supergiants and Foreground Stars) in the Direction of the Large Magellanic Cloud (with J. P. Brunet and L. Prévot) (Abstract), pp. 293—294, IAU Symp. No. 50. Spectral Classification and Multicolour Photometry (Eds. C. Fehrenbach and B. E. Westerlund, Reidel Publ. Co.).

Ardeberg, A., Maurice, E., and Rickard, J. — Photometric Investigation of IC 2944 (Abstract), p. 29, IAU Symp. No. 50. Spectral Classification and Multicolour Photometry (Eds. C. Fehrenbach and B. E. Westerlund, Reidel Publ. Co.).

Behr, A. — A Proposal for the Alignment of Large Telescopes. Astron. Astrophys., **28**, pp. 355—358.

Blaauw, A. — The Calibration of Luminosity Criteria, pp. 47—56, IAU Symp. No. 54. Problems of Calibration of Absolute Magnitudes and Temperatures of Stars (Eds. B. Hauck and B. E. Westerlund, Reidel Publ. Co.).

The European Southern Observatory. Proc. First European Astron. Meeting, Athens, Sept. 1972, **1**, pp. 152—155. Solar Activity and Related Interplanetary and Terrestrial Phenomena (Ed. J. Xanthakis, Springer-Verlag).

de Groot, M. — Some Relations between Wolf-Rayet and P Cygni-Type Stars, pp. 108—125, IAU Symp. No. 49. Wolf-Rayet and High-Temperature Stars (Eds. M. K. V. Bappu and J. Sahade, Reidel Publ. Co.).

Garnier, R. — Galactic Structure in the Direction of Cepheus (with M. Barbier, A. Bernard and J. H. Bigay). Astron. Astrophys., **27**, pp. 421—427.

Havlen, R. J. — OB Star Distribution in Ara (Abstract), B. A. A. S., **5**, p. 267.

Jørgensen, B. G. — Photographic Observations of Comets and Minor Planets (with B. Reipurth). Astron. Astrophys., Suppl., **11**, p. 107.

Maurice, E. — Additional Observations of Supergiants and Foreground Stars in the Direction of the Large Magellanic Cloud (with J.-P. Brunet, L. Prévot and G. Muratorio). Astron. Astrophys., Suppl., **9**, pp. 447—458.

Reiz, A. — IAU Commission 38. Exchange of Astronomers. IAU Report on Astronomy, 1973. Transactions IAU, 15A, pp. 599—600.

Spite, F.	Advantages and Limitations of Quantitative Spectral Classification, pp. 60—61, IAU Symp. No. 50. Spectral Classification and Multicolour Photometry (Eds. C. Fehrenbach and B. E. Westerlund, Reidel Publ. Co.).
Spite, M.	The Helium Content of 99 Herculis. Astrophys. Letters, **13**, pp. 137—138.
Spite, M., and Spite, F.	Study of the Abundances of Heavy Elements in F-G Type Stars. I. Differential Analysis of Two Metal-Deficient Stars: HR 646 and HR 860. Astron. Astrophys., **23**, pp. 63—68.
	HR 7955 as a Spectroscopic Binary. Astron. Astrophys., **25**, pp. 325—326.
West, R. M.	Automatic Classification of Objective Prism Spectra, pp. 109—124, IAU Symp. No. 50. Spectral Classification and Multicolour Photometry (Eds. C. Fehrenbach and B. E. Westerlund, Reidel Publ. Co.).
	Current Large Optical Telescope Projects, A review, European Southern Observatory (published in 1971).
Westerlund, B. E.	IAU Commission 45. Spectral Classifications and Multi-Band Colour Indices. IAU Reports on Astronomy, 1973. Transactions of the IAU, 15A, pp. 697—716.
	Spectral Classification and Multicolour Photometry. IAU Symp. No. 50 (Ed. with C. Fehrenbach, Reidel Publ. Co.).
	Problems of Calibration of Absolute Magnitudes and Temperatures of Stars. IAU Symp. No. 54 (Ed. with B. Hauck, Reidel Publ. Co.).
Wolf, B.	Fine Analysis of the AO Ia-O Supergiant HD 7583 in the Small Magellanic Cloud. Astron. Astrophys., **28**, pp. 335—348.

ESO Publications

The following ESO publications were issued:

Annual Report 1972,

The European Southern Observatory—an outline prepared in connection with the OECD meeting on International Cooperation in Optical and Radio Astronomy, to be held in Paris on 27 and 28 February, 1973.

Participation in Scientific Meetings

Havlen and Wood participated in the 139th meeting of the American Astronomical Society at Las Cruces, New Mexico, from January 9 to 12. Havlen presented a paper, "OB Star Distribution in ARA" at the meeting.

De Groot represented ESO in a round-table discussion on the "Presente y Futuro de la Astronomía", arranged by the Universidad de Chile, La Serena, on April 6.

Ardeberg and de Groot participated in the International Conference on Supernovae in Lecce, Italy, from May 7 to 11, and presented a paper "Photometry and Spectroscopy of the 1972 Supernova in NGC 5253".

Blaauw, Havlen, Rickard, West, Westerlund and Wolf participated in the IAU General Assembly in Sydney, Australia, from August 21 to 30. A number of contributions were presented at various commission meetings. Blaauw and Rickard also attended the associated IAU Symposium No. 58, "The Formation and Dynamics of Galaxies", in Canberra; West attended IAU Symposium No. 60 on "Galactic Radio Astronomy", in Melbourne, and IAU Symposium No. 61 on "New Problems of Astronomy", in Perth; and Wolf Symposia No. 56, "The Fine Structure of the Chromosphere", and No. 57, "Coronal Disturbances", in Surfer's Paradise.

West became a member of IAU Commission 45.

M. Spite participated in IAU Symposium No. 64, "Gravitational Radiation and Gravitational Collapse", in Warsaw, from September 5 to 8.

Wood participated in IAU Symposium No. 63, "Confrontation of Cosmological Theories with Observational Data", in Cracow, from September 10 to 12.

Lectures and Colloquia given by ESO Staff

De Groot gave a colloquium at Lund Observatory on "Some Relations Between P Cygni-type Stars and Wolf-Rayet Stars".

Rickard gave a lecture in Santiago on "Extraterrestrial Civilization".

West gave colloquia in Copenhagen and Uppsala. He received the "Rosenkjaer" prize 1972 (for popularization of science) from the Danish State Radio and subsequently broadcasted seven lectures on modern astronomy.

Wood gave a lecture in Louisville, Kentucky, on "Astronomy in Chile".

Colloquia given at ESO

Colloquia were given at ESO Headquarters in Santiago by I. Appenzeller, Göttingen; S. van den Bergh, Toronto; E. P. J. van den Heuvel, Utrecht; D. C. Morton, Princeton; and A. Reiz, ESO TP Division, Geneva.

Study Visits by ESO Staff

A basic maintenance course for the HP 2100 and HP 2114 B computers was given by a Hewlett Packard instructor to our electronic staff. The course was held partly at the ESO Headquarters in Santiago and partly on La Silla, and it lasted from April 23 to May 17. Participants were Becker, Bourlon, Hofstadt, Macchino, Marda, Nees and Roman.

Becker and Nees participated in a Hewlett-Packard disk course in Cupertino, California, during one week beginning in November 26.

Bourlon visited ESO TP Division, Geneva, in June to acquaint himself with the new 1 m telescope control system, which was installed on La Silla later in the year. He also visited Observatoire de Haute-Provence during this period for learning about various development works there, such as TV guiding systems and computer facilities.

Breysacher worked in the Laboratoire de Physique Astronomique at Observatoire de Paris to the middle of October on the construction and testing of the Lallemand caméra électronique for the ESO Echelec spectrograph. He visited Observatoire de Haute-Provence several times for participation in the operation of the Echelec spectrograph there.

Havlen made brief visits to Lowell Observatory, Flagstaff, and Steward Observatory, Tucson, for discussions of the operation of and reduction procedures for the area scanner and galactic structure problems, respectively.

M. Spite spent some time in September at Paris Observatory working on problems related to the abundance of elements in metal-deficient stars.

Vogel visited the Hale Observatories and Kitt Peak National Observatory from March 30 to April 20 to study recent developments in astronomical photography, particularly with respect to darkroom techniques.

West visited the US Naval Observatory in Washington, the Bogotá Observatory (Colombia). Blaauw and West visited the SRC Schmidt telescope of Siding Spring Observatory (N. S. W., Australia). West also visited the KODAK Research Observatories (Rochester, N. Y.) for discussions about photographic materials.

Wood visited Kapteyn Sterrewacht in Roden, Netherlands, in August for discussions of the CHILIMAP 5-micron sky survey project. He also visited Vienna Observatory for discussions of the Vienna (Dr. Weiss) / ESO Magnetic Star programme.

Visitors to La Silla

Krzeminski, Warsaw, spent the period April 1973 to March 1974 with ESO, Chile. His scientific work is reported under Research Activities. In cooperation with Hofstadt and Vogt, ESO, he worked on the development of a rapid timing system.

Lohsen, Hamburg Observatory, spent the period June 21, 1973 to January 31, 1974 with ESO, Chile, participating in the installation and programming of our area scanner. Dr. Rakosch, Vienna Observatory, who spent the period August 14 to September 14 on La Silla, participated also in this work — in particular by checking the linearity of the pulse-counting system of the instrument. The dead time of the counting system was found to be 0.35×10^{-7} sec; this means that stars as bright as 4.5 mag. can be measured with the 1 m telescope in the UBV system with a very small error in linearity.

Lohsen tested the utility of the scanner in the non-scan-mode by observing a fast variable (BD + 16° 516) using the circular diaphragm. The results show that useful observations can be made in this mode. The times of minimum show a scatter of about 2 or 3 seconds on the 50 cm telescope. Lohsen also prepared a profile reduction programme for the 16 K DOS-M system and documentation about the scanner.

Albrecht of Vienna Observatory spent the last three months of 1973 with ESO, Chile, working in particular with Wood, ESO. His main effort was put into developing the so-called Interactive Scan Reduction Control System for reducing data taken with the ESO three-channel spectrum scanner. He also developed a Virtual Array Handler, a set of routines that allows treatment of disk files of up to 32 K (twice the size of the total DOS-M computer memory) very much like an ordinary FORTRAN data array. Finally, Albrecht carried out a number of important changes in existing reduction systems and wrote several utility routines.

R. García, Universidad Santa María, and J. Fluxa N., Universidad Técnica del Estado, spent about six weeks during the summer holidays working in the electronic laboratory on La Silla. They participated in installation and maintenance of astronomical instrumentation and in the trouble-shooting and repair work of various electronic and communication equipment.

Also working with ESO during four to eight weeks during the vacation period were P. Carrasco, Universidad Técnica del Estado, and F. Guzmán, Inacap, in our Mechanical Workshop in Santiago; V. Mertens, Inacap, with the Technical Department, La Silla; and C. Huerta, Universidad Católica, with the Astronomy Department, La Silla.

All in all, about 300 visitors were received on La Silla during the year.

LIBRARIES

ESO Europe Library Geneva

The functions of the ESO library in Europe have been

(1) to provide the ESO libraries in Geneva and Chile with books, periodicals and observatory publications, and

(2) to develop a library serving the needs of the scientific and technical personnel of the TP Division in Geneva.

Books

650 requests for publications were received by the library.

700 books were purchased.

390 of these acquisitions were added to the existing stock in Geneva, which, at the end of 1973, totalled about 1,600 books.

Periodicals

The Geneva library received 115 periodicals divided as follows:

56 in astronomy and physics

10 in optics

31 in electronics

18 in instrumentation and engineering.

Back numbers of several periodicals were purchased for the Santiago and Geneva libraries.

171 volumes were bound in the Geneva Library.

Observatory Publications

A steady stream of observatory publications came in and were distributed to the three libraries.

Further names of observatories sending and receiving observatory publications on an exchange basis were added to the mailing list.

The Palomar Sky Survey Atlas, sections 1 to 6, was received and the Geneva copies placed in the ESO Sky Atlas Laboratory.

About 70 **outside-loan** requests for various publications and articles were received.

Acquisition List

The ESO libraries and various interested institutes received during the year five lists of new acquisitions. Thirty-three parcels of library material were dispatched in diplomatic bags from Geneva to Santiago and La Silla.

Collaboration

Excellent cooperation was maintained with the CERN library and the Geneva Observatory in Sauverny.

ESO Libraries in Chile

310 new books were received from Hamburg and Geneva during 1973. 219 for the Santiago library and 91 for the La Silla library.

Eight books were bought in Santiago for the La Silla library: seven on computers, in Spanish, chosen by the night assistants, and one for the Technical Department in La Serena. Eight literary works in Spanish were bought in Santiago for the night assistants.

Observatory Publications

Thirteen consignments of observatory publications were received from Geneva during 1973. Eight for the Santiago library and five for the La Silla one.

A revision of all observatory publications in the Santiago library was done, with correction and standardization of the names of the observatories, their location and the titles of their publications. Alphabetic indexes containing the names of the observatories and the titles of the publications received in Santiago were made.

Periodicals

The libraries received 153 different periodicals during 1973. 115 for the Santiago library were divided as follows: 83 in astronomy, mathematics and physics, 11 in electronics and 21 technical. 90 volumes were bound, 80 for the Santiago library and 10 for the La Silla library.

The Palomar Sky Survey Atlas, sections 1, 2, 3, 4, 5 and 6, was received and filed in the Santiago library.

Reprints and photocopies were received from Geneva for the use of the astronomers.

The librarian Mrs. Ardeberg left the ESO libraries in March. Mrs. Patricia Fox replaced her from April 1 to October 31, and Miss Ana Cecilia Fernández took over on November 19.

Mrs. Fox worked at La Silla for two periods during 1973. Book and periodical catalogues were brought up to date.

METEOROLOGICAL REPORT

During the year a total of 240 photometric nights was recorded—i. e., nights with six or more hours of uninterrupted clear sky. This is above average for the period 1966—1972. The mean value for this period is 223 photometric nights per year. Particularly above average were the months of August, October and November.

The following table gives the total number of clear hours as well as the total number of photometric nights for the years 1966—1973.

	1966	1967	1968	1969	1970	1971	1972	1973
Possible number of observing hours	3681	3681	3690	3681	3681	3681	3690	3681
Actual number of clear hours	2481	2412	2197	1996	2107	2136	2126	2300
Possible number of observing nights	365	365	366	365	365	365	366	365
Actual number of photometric nights	252	239	223	199	214	221	211	240

Snow fell on La Silla on June 7, June 15, and October 9; and rain on June 15, June 23 and October 15.

Signing of contract with Interbeton B. V. of Rijswijk, Netherlands. (From left to right: Mr. E. Leroy, ESO TP Division, Geneva; Prof. A. Blaauw, Director-General of ESO; Mr. A. G. F. Smit of Interbeton; and Ir C. Molenaar, Director of Interbeton.)

ESO 3.6 METRE TELESCOPE PROJECT DIVISION

Towards the end of 1972, the Finance Committee approved the Division's adjudication proposals for the placing of several of the major contracts, and so, right from the beginning of 1973, the large telescope project entered its construction phase. It will be recalled that the contract for the building was awarded to Interbeton B. V. of the Netherlands, for construction and assembly of the main structure of the telescope to Creusot-Loire of France, for the main gears to MAAG Gearwheel Company of Switzerland, for the domes, etc. and for the air-conditioning to Sulzer of Switzerland. The contract for the figuring of the mirrors and manufacture of the mirror-cells had been awarded

to REOSC of France in 1967 and for the diesel-motor generator sets for the new power plant on La Silla to Motoren-Werke Mannheim of Germany in 1972.

In the course of 1973 further contracts were placed: for the mirror supports with Creusot-Loire; for the top units with Ateliers Bouvier of France; for the hydraulic plant with Rexroth in Germany.

This year also saw the first assignment of TP staff to Chile, three staff members transferring their duty station to La Silla for the setting-up of the building site on the topmost summit of the mountain.

Construction and detailed design work on all of these different aspects of the telescope proceeded apace. By the end of the year the figuring of all the optical elements (and the manufacture of the cells) was virtually completed while a comprehensive test programme of the secondary mirrors was carried out by the Optics Group in conjunction with REOSC. These gave very satisfactory results.

An important design concept was changed in the latter part of the year. After detailed examination, it was proposed to abandon the original idea of a siderostat and to replace this by a coudé auxiliary telescope (CAT) in an alt-alt mounting. After discussion of the principle by the IC and examination of the financial implications by the FC this proposal was definitively adopted.

Work was begun on the construction of the new building, adjacent to the present TP premises in Geneva, which will house the mechanical workshop and the optical laboratory. This work is being carried out under the supervision of the CERN/SB Division.

In summary, the work on the 3.6 metre project proceeded steadily and, despite certain delays attributable to the internal situation in Chile during this turbulent year, generally followed the planning schedule. The leader of the ML Group, W. Richter, acted also as coordinator of the 3.6 m project and in this capacity prepared a computer programme based on the critical path method of planning. Data from other groups involved in the project were incorporated to give an over-all planning schedule. A comparison between the predicted completion dates for the project at the beginning and the end of 1973 shows an accumulated delay of about one month during this twelve-month period.

At the beginning of 1973 the Division comprised a total staff of 32, comprising seventeen ESO staff members, six CERN staff members assigned to ESO, three visiting scientists and six persons on contract from agencies. By the end of the year the staff strength had risen to 40, comprising twenty-nine staff members, one temporary staff member, three visitors and seven persons on contract from agencies. It should be mentioned in this connection that all staff assigned full time from CERN were granted ESO contracts of variable duration, according to their role with this Organization. A further two staff members had signed contracts with ESO but were not due to take up their appointments until January 1974.

Building Group

On March 30, 1973, ESO and Interbeton B. V. of Rijswijk, Netherlands, signed a contract for the civil engineering, electrical and sanitary installations and lifts of the 3.6 metre telescope building on La Silla. Amendments to this contract, concerning the construction of the new Power Plant building and the Danish National 1.5 metre telescope building, were prepared in the course of the year.

3.6 Metre Telescope Building

In March a three-man team was sent to Chile for supervision of the building project and simultaneously Interbeton sent a staff of three Europeans to recruit the labour force locally and begin execution of the contract. Shipments of material began in May and thereafter the contractor's camp and site installations were set up. Rock blasting for the building foundations lasted from July until October and the concrete foundations of the octagonal pier supporting the telescope were completed by the end of the year. The political events in Chile delayed progress on the building by about three months.

Power Plant Building

The imminent delivery of the diesel-generator sets made it urgent to proceed immediately with the building and it was started by Interbeton towards the end of May. By the end of the year the building had been almost completed and the diesel-generators and associated electrical equipment had been delivered to La Silla, awaiting installation.

Danish Telescope Building

The foundation excavations were made in August and September but the work was subsequently stopped, following a re-scheduling of the construction programme.

Domes

Although the design work was started in January following Finance Committee approval of the award of contract, it was not until June that the contract with Krupp was signed.

The manufacture of the structure began in August and by the end of the year about 230 tons of steel structure had been prepared for workshop assembly.

The dome for the CAT, which supersedes the original siderostat, was designed in the latter part of the year.

Air-conditioning

This contract with Sulzer was signed in July and design work continued since then throughout the year at the contractor's establishment in Buenos Aires.

Crane for the 3.6 Metre Site

The purchase of a 50-ton mobile crane from AURA having been authorized by the FC in late 1972, inspection and testing were successfully carried out by the Building Group in February 1973 and the contract with AURA concluded in March.

Throughout the year this crane was of invaluable service to ESO for the construction of both the telescope building and the power plant building.

Design Studies

A new design and layout of the photographic laboratories of the 3.6 m telescope building was produced by a working group, composed of astronomers and engineers, set up for this purpose.

The Building Group in Geneva produced the design and specifications for an improved overhead crane in the dome and for a special mobile door in the aluminizing plant area. The tender documents were prepared for the mirror handling equipment for transport of the main mirror from the telescope to the aluminizing plant.

Certain design studies were carried out for ESO-Chile; particular mention can be made of air-conditioning equipment for the Schmidt telescope building.

Mechanical Design Group (ML)

Reference has already been made to the contracts placed with Creusot-Loire for the construction and assembly of the telescope main structure, and to that placed with MAAG for the manufacture of the main gears.

On the basis of the design drawings and specifications provided by ESO, both of these firms produced workshop or execution drawings. On approval by ESO the construction work was started in the first part of 1973. By the end of the year the main structural elements of the telescope had been welded up and machining of parts of the structure had begun in the Creusot factory at St. Chamond. At the MAAG plant, the teeth of the first large gearwheel were being cut at the end of the year.

In the first months of 1973 the design of the top units and mirror supports was completed and tenders were invited for the manufacture of these elements. The contract for the top units was awarded to Ateliers Bouvier of Grenoble, France, while that for the mirror supports was placed with Creusot-Loire. The workshop drawings of those sub-assemblies are currently being prepared.

Tenders were also called in for the supply of the hydraulic plant, to ESO specifications, to feed the oil pad bearings of the telescope. The adjudication was in favour of Rexroth, Germany, and the contract was placed towards the end of the year. The specifications and design drawings for the aluminizing plant and for the handling equipment were completed and the call for tenders was being prepared at the end of the year.

Optics Group

This group was officially inaugurated in March 1973 under the leadership of R. N. Wilson. The most urgent aims of this were to provide the necessary competence in optics for testing of those elements already completed under the terms of the contract awarded to REOSC in 1967, to produce the optical design for those elements still to be defined (e. g. prime focus correctors), and insofar as the manpower was available, to carry out the optical design for the auxiliary instrumentation.

Optics for the 3.6 m Telescope

Following an analysis of all available methods for testing the convex secondaries, the IC gave its approval of a test programme following the method proposed by Lytle. The design calculations and tolerances were provided by the Optics Group while REOSC manufactured the optical and mechanical test elements.

This test programme, carried out in close collaboration with REOSC at their premises, was completed in September and was successful in every way. As a result, the two convex secondaries were formally accepted in December.

Following the conceptual design of the prime focus and Cassegrain adaptors, a design study was commissioned with REOSC in order to analyze the optical system.

Auxiliary Instrumentation Optics

A basic concept for a modular design of the coudé spectrograph was presented to the review team in September and was accepted for further study.

A photometric method for the optical alignment of large two-mirror systems was developed and tested in the laboratory as well as on the 1.5 m Ritchey-Chrétien telescope of the Vienna Observatory.

Activities for CERN and Outside Institutes

Upon request of CERN, R. N. Wilson participated in a design study for the optics of a new development in Cerenkov counters to be used in the experimental areas of the new 300 GeV giant accelerator. The system recommended by the Optics Group was adopted.

Other requests from outside institutes regretfully had to be turned down because of lack of manpower capacity in the group.

Facilities, Equipment and Staff

Following prolonged and ultimately fruitless negotiations with the firm Carl Zeiss for the purchase of software for optical calculations, the Optics Group obtained an equivalent product from a commercial firm in the U. S. A. Concluded in November for a sum of $ 20,000, this purchase provided the group with a powerful tool of fundamental importance for all aspects of optical design for telescope and auxiliary instrumentation alike. This computer programme is now operational on the CERN CDC 7600 computer.

The dimensions and basic layout of the optical laboratory in the new TP building in Geneva were decided early in the year.

A designer-draughtsman was transferred from the Mechanical to the Optics Group shortly after its inauguration, bringing the staff strength of the group to two persons. A post was advertised in mid-year for an optical designer but, although the response was considerable, the subsequent selection board failed to produce a suitable candidate. It was decided to modify the vacancy notice and re-issue it.

This turn of events had a major impact on the activities of the group. Virtually all optical design for auxiliary instrumentation was stopped in order to allow the more urgent work on the 3.6 m optics to proceed. The failure to recruit a suitably qualified optical designer has had and will continue to have (until the situation is rectified) a negative effect on many activities including the detailed optical design of the prime focus and Cassegrain adaptors, the prime focus correctors, the coudé spectrograph, the line photometer, optical design for institutes in France and Denmark and, perhaps most important, the optimum utilization of the design software.

Controls Group

Throughout 1973 the controls group continued the development of the control system for the 3.6 m telescope. A large number of essential components have been delivered and subsequently forwarded to the different contractors.

The control computer system has been installed and brought into operation. The necessary operating systems have been thoroughly tested and perfected. The conditions of usage, as they are expected to be on La Silla, are continuously simulated.

The proper maintenance of this computer system by the manufacturer during the guarantee period has been rather disappointing. Since no maintenance will be provided by the manufacturer on La Silla it has been decided to train TP personnel to perform this duty and thereby to become independent of the manufacturer.

The controls group will then also be better prepared for the actual conditions on La Silla where only limited repair services will be available.

A proposal was prepared to use the 3.6 m computer system to serve other ESO telescopes on La Silla on a time-sharing basis as well as for the controlling of 3.6 m instruments and the acquisition of data.

A test stand was constructed to test and develop the servo-drive units. Power amplifiers were selected and partially delivered and actual testing began by the end of the year.

For the control of the large number of small motors in the telescope (to move mirrors, counterweights and the top units) a standard motor control system was developed, a prototype of which subsequently became operational in the laboratory and was made ready for production.

A generalized data transmission system that forms the communication link between the control computer and the telescope hardware went through the prototype development phase, operational testing and was prepared in printed circuits for production.

A control system incorporating many of the innovations of the system for the 3.6 m telescope was constructed and installed on ESO's 1 m photometric telescope on La Silla. This drive system became operational in October 1973 and thereafter served as operational prototype for the 3.6 m telescope.

Although minor difficulties were encountered initially, the results at the end of the year were very satisfactory and the users also were very satisfied.

Auxiliary Instrumentation

At its meeting in February the IC discussed, in view of assigning priorities, the list of auxiliary instruments for the initial period of operation of the 3.6 m telescope which had been submitted to the committee the year before.

As a result of this discussion, the IC recommended that first priorities be accorded to the following instruments and instrumental areas:

integrated telescope equipment

classical coudé spectrograph

intermediate dispersion Cassegrain spectrograph

high-resolution single interferometer scanner (Fabri-Perot interferometer with an echelle spectrograph as pre-monochromator)

four (six) channel photometer.

At its following meeting, in October, the IC recommended the inclusion of an echelle spectrometer for line photometry in the list of first-priority instruments for the 3.6 m telescope. The realization of this project was planned as a collaboration between ESO and the Ole Rømer Observatory, Aarhus, within the framework of research and collaboration development foreseen in the ESO budget.

A collaboration was also initiated between ESO and a group at the Göttingen Observatory, headed by Dr. G. Schmahl, for the development of holographic gratings of large size.

At the same meeting the IC recommended, in the area of instrumentation for infrared astronomy, to take steps for testing the performance of telescopes in the Ritchey-Chrétien configuration in order to study the arguments for implementation of a dedicated infrared top-end on the 3.6 m telescope. The recommendation implies that an infrared photometer should be constructed for investigating whether a beam-switching technique in the Ritchey-Chrétien focal position is an acceptable alternative to a wobbling secondary mirror. Discussions have been taken up with Prof. J. Borgman, Kapteyn Sterrewacht, Roden, in view of a possible collaboration between ESO and the Kapteyn Sterrewacht for the realization of this project.

After having had the advice of the IC and the OPC, the ESO Directorate decided to acquire one copy of the photoelectric radial velocity spectrometer, CORAVEL. This instrument, which was developed in a collaborative effort between the Geneva and Marseilles observatories, was planned for initial use on the ESO 1 m photometric and 1.5 m spectrographic telescopes.

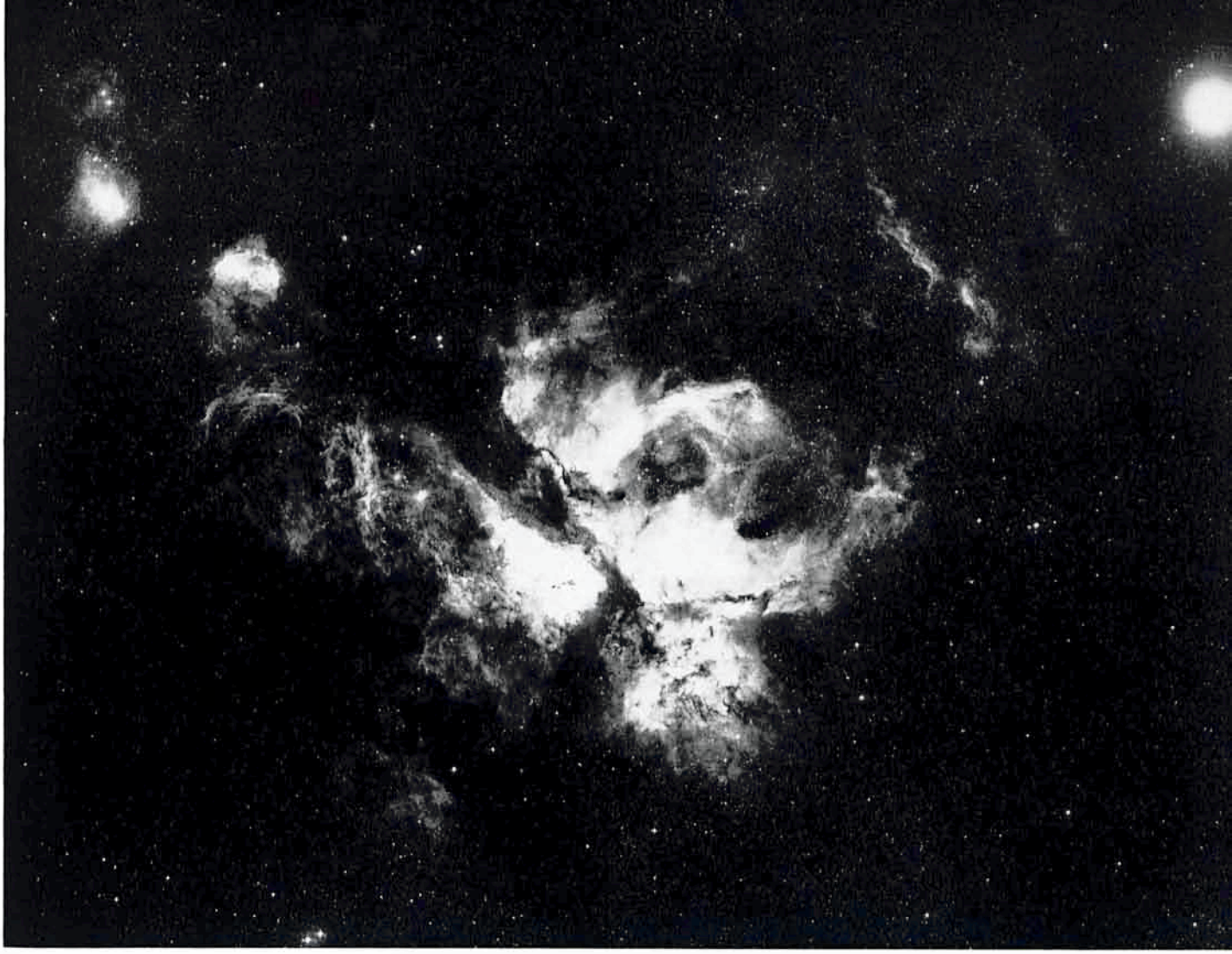
At its February meeting the IC took a further important step towards implementation of the auxiliary instrumentation programme for the 3.6 m telescope by recommending that review teams be established for each instrument or instrumental area assigned first priority. The formation of such review teams should ensure an efficient collaboration between the ESO astronomical community and the ESO TP Division, which is responsible for the realization of the programme.

The main objective of review teams was to advise the TP Division on all matters pertaining to the astronomical aspects of the projects, review them with regard to concept, design and planning and keep the ESO Directorate continuously informed about the progress of the projects.

During the year, review teams were established for all aforementioned instruments and instrumental areas with the exception of instrumentation for infrared astronomy.

The review team for the integrated telescope equipment met twice, most of the astronomical requirements have been specified and new solutions of a number of design problems have been worked out in the Division.

In a meeting of the review team for the four (six) channel photometer specific suggestions for the astronomical parameters were made, on the basis of which a conceptual design was worked out.



The Carina nebula in ultraviolet light, photographed with the ESO Schmidt telescope.

THE SCHMIDT TELESCOPE

The year 1973 was an intermediate year between the mounting and testing of the telescope in the end of 1971 and 1972 and the final modifications and improvements to be executed in 1974.

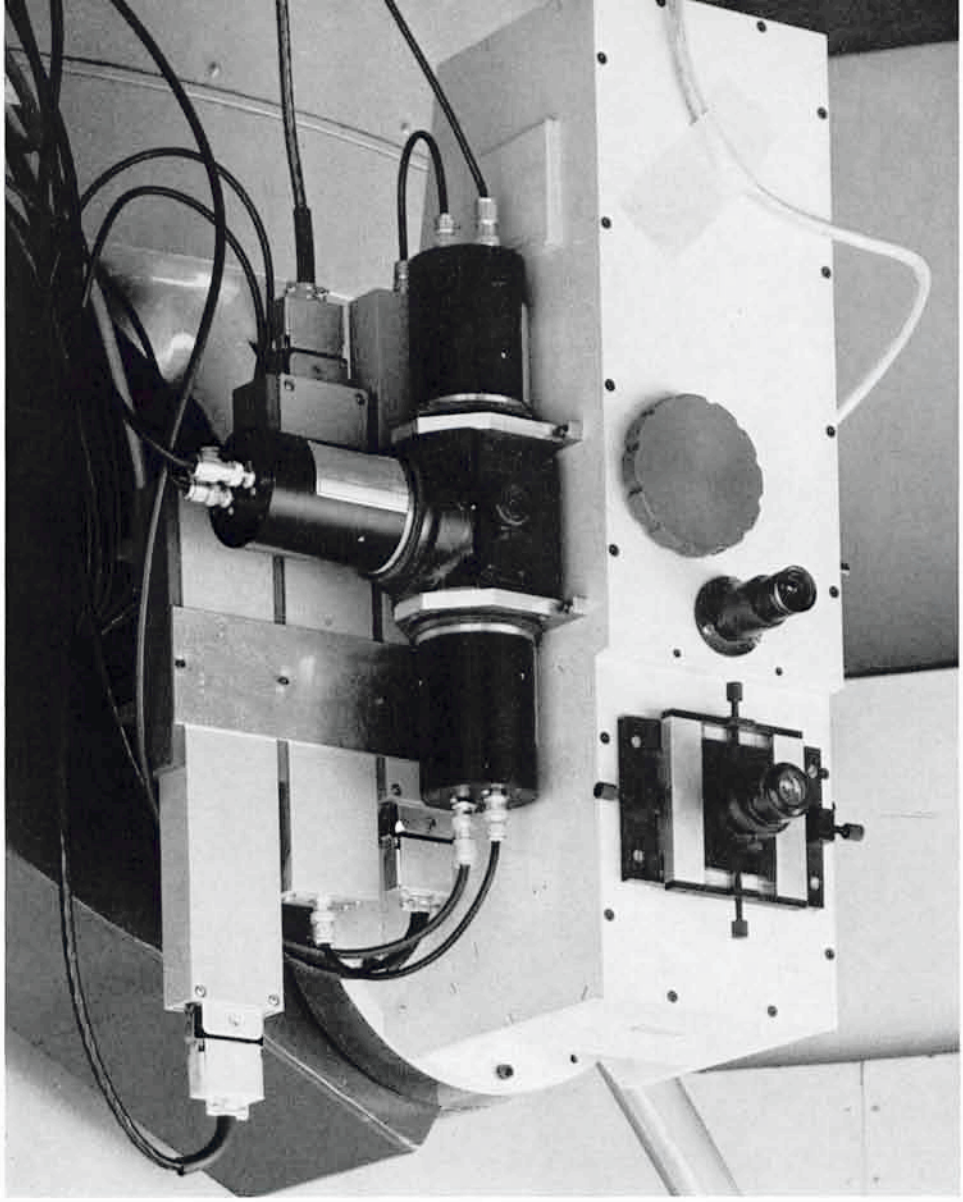
The design for the modification was finalized and detail drawings were executed and completed to the extent of about 80 per cent.

The optics allowing guiding in the focal field of the camera were tested and performed according to expectations. The most critical test of taking photographs of the sky during one minute, moving the telescope over great angles, pointing again to the same guiding star and making a second exposure of one minute of the original field resulted in single-image plates proving the rigidity of the camera-guiding system.

A simple Sofretec television system was successfully tested. A new camera with an ISIT tube will be mounted in 1974. It is expected that guiding can be done on 12th magnitude stars. An optical system to correct for differential refraction between plate centre and guiding star was developed. The system will also allow for viewing a guiding field up to 30 × 30 arc minutes which is ample for guiding stars of 12th magnitude.

Although the instrument was not yet in optimal shape, plates were taken for the Quick Blue Survey programme and also for some member state institutes. During new moon periods the telescope was used for astronomical programmes whereas experiments were performed during full moon periods.

The instruments for marking the photographic plates were completed and brought into regular use. The calibration equipment was still under development. It is aimed at a calibration during the exposure of the photographic plate. One of the most serious problems was the vignetting around the calibration areas. A solution was found and the calibration instruments will be constructed and tested in the course of 1974.



The ESO spectrum scanner.

OTHER TELESCOPES AND AUXILIARY INSTRUMENTS

Telescopes

The 1.52 m Telescope

The telescopes generally performed well throughout the year.

The primary mirror was re-aluminized on April 11 with very good results, noticeable in shorter exposure times.

The new mechanical sidereal clock was connected to the sidereal master clock on La Silla.

A new system of balancing the telescope was introduced.

The modifications of the speeds of the two mobile platforms were completed by the end of the year. A slow speed for the rotation of the dome was also introduced.

The coudé spectrograph worked well. The problem with the calibration remained. An analysis of the light intensity distribution along the slit showed an uneven illumination which means that care has to be taken when using the 10-step wedge. Some of the steps fall in parts where the intensity variation is very steep. Wolf prepared a document for visiting astronomers so that they may take the necessary steps of precaution. A new calibration system—a two-step wedge, modulated by a one-element Lyot filter—is being considered.

Much of the equipment for **the echelec spectrograph** arrived, including the material for the special laboratory for the Lallemand caméra électronique. It is expected that mounting and testing will be completed in June, 1974.

The ETA calibration spectrograph was brought into operation by F. and M. Spite and can now be used to derive for any emulsion a calibration curve of good precision.

The ESO spot sensitometer and its photoelectric calibration photometer have come into normal operation. It is now regularly used to check new shipments of plates from Kodak in addition to being available for normal calibration work.

The RV Cass spectrograph has been working satisfactorily.

A considerable improvement would be an exposuremeter on this spectrograph. It is hoped that one designed by Maurice will be built in 1974.

The clichothèque. ESO edited regularly chronological lists of the spectra taken at La Silla. These lists are at present available at La Silla, in Santiago and in Geneva. A copy limited to his own observations is sent to each visitor.

In these lists, in addition to the data concerning the object and the spectrum, sun correction for radial velocity and 1950 coordinates are computed. The modernization of the clichothèque was carried out by E. Maurice, M. Spite and F. Spite.

The Boller and Chivens image tube spectrograph. Several improvements both in the spectrograph itself and the two image tube camera systems were made. Detailed exposure time calibrations were not completed by the end of the year but they will be obtained naturally with its use. The changes were:

(a) Acquisition of three new gratings. They are Bausch and Lomb gratings of high efficiency. Combined with the two Perkin Elmer gratings originally delivered, a good selection at several blaze wavelengths is now available.

(b) Replacement of the F 4708 electrostatic image tube by a newer "observatory quality" selected tube. Exposure times of up to six hours are now possible. This tube still has the disadvantage of UV absorption and requires a red blocking filter for second order blue use.

(c) The F 4089 magnetically focussed image tube was successfully tested in June. A new plate-holder was designed and tested in October. The tube operates at about 16 kV. The power supply has a high capacity to maintain a good focus but is extremely dangerous if used improperly. Several safety precautions were designed into the plate-holder and the camera. Caution must still be exercised when using this camera.

The advantages of this tube over the F 4708 are its UV transmission and cathode response of S—11 (for blue region without red blocking filter). Another tube has the response of S—25. The two tubes are interchangeable. The quartz entrance windows are ground to the field-flattener curvature of the Bowen-Schmidt camera of the spectrograph. Thus, there is one less optical element in the system to absorb light.

The image tube camera in use with the Zeiss camera has worked well without modification for nearly three years now. Recently the tube itself was exchanged for another ITT F 4708 "observatory quality" selected tube. The dark background is so low that exposures up to five hours are now possible. Previously the limit was about 90 minutes. Most broadband filter exposures are limited by sky background. Since most work in the past had been broad-band, the tube background was not a problem; but now the camera can be used for narrow-band photography to a much greater extent. In addition the photo cathode sensitivity is more uniform.

The image tube guiders. A three-stage image intensifier was set in operation as a finder on the guide box for the Boller and Chivens spectrograph. It is planned to adapt it also to the guiding eyepiece.

The Fabry-Perot interferometer. During this period a third etalon to cover visual wavelengths was acquired. Several new filters were ordered for studies of OI and OII lines. The interferometer was adapted to the mounting ring of the B & C image tube spectrograph. This allows the instrument now to be used at either the 1.52 m or 1 m telescopes.

The portable data system for the 1.52 m telescope was used by Lohsen for the area scanner. The interferometer was not yet operated with this system, although successful tests of the software had been made.

The 1 m Telescope

A new drive control system was installed in September-October, 1973, by the control group of the ESO TP Division. The operation of the telescope has been much improved from the viewpoint of the observing astronomer. Star acquisition, dome rotation, and coordinate precision are now all rapid and efficient. The computer programming capability makes possible much more flexibility for example with set and guide speeds and offset distance. Many stellar coordinates can be easily stored and recalled, avoiding input errors. Balancing the telescope is much more accurately done now by monitoring the motor currents.

During the observations of close binary stars with the new area scanner a tracking error of a period of about 4 min, amplitude 1.5 second of arc was noticed.

The ESO photometer was operating normally and carried a large amount of the 1 m telescope's observing load. For basic classical one-channel photoelectric photometry the instrument proved to be adequate. However, many requests for a more modern photometer were made and various possibilities were being looked into.

A solid state DC amplifier became available to replace the tube-operated GR amplifiers. Several amplifiers of different manufacture were ordered. Pulse-counting became operational but was recommended only for faint star work.

The first test run with the new computer-controlled digital **spectrum scanner,** permanently mounted at the Nasmyth focus, was carried out in April on the 1 m telescope. The computer control programmes were written by Middelburg. All 4096 channels of the multichannel analyzer MCA can now be read out to magnetic tape in about 5 seconds. Programmes for reducing the collected data were developed by Albrecht from Vienna Observatory.

The ESO polarimeter. Many users of this instrument during the past years have indicated that a more modern instrument would be advantageous. The present instrument was designed for classical polarimetry. It has some mechanical problems which reduce the accuracy obtainable under normal observing conditions. Proposals for a new polarimeter design have been requested from users, and A. Behr, ESO TP Division, is coordinating the studies. The polarimeter is now integrated into the GPDAS of the 1 m telescope.

The area scanner was put into operation by Messrs. Lohsen and Rakosch on the 50 cm and 1 m telescopes. Data acquisition programming for double-star observations was made by Lohsen. Data output is in the form of punched paper tape and a temporary oscilloscope display. Data acquisition is handled by an HP 2114 B computer with 8K memory.

Photometric test bench. Owing to the necessity of maintaining a constant check on the sensitivity and spectral response of the phototubes in use on La Silla and on the proper values of high voltage, discriminator setting, and dead time correction for the SSR pulse-counting systems, a photometric test bench is under construction. The bench is comprised of a controlled light source, collimating system, neutral density and colour filters, Fabry-field lens and photomultiplier with cold box.

Phototubes and filters. Several new Strömgren 4-colour filter sets were ordered from Heliotek, the company which manufactured the original matched sets. New Corning and Schott UBV filter sets were received. They will be tested for transformation properties and employed in the area scanner, 50 cm photometer, Bochum photometer and 1 m ESO photometer. Two CA C31034A GaAs phototubes were ordered. They are noted for their high quantum efficiency out to 9000 Å.

The ESO 50 cm Telescope

The primary mirror was re-aluminized in the beginning of April. The instrument generally worked well. Problems solved concerned the dome rotation and the presetting unit.

During observations with the area scanner it was found that the optical quality of the telescope does not permit the resolution of very close pair of binaries. A tracking error with a period of 4 min and an amplitude of 2 seconds of arc appears to exist.

The GPO astrograph worked the whole year without any problems.

Data Acquisition Systems

The GPDAS of the 1 m telescope has been in operation for almost two years now. Nees was largely responsible for the design and construction of the control logics necessary to operate the computer system remotely. He was also responsible for the installation on La Silla. Middelburg developed a photometric data acquisition programme and also the elaborate UBV reductions, Hβ, 4-colour-programmes, etc. Visitors successfully used their own instruments connected to the GPDAS.

Hardware and software modifications foreseen to modernize the system are:

1. A new handset, similar to the one used with the 50 cm telescope system.
2. New interfacing system so that different instruments can be installed with minimal rewiring.
3. New faster counters for high-speed data acquisition.
4. More software packages to adapt to visitor instrumentation.
5. Interconnection of GPDAS and new 1 m drive system developed in Geneva.
6. Revision of existing programmes to incorporate the above changes.

The 50 cm telescope data system. DAS-50, an abbreviated version of the 1 m GPDAS system, was put into service in April. There was not yet magnetic tape available in this system but it had the new type of counters and a better handset control. On the handset are shown filter and diaphragm positions, number of integrations and mean error. The data format is the same as for the 1 m telescope system, thus, the reduction programmes are identical. Both the GPDAS and the DAS-50 provide DC and pulse-counting option.

The data system for the 1.5 m telescope consists now of an HP 2114 B computer and peripherals for use primarily with the Fabry-Perot interferometer and the area scanner.

Measuring Equipment

The disk operating computer system (DOS-M) arrived at the beginning of the year. It has been used extensively. A second magnetic tape drive arrived in October. A new operating software system has been prepared to include the second tape drive.

The Grant machine and its computer system remained substantially the same. The 2114 B computer was replaced by a 2100 computer. Small changes were made in programmes. Partial tests of the screw showed that the accuracy of position measurements was such that the error never reached 0.5 micron.

The iris photometer. Modifications were made by the Electronics Department on one of the Askania iris photometers. The modifications consisted of digitizing the iris setting value for punched tape output and automating the operation of the iris diaphragm.

The isodensitracer and the Schnell photometer curve follower equipment both worked well.

The construction of the accessory equipment for the **Abbe comparator** and the **Hilger Watts measuring machine** for radial velocity measurements (rotating prism measuring device and automatic data output system) progressed well. It was expected that the former would be available on La Silla in mid-1974.

The machine for measuring radial velocities from the GPO astrograph plates was moved to La Silla.

An Abbe comparator, a Joyce-Loebl microdensitometer, a Zeiss spectrum projector, a Boller & Chivens spectrum comparator, and a projector for GPO plates are now available on La Silla.

DANISH NATIONAL 1.5 m TELESCOPE PROJECT

The progress of the project during 1973 will be dealt with under the following main headings:

Optics

The work on the optics, carried out at l'Institut d'Astrophysique in Liège under the responsibility of Dr. D. Malaise, was brought close to completion during the year. Testing of the primary mirror gave very satisfactory results, but in order to take advantage of the excellent seeing conditions on La Silla an attempt will be made to further improve the quality of the mirror. The figuring of the secondary mirror also developed satisfactorily during the year of report.

The Telescope Mounting

A contract for the manufacture of the telescope mounting (excluding the mounting of the secondary mirror and the electronic drive and control system) was signed in February 1973 with Grubb Parsons in Newcastle-upon-Tyne. Delivery was expected to take place early in 1975. The mounting of the secondary mirror will be manufactured in the workshop of l'Institut d'Astrophysique in Liège, according to a design worked out by Dr. Malaise and under his supervision.

The Electronic Drive and Control System

Following negotiations between the Telescope Committee and the ESO Telescope Project Division, an agreement was reached according to which the TP Division will undertake the construction of the drive and control system on the basis of the design developed in the Division for the ESO photometric and Schmidt telescopes.

The Telescope Building

Work on site preparation was started by the contractor, the Dutch company Interbeton B. V. in mid-1973. According to the over-all planning for construction on La Silla, the main work on the building will be carried out during 1974.

The Dome

Construction of the 10.5 m reinforced fiber glass dome was begun at the Bronswerk-Structural plant in Utrecht in early 1973. At the end of the year the work was so advanced that assembly and testing was foreseen to take place during the first half of 1974.

The ESO S-3000 plate testing and measuring machine was installed in the ESO Sky Atlas Laboratory in December 1973.

ESO SKY SURVEY PROJECT AND SKY ATLAS LABORATORY

Activities in Chile

The actual taking of plates for the ESO (B) Survey started on La Silla in April 1973. Certain technical difficulties prevented a rapid progress (see chapter Schmidt telescope). However, at the end of 1973, about 80 plates were taken, of which about 40 were accepted for the ESO (B) Survey.

It became apparent that the darkrooms which were available in the Schmidt telescope building were not adequate for safe processing of large astronomical plates of the highest quality. It was therefore decided to rearrange the darkrooms and re-equip them with modern processing facilities. The planning was done jointly by the astronomers responsible for the operation of the Schmidt

telescope and the ESO Sky Atlas Laboratory. Much of the experience that had been gained during the set-up period of the ESO Sky Atlas Laboratory could profitably be used in this connection.

During 1973, the following equipment was installed in the Schmidt darkrooms:

— a freon wash machine to clean photographical plates and glass filters,

— a tray-rocker for developing large astronomical plates,

— a contact copying machine for making positive copies of original plates taken with the Schmidt telescope,

— a stainless-steel mask to print coordinate grids along the edges of original plates.

The installation of new sinks, processing tanks and a mixing plant for chemicals, as well as the painting of the whole area with anti-dust paint will take place early in 1974.

In view of the necessity of sending large amounts of valuable Schmidt plates from La Silla to Santiago, and in several cases to Europe, the problem of safe transport was looked into. Special boxes of light-weight fiber glass were equipped with inner steel cases in which the plates (without envelopes) are separated by rubber edges. That way there is no risk of the plates being scratched by the envelopes. The method has indeed proven very satisfactory and so far no plate has come to any harm.

ESO/SRC Collaboration

The SRC 48-inch Schmidt telescope which will take the blue plates of the joint ESO/SRC Atlas of the Southern Sky was received from the factory early in 1973 and shipped to Australia in the middle of the year. It there underwent thorough testing and was declared operational in September. R. West of the ESO Sky Atlas Laboratory visited the SRC telescope on Siding Spring in Australia during the testing period and discussed the practical details of the ESO/SRC collaboration with SRC astronomers.

Mr. P. Corben of SRC visited ESO/Chile in May and made several test exposures with the ESO Schmidt telescope in order to evaluate IIIa-J plates that had been sensitized by long-term nitrogen-flushing at the Edinburgh Observatory.

Mr. P. Standen of SRC spent a two-week visit to the ESO Sky Atlas Laboratory, mainly to learn the methods employed there for copying large astronomical plates.

The ESO/SRC Agreement and its attached arrangements were passed through the ESO Finance Committee and Council and were ready for signature by ESO and SRC at the end of the year. They will be signed in January 1974.

In the final form, the ESO/SRC "Agreement concerning cooperation in programmes based on their Schmidt telescopes" foresees a close collaboration

between ESO and SRC in all aspects of making and using sky atlases. The arrangements deal explicitly with

1. The production, publication and sale of the joint two-colour Atlas of the Southern Sky.
2. The production and distribution of initial copies of the ESO (R) and the SRC (B) surveys.
3. The production and distribution of initial copies of the ESO (B) Survey.

Some difficulties were encountered in 1973 by SRC in Australia (and by major American observatories as well), with the IIIa-J emulsion. Two consecutive coatings of this emulsion by Kodak were unsuccessful and the plates could not be used for high-quality astronomical work due to inhomogeneities. However, a third batch, which was delivered at the end of 1973, was successful, and it is expected that the SRC Schmidt telescope will start the taking of SRC (B) plates in the beginning of 1974.

This means that the first instalment of the ESO/SRC Atlas of the Southern Sky may be sent out late in 1974.

As a result of the practical collaboration that has existed throughout the year between ESO and SRC, SRC has produced for ESO two tray-rocking machines for development, and ESO, in its turn, two freon wash machines which are now installed at Siding Spring.

ESO prepared a list of guide stars to be used by ESO and SRC in common, and the SRC, through Dr. A. Murray, provided ESO with overlays containing all SAO stars in each of the 606 fields of the southern sky surveys.

ESO/Uppsala Collaboration

Similar to the Palomar Sky Atlas at its apparition in the mid-1950s, the availability of the ESO (B) Atlas (ESO Quick Blue Survey) will undoubtedly lead to the discovery of many new interesting objects in the southern sky.

Whereas it was clear that certain possibilities for personal research should be given to the ESO staff astronomers directly involved in the routine work of the sky surveys, it was also felt that the expertise (and necessary time) was not available within ESO for a large-scale searching of the Schmidt plates. In order to avoid haphazard first exploitation of this field and to put the searching for new objects into a system that would be of advantage to all parties involved, the idea arose that ESO should collaborate with an observatory with experience in this field. A catalogue of new objects could then be efficiently established and published rapidly.

Following these considerations, it was decided to approach the Uppsala Observatory which has long held a recognized position in the field of galaxy astronomy, notably through the efforts of its present Director, Prof. E. Holmberg.

A meeting took place on September 30, 1973, in Copenhagen between the Director-General of ESO and Prof. Holmberg, and a list of types of objects

to be identified on the ESO (B) plates was established. Following this meeting, the Director-General appointed R. West coordinator of this project on the ESO side, and a further meeting took place in Uppsala on October 25—26, 1973. At the end of the year, a frame contract for the collaboration between ESO and the Uppsala Observatory was being worked at.

It is foreseen that four astronomers at the Uppsala Observatory will be active in the search of objects. For the search, a small measuring machine has been built at the Uppsala Observatory and two more are to be built in 1974.

These are the objects to be identified on the 606 fields of the ESO (B) Survey:

1. All NGC + IC galaxies, between -20° to -30° also Vorontsov-Velyaminov and Arp objects.
2. All galaxies beyond these catalogues down to a limiting diameter still to be established, but probably 1 mm = 1'.1.
3. All disturbed galaxies as faint as practically possible.
4. All stellar clusters in Budapest catalogue and fainter down to a certain limit still to be established.
5. All planetary nebulae that have already been listed by Kohoutek, etc.

Finding lists and charts will be published at a rapid rate in the "Astronomy and Astrophysics Supplement Series".

ESO Sky Atlas Laboratory

Work on testing of materials and methods for the production of sky atlases continued throughout the year. In this context, Mr. William C. Miller, Pasadena, spent a month as consultant to the Sky Survey Project, and visited La Silla, the Royal Observatory in Edinburgh (SRC) and the ESO Sky Atlas Laboratory in Geneva. Mr. Miller played a central role in the planning of the Palomar Sky Atlas and, as chief photographer of the Hale Observatories, was able to contribute significantly to the solution of technical problems in connection with the production of the coming sky atlases. As a result of his visit and subsequent evaluations of samples in Pasadena, the production method for copying original Schmidt plates on-glass and on-film could be established in the middle of the year.

The actual production of on-glass copies of the ESO (B) Survey started in November and was proceeding at a good rate at the end of the year.

A marketing survey for the ESO/SRC Atlas of the Southern Sky was carried out early in 1973.

In reply to a questionnaire that was sent to more than 400 observatories around the world, a substantial number of firm orders for the Atlas was received, and even more observatories indicated their intention to place an order later on.

Publicity in form of a small exhibition was given to the ESO/SRC Atlas during the IAU General Assembly in Sydney.

Several technical-photographical problems in connection with the handling of large astronomical plates were looked into by the ESO Sky Atlas Laboratory. On the basis of a design received from the Kitt Peak National Observatory, a prototype Freon wash machine was constructed by the CERN West Workshop under the supervision of ESO photographers. From the experience with this machine, a significantly improved version was built in five copies, two of which were sold to SRC, two were placed in the Schmidt telescope building on La Silla and one remained at the ESO Sky Atlas Laboratory.

Tanks were designed for the processing of original and copy plates in the Schmidt darkrooms on La Silla. Special attention was given to the problem of making processing of large, fragile plates safe in complete darkness. New plate-holders were designed as a result of the experience that was gained.

An Optronics S-3000 Specscan measuring machine that is capable of measuring astronomical plates up to 14″ × 14″ was delivered in December. It will serve to calibrate the sky survey plates astrometrically and for the quality control by evaluation of the image structure. Dr. D. Wiskott of the CERN Data Handling Division served as a consultant to ESO on this matter.

It was decided to make use of the experience of the ESO Sky Atlas Laboratory in the design of the photographical darkrooms in the 3.6 m telescope building, and a working group was established.

Study visits to the ESO Sky Atlas Laboratory were made by P. Standen (SRC), J. Heudier (Nice Observatory) and T. Bech (Copenhagen Observatory). Mr. W. Poldermans spent two months as a summer student. Mr. Ed. Hahn and Mr. Lou Kime of KODAK/Rochester visited the Laboratory during two days in November for mutual consultation.

An exhibition on the Organization of ESO took place in the CERN main building from November 5 to 17. Most of the material on display, among which were several very large enlargements of ESO Schmidt plates, was prepared by the ESO Sky Atlas Laboratory.

The following internal reports on subjects related to astronomical photography were issued by the Laboratory in 1973:

— "A method to produce composite images of several astronomical plates" (B. Dumoulin).
— "A method for improvement of contrast in high density areas on astronomical photographical plates" (B. Dumoulin).
— "Report on a photographic method to achieve composite colour isodensigrams of large astronomical plates" (W. D. Poldermans).
— "Subtractive colour prints of astronomical plates of different wavebands" (W. D. Poldermans and R. M. West).

Copies of these reports are available upon request to the Sky Atlas Laboratory (see address on inside cover of this Report).

Construction of new power station.

BUILDINGS AND GROUNDS

Establishments in Chile

The following has been abstracted from the much more extensive report for 1973 prepared by the Technical Department of ESO in Chile; this is available to Council on request.

Pelícano and La Silla
Power Supply

The power necessary for the observatory was generated, as in previous years, by three generators in Pelícano and one mounted on La Silla for all electronic instruments in the telescope domes.

The Pelícano plant ran 23,000 hours, with a total fuel consumption of 300,600 litres.

A 6,000 V underground electrical cable was installed from the existing transformer station to the site of the 3.6 m telescope. Two new transformer stations, Armex and Blockarmex, have been installed. The former, of 200 kVA, will replace the old 6,000 V/380 V transformers; it is mounted on the site of the existing transformer station and connected to the cable referred to above. The latter is installed at the other end of the cable, on the 3.6 m telescope site.

Towards the end of the year, the voltage stabilization plant for the existing electronic equipment was put into operation.

Water Supply

The deep wells, which have been in service for about eight years, showed a certain reduction of their capacity caused by the accumulation of fine sand and clay in the bottom. Therefore, the three wells which were in operation were cleaned with an air-lift device.

The fourth well was also put into service; it was equipped with a pump and connected to the water line leading to pump station No. 1, in the northern corner of Pelícano Camp.

The production and consumption of water were as follows:

	m^3/year	m^3/day	%
Water used in Pelícano	9,870	27.0	30.0
Water used on La Silla	17,248	47.3	52.5
Treatment, losses, etc.	5,730	15.7	17.5
Water pumped from the wells	32,848	90.0	100.0

The foundation was made for an additional 150 m^3 water tank on La Silla. A work order for the tank was placed with a contractor in Santiago.

A pump station was installed at the water tank site for the water supply to the site of the 3.6 m telescope.

Heating System

Two more sub-stations were installed on La Silla:

— one in dormitories 3 and 4, with a capacity to tranfer 75,000 kcal/hr for heating plus 39,000 kcal/hr for domestic water consumption,

— another in dormitories 5 and 6 with 50,000 kcal/hr for domestic water.

In the central heating plant one boiler had to be welded at some spots where leakages were present.

Telescope Buildings

The Astro-Dome building which had been standing empty since November, 1971, was reconditioned to receive the Roden infrared instrument. A thorough revision of its electrical equipment was done. Dome and screen motors were

inspected, and an inner wiring for stabilized current was placed. Thermal insulation was installed, a concrete pillar was built to support the telescope and a platform and an air-conditioned office were added.

TP office

An office building, 120 m², for the ESO TP Division Group was erected. It comprises a conference room, an office for the chief engineer, a large room for two field supervisors and a secretary, store rooms and toilet facilities.

Hotel, La Silla

The existing dining-room and the kitchen were extended, the former to seat 120 persons and the latter to have the corresponding capacity. The extensions were necessary in anticipation of the elimination of Camp Pelícano as well as of the increased personnel during the construction and subsequent operations of the 3.6 m telescope.

Roads

The maintenance of roads was kept to a minimum as the equipment was needed by ESO and Interbeton for other works.

Airstrip

The construction of a landing strip for small planes started in October with ESO equipment and personnel, under the supervision of the Technical Department of La Silla. The area, of 60 × 1500 m, is located on the south side of the public road, 9.5 km west of Pelícano and 4.5 km east of the Panamerican Highway.

La Serena
Bungalows

Four Weston bungalows arrived in March 1973; three of them were erected on the extended Las Cisternas premises at the end of the year, and the fourth bungalow will be ready early in 1974.

In addition, a house was bought in the neighbourhood of these premises to lodge a member of the TP Division.

Office

A house in Las Cisternas Street was bought for use as an office by the Technical and Administrative services in La Serena. The previous office in Balmaceda was closed.

Santiago
Headquarters Building

In order to obtain more office space on the grounds, two offices, a drafting room of 45 m² and a personnel office measuring 30 m², were planned for the terrace and construction was started. Owing to the many difficulties encountered in Chile in 1973 the construction time had to be extended into 1974.

Among the alternatives for paving the driveway, presented by the architect selected for this job in 1972, one was chosen and the tender documents were prepared.

In November, eight firms were invited to tender on a lump-sum basis; seven firms declined the invitation owing to instability of prices of the materials in the country. The contract was awarded to the only contractor who presented an offer on a cost plus fee basis.

ESO Houses

The guesthouse was painted outside and inside and a new laundry was built in the basement. The houses were maintained by workers assigned to the Technical Department. The heating installations were maintained by a Chilean firm.

TP Division, Geneva

Extension of TP Premises

In March 1973 the TP Division authorized the CERN/SB Division to proceed with the construction of a new hall adjacent to the present buildings.

The specifications for this hall had already been worked out, and incorporated in this building will be an assembly area for mechanical sub-assemblies to the large telescope and the CAT, an optical laboratory, a mechanical workshop, office and storage space.

The tendering and adjudication procedures were handled by the CERN/SB Division which alone is authorized to supervise construction on the CERN site. This building is expected to be commissioned in mid-1974.

ADMINISTRATIVE MATTERS

General

In Chile, the Administration faced serious problems, stemming from the deteriorating economic and political situation in that country. The scarcity of many items essential for the daily life of our staff, as well as the shortage of materials required for normal operation of the observatory and for new construction, was already noticeable in 1972. However, it worsened during the first three quarters of the year to the point of becoming the most serious concern of the Administration, and regular imports of foodstuffs, for instance, were necessary. Problems of communication and safety also greatly preoccupied the Administration. Towards the end of the year, after the change of government, the situation in these respects gradually reversed.

Under the troublesome circumstances prevailing throughout 1973, attempts to further improve and develop administrative and financial procedures, especially the introduction of a cost-distribution system at the observatory site, could not be successfully pursued. The situation was further complicated by the departure, at the end of the year, of the head of the administrative staff in Chile.

With regard to the legal status of ESO in Europe, the Working Group of the ESO Council — appointed in 1972 — continued its work and completed the text for the multilateral protocol on privileges and exemptions for ESO, to be submitted for signature and ratification by the governments of the member states, hopefully in 1974.

This protocol would also provide the formal basis for the introduction of a system of internal taxation of ESO international staff salaries.

Personnel

After the formulation during 1971 and 1972 of Combined Staff Rules containing the basic principles for international and local (Chilean) staff and the implementation of Staff Regulations for international staff (shaped after those adopted by CERN) and of Regulations for local (Chilean) personnel, the activity of the Personnel Service in 1973 was mainly concentrated

(a) again on the Staff Rules and the Regulations for international staff, since a general revision in CERN also affected the situation in ESO and since a few items were still left from the previous ESO Working Group;

(b) on a basic assessment of the cost-of-living situation in Chile versus European (Geneva) indices, in order to arrive at an acceptable procedure to identify and calculate cost-of-living adjustments;

(c) on the Old Age Insurance System of ESO, since a limitation of membership in the CERN Pension Fund required complementary measures; and

(d) on the Development of principles granting, in special cases and under special conditions, compensation to ESO international staff in areas involving special hazards.

As a result, a number of improvements in the situation of international staff was adopted during 1973 (the final revision to be terminated in 1974) and the ESO pension policy reformulated, allowing staff members, under certain conditions, to remain members in a previous old age insurance system.

The review of the cost-of-living situation in Chile was undertaken with the efficient assistance of experts from the Inter-Organizations Study Section on Salaries and Prices, linked to OECD, providing a neutral and professional assessment of the underlying factors as of July/August, 1973.

A continuation of this cooperation is envisaged.

These increased activities, accompanied by a general improvement of the inner structure and efficiency of the Personnel Service, were made possible by the appointment of a staff member with a professional background in personnel matters.

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

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

F. Walsh	Translator	March 1
J. C. Carreau	Head of Personnel	April 1

(b) **Chile**

E. Leroy	Senior Engineer	March 1
H. Franz	Head of Maintenance Service	August 1
J. Danziger	Astronomer	September 15
N. Vogt	Astronomer	December 1

(c) **TP Division, Geneva**

W. Richter	Leader of Mechanical Group	April 1
J. van der Lans	Leader of Controls Group	April 1

Departures:

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

None

(b) **Chile**

J. Haahr	Maintenance Engineer	May 3
A. Ardeberg	Astronomer	May 12
E. Maurice	Astronomer	September 30

(c) **TP Division, Geneva**

P. Sturzinger	Electronics Engineer	November 30

Personnel in grade 9 or higher per December 31, 1973

Hamburg Office:

A. Blaauw	Director-General
A. B. Muller	Senior Astronomer
G. Bachmann	Head of Administration
J. Meuser	Purchasing and Shipping
J. C. Carreau	Head of Personnel
R. Doorn	Administrative Officer
F. Walsh	Translator
P. Huijmans	Administrative Officer
H. W. Marck	Accountant
F. V. De Buck	Auditor

Chile:

B. Westerlund	Director of ESO in Chile
M. A. Peuch	Assistant Director ESO/Chile
R. Villena	Chief Engineer
H. Scheffold	Senior Administrative Officer
J. Danziger	Astronomer
M. de Groot	Astronomer
R. Garnier	Astronomer
R. Havlen	Astronomer
J. Rickard	Astronomer
H. E. Schuster	Astronomer
F. Spite	Astronomer
N. Vogt	Astronomer
B. Wolf	Astronomer
H. J. Wood	Astronomer
W. Müller	Construction Engineer
Ph. Bourlon	Electronics Engineer
M. Becker	Electronics Engineer
W. Nees	Electronics Engineer
H. Franz	Maintenance Service
H. Straatman	Administrative Officer
G. Anciaux	Administrative Officer

ESO TP:

S. Laustsen	Project Leader
W. Richter	Leader, Mechanical Group
J. R. van der Ven	Mechanical Engineer
E. Leroy	Senior Engineer
W. Bauersachs	Mechanical Engineer
R. Wilson	Leader, Optics Group
B. Malm	Electronics Engineer
J. van der Lans	Leader, Controls Group
D. Plathner	Mechanical Leader
N. Rodgers	Administrative Officer

R. Clop	Mechanical Engineer
P. Scharnweber	Electrical Engineer

Sky Atlas Laboratory:

R. West	Senior Astronomer

Visiting Scientists:

A. Behr
A. Reiz

As it is of interest to see to what extent the constitution of the international staff reflects the participation of the member states of ESO, we reproduce here some statistics presented at the 1973 December Council meeting. The table below gives, in the second column, the number of appointees belonging to the various member states (and those of other nationality) per December, 1973. The third column gives these numbers in percentages of the total for the member states only. For comparison, the last column gives the percentage of their financial shares. It will be noted that, apart from a relatively small number of "foreign" nationalities, there is a satisfactorily proportional representation of the ESO countries among the international staff. For more refined statistics, naturally, the distribution over the various grades should also be taken into account; it turned out that this did not affect the above conclusion.

Representation of nationalities among international staff

Member state	Number of employees	Number in %	Financial share in %
Belgium	6	6.7	8.1
Denmark	3	3.4	4.7
France	23	25.9	33.3
Fed. Rep. of Germany	37	41.6	33.3
Netherlands	14	15.7	10.2
Sweden	6	6.7	10.4
Total	89	100.0	100.0
Other nationalities	12		

In order to improve the long-term financial planning in ESO, and to provide a proper basis for the "Bannier budgetary procedure", a consultant (Dr. B. Kuiper) from CERN was charged with the task of compiling an over-all description of the ESO programme with emphasis on the past and future financial implications. Its publication is expected in late 1974.

The Working Group of the Finance Committee, established in 1972 to review the ESO Financial Rules and Regulations, could not continue its work in 1973, since priority had to be given to the Council Working Group for the Development of a Multilateral Protocol. It is to resume work late in 1974.

However, following the Working Group's study of the currency problem at its first meeting in 1972, the Council agreed in 1973 to change over from the US dollar to the German mark as the currency in which budget/accounting and contributions shall be expressed, thus reducing the financial risks resulting from parity changes and facilitating the financial administration.

Simplification and increased efficiency was also the objective of the long-envisaged change-over from manual to EDP accounting. The first steps for this were taken in Hamburg in 1973 together with TREUARBEIT, a German management consultancy and chartered accounting firm, selected after limited tendering. The aim is to include not only the accounting in Hamburg, but also — at least as regards the results — the accounting in Chile and the computerized statements already provided by CERN for the TP Division.

The Bundesrechnungshof, which has served as external auditor during the last ten years, terminated its audit with the verification of the 1973 accounts, after Council decided to appoint, as of January 1, 1974, an external auditor from the French Cour des Comptes. The contribution of the Bundesrechnungshof to ESO was particularly appreciated, since these external auditors not merely audited the annual accounts but also made a number of valuable recommendations towards the improvement of the general management and the inner structure of the Organization.

The following tables show the budget statement for 1973, the accumulated expenditure per December 31, 1973, and the budget forecast for 1974, now in German marks.

As can be seen from the budget statement, expenditure for capital outlays and income from member states' contributions to ESO did not reach the respective forecasts. The reasons were that the financial impact of certain capital projects shifted to subsequent years and that the decreasing parity of the US dollar, as compared to the German mark, resulted, in terms of German marks, in a reduced income.

Budget Statement 1973

(in DM 1000)

Expenditure

Budget Heading	Approved Budget	Transfers	Revised Budget	Expenditure (incl. commitments and unused credits carried over to 1974) for			
				Directorate Hamburg	Establishment in Chile	3.6 m TP Division Geneva	Total
1 Personnel	9,918	—	9,918	1,696*	4,784	1,768	8,248
2 Operations	5,823	/. 162	5,661	863	3,422	968	5,253
3 Capital outlays	15,160	236	15,396	32	3,156	7,011	10,199
4 Sky Survey Project	884	—	884	884	—	—	884
TOTAL EXPENDITURE	31,785	74	31,859	3,475	11,362	9,747	24,584
Reserve for cost variation	2,347	/. 74	2,273	—	—	—	—
Reserve for 3.6 m Telescope Project	1,599	—	1,599	—	—	—	—
GRAND TOTAL EXPENDITURE	35,731	—	35,731	3,475	11,362	9,747	24,584

*Including visiting scientists associated with the TP Division.

Income

Budget Sub-Heading	Estimate	Actual (incl. receivables)
90 Contributions from member states	25,440	21,046
91 Unused appropriations from previous years	6,910	6,997
92 Profit from parity changes	1,768	1,790
94 Sale of Sky Maps	—	10
95 Miscellaneous	1,613	2,236
	35,731	32,079

Accumulated Expenditure up to December 31, 1973

(in DM 1000)

Budget Heading		
1 Personnel		32,975
2 Operations		20,966
3 Capital outlays		
(a) Land, Buildings, Roads	31,316	
(b) Instruments	10,813	
(c) Architects and Consultants	5,458*	47,587
4 Astronomical and meteorological activity, South Africa		2,024
5 3.6 m Telescope Project		28,992
6 Sky Atlas Project		1,550
Unforeseen		342
TOTAL EXPENDITURE UP TO DECEMBER 31, 1973		134,436

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

Budget for 1974

(in DM 1000)

Expenditure

Budget Heading	Directorate Hamburg	Establishment in Chile	3.6 m TP Division Geneva	Total
1 Personnel	2,235	6,288	2,606	11,129
2 Operations	1,339	3,400	1,153	5,892
3 Capital outlays	55	2,078	15,171	17,304
4 Sky Atlas Project	893	—	—	893
	4,522	11,766	18,930	35,218
Reserves				
Reserve for cost variation (6 %)				2,113
TOTAL EXPENDITURE				37,331

Income

Budget Sub-Heading	Estimate 1973
90 Contributions from member states	30,000
91 Unused appropriations from previous years	5,906
94 Sky Atlas Project	591
95 Miscellaneous	834
TOTAL INCOME	37,331

As for 1972, we shall use the current report for a brief presentation of statistics on some of the functions supervised by the Administration:

(a) Use of Hostel and Dormitories at La Silla by Visitors

This excludes lodgings by personnel semi-permanently stationed on La Silla (technicians, resident astronomers, administrative personnel, kitchen personnel, night assistants, etc.). A total of 4,767 lodgings was provided for visitors in 1973, broken down as follows:

Visiting astronomers for ESO telescopes	1,590	(33 %)
ESO astronomers based in Santiago	620	(13 %)
ESO non-astronomical staff based in Santiago	861	(18 %)
Astronomers connected with "national" telescopes	489	(10 %)
Consultants and specialists, Schmidt telescope	129	(3 %)
ESO staff based in Hamburg	87	(2 %)
ESO staff 3.6 m telescope, Chile and Geneva	303	(6 %)
Miscellaneous and accompanying persons	688	(15 %)
	4,767	(100 %)

(b) Use of Santiago Guesthouse by Visitors

In the year under review 274 visitors were recorded in the visitors' book, to which approximately 10 per cent of unrecorded visitors have to be added. The annual numbers of lodgings provided by the guesthouse since 1968 (i. e., not counting the lodgings of in-house personnel) are given in the table below.

Year	1968	1969	1970	1971	1972	1973
Number of lodgings for visitors	881	1,932	1,784	1,438	1,532	1,422

In these numbers, accompanying wives and children have been counted as half-units. The actual number of lodgings, counting wives and children as whole-units, for 1973 was 1,631. Of these, 490 were for visiting astronomers, and the remaining 1,141 for newly-arrived staff and their families, staff from Hamburg and the TP Division, etc. The guesthouse was closed from January 14 to February 18.

(c) Purchases

The totals of purchase orders or contracts placed by the various establishments in the period October 1, 1972 to September 30, 1973, broken down by value, were:

	Total	Chile	Hamburg	Geneva
Value below DM 10,000	3,514	2,877	483	154
Value DM 10,000 to DM 100,000	145	33	20	92
Value exceeding DM 100,000	11	2	1	8
TOTAL	3,670	2,912	504	254

COUNCIL, COMMITTEES, WORKING GROUPS

(a) **The Council of ESO** met:

on June 5/6 in Hamburg (21st meeting),
on December 13/14 in Hamburg (22nd meeting).

At the June Meeting, Council was the guest of the University of Hamburg and was welcomed by its President, Dr. Fischer-Appelt. The meetings were held in the University's guesthouse. The December meeting, as several previous ones, was also attended by representatives of AURA; this time Prof. R. Wildt, Chairman of the AURA Board, and Mr. G. Lee, President of the AURA Corporation. Both meetings were also attended by observers on behalf of the Swiss government (Mr. Ch. Favre and Prof. R. Rufener).

These meetings of Council were preceded by meetings of the

Committee of Council:

on March 29 in Paris (7th meeting)
on May 18 in Geneva (8th meeting)
on November 28 in Geneva (9th meeting),

serving, as usual, for exploratory discussions in connection with the subsequent Council meetings.

(b) **The Finance Committee** met three times:

on April 26 in Hamburg (26th meeting)
on November 12/13 in Hamburg (27th meeting)
on December 12 in Hamburg (28th meeting).

The Committee dealt with a variety of financial and administrative matters, including budgets and financial plans, staff regulations, salaries, allowances and adjudications.

(c) **The Scientific Policy Committee** met three times:

on March 28 in Paris (3rd meeting)
on September 14 in Copenhagen (4th meeting)
on November 7 in Paris (5th meeting).

The third meeting of the SPC was devoted mainly to the discussion of ESO's future involvement in infrared astronomy, a follow-up of the discussions of the

second meeting. Next to the regular members and invitees of the Committee, infrared astronomers from all member states as well as from Norway and Switzerland were invited in order to find out what wishes regarding infrared research existed among them and what initiatives they would like ESO to take to promote infrared research.

It emerged that most participants wished ESO to provide a dedicated middle-sized infrared telescope, whereas the necessary auxiliary instrumentation would be developed through national efforts at various institutes.

The Scientific Policy Committee reported to Council about these wishes at the meeting of Council on June 5/6.

The fourth meeting of the SPC was mostly concerned with a resolution adopted by Council at its meeting of June 5/6, at which the SPC had been requested to

(1) explore the desirability and the necessity for ESO to create in Europe the means for encouraging and organizing cooperation in astronomical research, particularly in view of the use of the facilities in Chile;

(2) explore how the development and construction of the auxiliary instrumentation required for operation of the telescopes in Chile can best be inspired by the needs of those research problems for which the equipment is optimally suited;

(3) explore the desirability for ESO to create, in addition to the existing services now in Hamburg and Geneva, a service by which the activities mentioned under (1) and (2) above might be organized.

Professor B. P. Gregory, former Director-General of CERN and now Director of the Centre National de la Recherche Scientifique in France, and Professor R. Lüst, President of the Max-Planck-Gesellschaft, served as advisers to this meeting.

The meeting also examined a project for an ESO/SRC conference in 1974 on initial research programmes for the new large telescopes and a possible follow-up with a workshop on related subjects, and recommended its implementation.

The fifth meeting of the SPC exclusively served for finalizing the committee's advice to Council concerning the matters initiated at the fourth meeting.

(d) **The Instrumentation Committee** met twice:

on February 13/14 in Geneva (37th meeting)
on October 3/4 in Geneva (38th meeting).

The second meeting was originally planned to be held in Chile between October 6 and October 16, and should have given opportunity to make the IC members acquainted with all the ESO installations in Santiago and on La Silla.

Due to the political development at that time in Chile this plan had to be postponed to a further meeting.

The Council adopted the "Rules of Procedure for the IC" (see document ESO/Con — 140 rev. of December 4, 1973).

Apart from the items regularly figuring on the committee's agenda, such as reports on the status of operation of equipment in Chile and on the status of work for the 3.6 m telescope and its auxiliary equipment, the committee devoted considerable attention to the following items:

(1) The final shop testing of the optics for the 3.6 m telescope.

(2) The reports on the construction of the 3.6 m telescope, the main building and the dome.

(3) The auxiliary coudé feed for the 3.6 m telescope.

(4) The activity of the review teams for the development of the first priority items of auxiliary instrumentation, e. g.:
   (a) Cassegrain adaptor
   (b) Classical coudé spectrograph
   (c) 4 (6) channel photometer.

(5) The establishment of a working group to study the astronomical need and to define the specification of a sophisticated plate measuring machine for the work of ESO.

(6) The organization of research and development in collaboration with institutes in ESO countries.

(e) **The Observing Programmes Committee** met twice:

on May 24 in Hamburg (12th meeting)
on December 11 in Hamburg (13th meeting).

The main item for both meetings was the review of applications for observing time (including a few from non-member countries) for Periods 12 (October 1, 1973 to April 1, 1974) and 13 (April 1, 1974 to October 1, 1974). The generally good quality of the submitted programmes and the fact that there normally is a considerable overdemand in relation to the available time (see section on Visiting Astronomers) makes it hard for the Directorate to arrive at satisfactory allocations. Ratings used by the committee's evaluations were: "outstanding", "very good" and "good".

In this context the Director-General suggested a resumption of the earlier policy of inviting a number of applicants to the OPC meeting for a presentation and a justification of their applications. This suggestion was accepted and will be realized at a forthcoming meeting of the OPC.

The new application form and the Regulations for Visiting Astronomers were finalized.

At both meetings there was discussion on the duration of OPC membership, which in principle was fixed at three years. However, as it is rather difficult to find good replacements in the smaller countries, there should be a possibility for continuation of membership. It was agreed that a member should become substitute member when replaced.

(f) **The Working Group of Council for the Establishment of a Multilateral Protocol,** created at the Council meeting of June, 1972, met once, on May 29, in Hamburg. Good progress towards ratification of the Protocol was made, as described in the section Administrative Matters.

(g) **The Working Group of the Finance Committee for the review of the ESO Financial Rules and Regulations,** created in 1972, did not meet in 1973; see also the remarks in the section on Administrative Matters.

APPENDIX

List of Members of Council, Committees and Working Groups per August 1, 1974

Council

Belgium:	A. G. Velghe L. Poulaert / M. Deloz
Denmark:	M. Rudkjøbing P. A. Koch
France:	J. F. Denisse A. Alline
Federal Republic of Germany:	R. Kippenhahn C. Zelle
The Netherlands:	H. G. van Bueren J. H. Bannier (acting President)
Sweden:	P. O. Lindblad M. Fehrm

Committee of Council

A. Alline (France)
J. H. Bannier (Netherlands), acting President
J. Borgman (President of the Instrumentation Committee)
M. Deloz / L. Poulaert (Belgium)
M. Fehrm (Sweden; President of the Finance Committee)
P. Ledoux (President of the Observing Programmes Committee)
P. A. Koch (Denmark)
B. Strömgren (President of the Scientific Policy Committee)
C. Zelle (Federal Republic of Germany)

Scientific Policy Committee

	Standing invitation to attend the SPC's meetings
L. Biermann	J. H. Bannier (acting President of Council)
J.-C. Pecker	J. Borgman (President of the Instrumentation Committee)

B. Strömgren (Chairman)	P. Ledoux (President of the Observing Programmes Committee)
L. Woltjer	M. Fehrm (President of the Finance Committee)

Finance Committee

Belgium:	M. Deloz
Denmark:	H. Grage
France:	no nomination
	C. Bonnet
Federal Republic of Germany:	C. Zelle
The Netherlands:	P. J. Fierst van Wijnandsbergen
Sweden:	M. Fehrm (Chairman)
	B. Samuelsson

Instrumentation Committee

K. Bahner
J. Borgman (Chairman)
R. Cayrel
G. Courtès
Aina Elvius
Ch. Fehrenbach
D. J. Malaise
P. E. Nissen
E. H. Schroeter

Observing Programmes Committee

	Substitute
G. Wlérick	J. Lequeux
E. P. J. van den Heuvel	P. S. Thé
E. B. Holmberg	Aina Elvius
P. Ledoux (Chairman)	P. Swings
M. Rudkjobing	P. E. Nissen
K. Hunger	Th. Schmidt-Kaler

Working Group for a Multilateral Protocol	**Working Group for Financial Rules and Regulations**
J. H. Bannier (Chairman)	C. Bonnet
L. Delrot	M. Deloz (Chairman)
H. Dumont	P. J. Fierst van Wijnandsbergen
A. Freytag	G. Friborg
M^me M. R. d'Haussy	H. Grage
C. E. I. M. Hoogeweegen	S. C. J. von Welck
O. Ottosson	

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ESO Guesthouse	Gustavo Adolfo 4634, Santiago de Chile. Telephone: *48 42 54* (near cross-roads Avenida Cristóbal Colón and Amerigo Vespucio, then through Félix de Amesti).
ESO Local Office La Serena	Casilla 27 D. Cisternas 2020, La Serena, Chile. Telephone: 11 67, 11 77. Telegrams: ESOSER — *La Serena.*

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