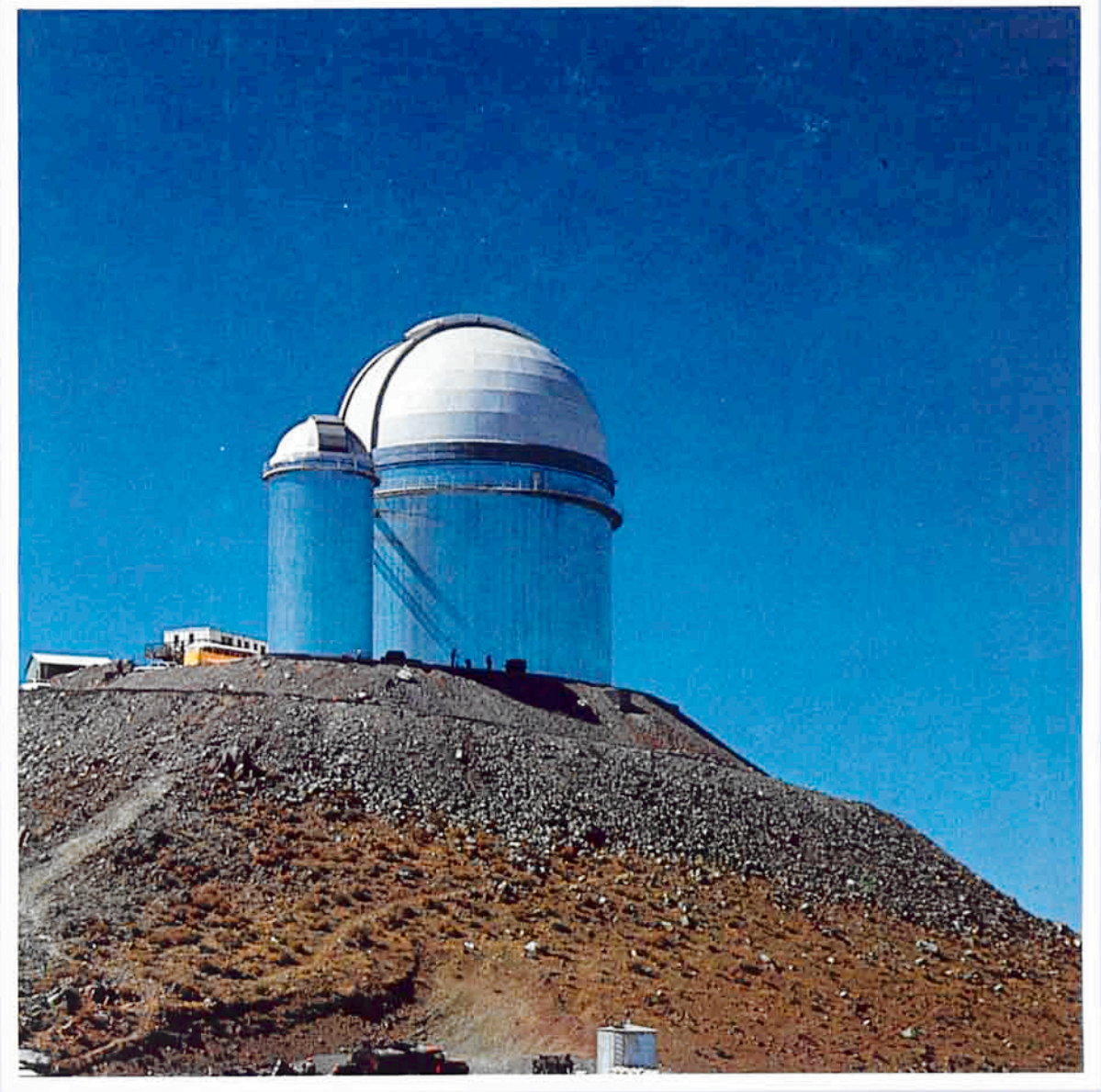
ANNUAL REPORT 1975



EUROPEAN SOUTHERN OBSERVATORY

Cover Photograph:

The 3.6 m telescope building with the tower for the coude auxiliary telescope on the highest top of La Silla.

At the end of 1975, the construction work on the 3.6 m telescope building was in its final stages, while at the same time, in Europe, the pre-assembly and testing of the instrument had come to an end. The installation of the telescope is expected to begin during the spring of 1976.

ANNUAL REPORT 1975

presented to the Council
by the Director-General, Prof. Dr. L. Woltjer

Organisation Européenne pour des
Recherches Astronomiques dans l'Hémisphère Austral

EUROPEAN SOUTHERN OBSERVATORY

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INTRODUCTION

During 1975, the main project of ESO in Europe came to a successful conclusion. The 3.6 metre telescope—for so many years the centre-piece of all work in ESO—was assembled and tested with very encouraging results. By the end of the year, the preparations for shipment to Chile were making good progress and all plans were ready for a speedy installation in the following year.

Far-reaching decisions were taken by the ESO Council: The offer of the German Federal Republic to provide ESO with a site and buildings for its headquarters in Garching near Munich was accepted. The construction will take some time, but it is expected that late in 1979 all ESO activities in Europe will be concentrated in Garching. In addition, it was decided that ESO should have a scientific-technical centre in Europe—located in Geneva until the buildings in Garching are completed—to insure optimum use of the La Silla observatory and to promote cooperation in astronomy in Europe.

In Chile, the dispersion of ESO facilities made an efficient operation of the La Silla observatory difficult. To improve the situation, it was decided to shift the centre of ESO activities from Santiago to La Silla. By the end of the year, most technical services had already left Santiago for the mountain, while a regular plane service from Santiago to Pelícano solved the related logistics problems. During all of these changes, astronomical work on La Silla proceeded without interruption: The Quick Blue Survey with the Schmidt telescope passed the half-way mark and observations of a great variety of astronomical objects were made by visiting astronomers from institutes in the ESO member countries als well as by staff astronomers from ESO in Europe and in Chile.

At La Silla the construction programme made good progress. The building for the 3.6 m telescope was nearing completion, while that for the 1.5 m Danish telescope was ready for the telescope installation, foreseen for the next year.

RESEARCH ACTIVITIES

Telescope Use

Requests for telescope time by visiting astronomers greatly exceeded the time available. During the period April 1, 1975 to April 1, 1976, 609 nights were requested for the 1.52 m telescope, of which only 238 could be granted. For the 1 m telescope, the corresponding figures are: requested: 509, granted: 233.5. ESO staff astronomers received 128 nights with the 1.52 m and 132.5 nights with the 1 m telescopes for research and maintenance. A complete log of the telescope use is presented in Tables 1–6. For the Bochum and the Danish telescopes, only the time used by ESO staff and visiting astronomers is listed.

The Schmidt telescope was extensively used during the year to take plates for the Quick Blue Survey and also for some other programmes.

Table 1

Use of the 1.52 m telescope during 1975

Period	Observer	Institute	Programme	Equipment
January 1–7	Dravins	Lund	Stellar chromospheres	Coudé
January 7–12	Dennefeld *et al.*	CNRS, Paris	Transparency of rings of Saturn	Special
January 12–19	Danziger	ESO	Supernova remnants	B&C
January 19–25	Spite, M.	ESO	Metal-deficient stars	Coudé
Jan. 25–Feb. 1	de Loore	Brussels	X-ray sources and peculiar A stars	Coudé
February 1–9	Spite/Breysacher	ESO	Metal-deficient stars, rotation in clusters	Echelec
February 9–11	Vogt	ESO	Eclipsing binary HD 52942	Coudé
February 11–13	Havlen	ESO	Classification of blue stars in Puppis	B&C
February 13–21	Hunger	Berlin	Helium stars	Coudé
February 21–26	Grewing	Bonn	Interstellar absorption lines	Coudé
February 26–27	de Graauw *et al.*	Utrecht	Infrared heterodyne detection	Special
Feb. 27–March 2	Grewing	Bonn	Interstellar absorption lines	Coudé
March 2–4	de Graauw *et al.*	Utrecht	Infrared heterodyne detection	Special
March 4–6	Wood	ESO	Southern magnetic stars	Zeeman
March 6–10	de Graauw *et al.*	Utrecht	Infrared heterodyne detection	Special
March 10–11	Wood	ESO	Southern magnetic stars	Zeeman
March 11–13	Westerlund	ESO	Photography: radio sources, galaxies and LMC clusters	Zeiss camera
March 13–19	Dossin	Liège	Planetary nebulae	Coudé
March 19–26	Solf	Heidelberg	Emission and absorption lines in long-period variables	Coudé
March 26–30	Wolf	ESO	A and B supergiants in Magellanic Clouds	Coudé
March 30–April 11	Ilovaisky	Paris	Southern X-ray sources	B&C
April 11–16	Danziger	ESO	Supernova remnants	B&C
April 16–19	de Groot, Smith	ESO	Tests	Zeiss camera, RV Cass
April 19–26	Vreux	Liège	Spectrophotometry of Of Stars	Coudé
April 26–30	Wood	ESO	Magnetic stars	Zeeman
April 30–May 4	Spite, F.	ESO	Metal-deficient stars, rotation standards	Coudé
May 4–9	de Groot	ESO	Spectroscopic binaries	Coudé
May 9–17	Dossin	Liège	Southern planetary nebulae	Coudé
May 17–18	de Groot	ESO	Spectroscopic binaries	Coudé
May 18–19	Rickard	ESO	Tests of Carnegie image-tube camera	Echelec
May 19–23	de Groot	ESO	Spectroscopic binaries	Coudé
May 23–27	Rahe	Bamberg	Eclipsing binaries	Coudé
May 27–June 8	Hensberge	Amsterdam	X-ray sources	Coudé
June 8–9	de Groot/Westerlund	ESO	Spectroscopic binaries	Coudé
June 9–11	Westerlund	ESO	B pec. stars, carbon stars	Coudé, B&C
June 11–14	Havlen	ESO	Stars in Anon (17^h–38°) and NGC 6193, cluster galaxies	B&C
June 14–18	Wood	ESO	Southern magnetic stars	Zeeman

Period	Observer	Institute	Programme	Equipment
June 18–July 6	Maitzen/Moffat/Schmidt-Kaler	Bochum	RV of clusters and distant luminous stars	RV Cass
July 6–24	Schnur	Heidelberg	Radial velocities of OB stars in Norma	B&C
July 24–Aug. 1	Wamsteker	ESO	Infrared photometry	IR
August 1–5	Schnur	Heidelberg	Radial velocities of OB stars in Norma	B&C
August 5–13	Terzan	Lyon	UBV photometry in globular clusters	Zeiss camera
August 13–18	Wolf	ESO	A and B supergiants	Coudé
August 18–28	Chu-Kit	Marseille	Interstellar Ca in O-B stars	Coudé
Aug. 28–Sept. 1	Wolf	ESO	A and B supergiants	Coudé
September 1–6	Westerlund	ESO	Galaxies, blue stars in SMC	B&C
September 6–12	West	ESO	ESO/Uppsala galaxies	Zeiss camera, B&C
September 12–26	Andersen	Copenhagen	Radial velocities of bright stars	Coudé
September 26–30	Breysacher	ESO	Wolf-Rayet stars in Magellanic Clouds	Echelec
Sept. 30–Oct. 5	Crane	ESO	Search for ionized gas in groups of galaxies	Special
October 5–15	Divan *et al.*	Paris	Supergiants in SMC and galactic O stars	Special
October 15–20	Wolf	ESO	A and B supergiants in Magellanic Clouds	Echelec
October 20–22	Breysacher	ESO	Wolf-Rayet stars in Magellanic Clouds	Echelec
October 22–30	Reimers	Kiel	Mass loss from red giants	Coudé
Oct. 30–Nov. 8	van Paradijs	Amsterdam	Candidates for southern X-ray sources	B&C
November 8–13	Breysacher	ESO	Wolf-Rayet stars in Magellanic Clouds	Echelec
November 13–24	Muratorio	Marseille	Emission stars in Magellanic Clouds	Coudé
Nov. 24–Dec. 1	Havlen	ESO	Clusters of galaxies	B&C
December 1–10	Westerlund	ESO	Red stars in Magellanic Clouds	B&C
December 10–21	Dravins	Lund	Stellar granulation	Coudé
Dec. 21–Jan. 1	Maitzen	Bochum	Radial velocity of distant stars	RV Cass

Table 2

Use of the 1 m telescope during 1975

Period	Observer	Institute	Programme	Equipment
January 1–3	Smith	ESO	Tests and aluminizing	Zeiss camera
January 3–4	Materne	Hamburg	Photometry of pre-main-sequence stars	Standard
January 4–13	Havlen	ESO	Hβ photometry of Puppis OB stars	Standard
January 13–20	Haug	Hamburg	Study of galactic absorption in Vela	Standard
January 20–22	Smith	ESO	Tests	B&C
January 22–26	Haug	Hamburg	Study of galactic absorption in Vela	Standard
January 26–31	Rakos	Vienna	Photometry of Sirius B and visual binaries	Area scanner
Jan. 31–Feb. 3	Wood	ESO	Ap stars	Spectrum scanner
February 3–9	Vogt	ESO	Eruptive variables	Standard and B&C
February 9–11	Havlen	ESO	Classification spectra of blue stars	B&C
February 11–18	Alcaíno	Santiago	Photoelectric sequences of globular clusters	Standard
Feb. 18–March 3	Stenholm	Lund	Scintillations, open clusters, stars	Standard
March 3–11	Westerlund	ESO	Photometry in Crux, radio sources	Standard
March 11–12	Smith	ESO	Tests	B&C
March 12–22	Swings	Liège	Emission-line objects with IR excess	B&C
March 22–30	Lindblad	Stockholm	Local system of stars	Standard
March 30–April 11	Chevalier	Paris	UBV photometry of X-ray sources	Standard
April 11–16	Blaauw	ESO	Hβ photometry in McCormick fields	Standard
April 16–21	Johansson	Uppsala	Stars in suspected open clusters	Standard
April 21–May 1	Andriesse	Roden	Infrared mapping of M 17	Special
May 1–6	Wamsteker	ESO	IR photometry	Special
May 6–10	Vogt	ESO	Eruptive variables	B&C
May 10–19	Manfroid	Liège	Southern gaseous nebulae	B&C
May 19–21	Wood	ESO	Southern magnetic stars	Spectrum scanner
May 21–23	Vogt and others	ESO	Tests	Spectrum scanner
May 23–26	Rickard	ESO	Tests of silicon vidicon	
May 26–29	Havlen/de Jonge/Smith	ESO	Tests of various equipment	
May 29–June 10	Lyngå	Lund	Distant stars in Circinus	Standard
June 10–16	Alcaíno	Santiago	Photoelectric sequences of globular clusters	Standard
June 16–22	Lodén	Stockholm	Local system of stars	Standard
June 22–26	Rickard	ESO	Tests of silicon vidicon	
June 26–July 3	Westerlund	ESO	Carbon stars in SMC, NGC 6611, emission-line objects	B&C
July 3–8	Havlen	ESO	UBV of young clusters, galaxies of Calan 129 group	Standard
July 8–10	Alcaíno	Santiago	Photoelectric sequences of globular clusters	Standard
July 10–15	Garnier	ESO	UBV photometry	Standard
July 15–18	Westerlund	ESO	Galactic clusters, radio sources	Standard
July 18–22	Garnier	ESO	UBV photometry	Standard

Period	Observer	Institute	Programme	Equipment
July 22–Aug. 4	Bernard	Lyon	UBV photometry of globular clusters	Standard
August 4–9	Garnier	ESO	UBV photometry	Standard
August 9–27	Schultz	Bonn	Infrared observations	Special
Aug. 27–Sept. 1	Wamsteker	ESO	IR photometry	Special
September 1–11	Wlérick	Meudon	Variable radio sources	Standard
September 11–16	Garnier	ESO	UBV photometry of QSO	Standard
September 16–20	Thé	Amsterdam	M dwarfs and the missing mass	Standard
September 20–25	Dürbeck	Hoher List	Southern W UMa systems	B&C
Sept. 25–Oct. 1	Wamsteker	ESO	Infrared photometry	IR
October 1–5	Garnier	ESO	UBV photometry	Standard
October 5–13	Ardeberg/Bergvall	Lund	Galaxies (UBV), 47 Tuc (uvby)	Standard
October.13–22	Staller	Amsterdam	M dwarfs near South Galactic Pole	Standard
Oct. 22–Nov. 1	Metz	Munich	Simultaneous observations of SX Phe	Polarimeter
November 1–13	Mianes	Lyon	Red photometry of 220 stars	Standard
November 13–20	Wamsteker	ESO	Infrared photometry	IR
Nov. 20–Dec. 1	Westerlund/Olander	ESO/Uppsala	IRV of carbon and M stars in LMC	Standard
December 1–11	Havlen	ESO	Clusters of galaxies	Standard
December 11–12	Wamsteker	ESO	Blue stars at high galactic latitude	B&C
December 12–20	Schnur	Heidelberg	O and B stars	B&C
Dec. 20–Jan. 1	Vogt	ESO	Eruptive variables	Standard

Table 3

Use of the ESO 50 cm telescope during 1975

Period	Observer	Institute	Programme
January 1–3	Elst	Brussels	Light variation of AI Velorum
January 3–13	Dennefeld	CNRS, Paris	Transparency of rings of Saturn
January 13–21	Hensberge	Antwerp	uvby photometry
January 21–25	Rakos	Vienna	Visual binaries
Jan. 25–Feb. 1	Hensberge	Antwerp	uvby photometry
February 1–24	Haug	Hamburg	UBV for B stars in Vela
Feb. 24–March 1	ESO staff		
March 1–21	Johansson	Uppsala	Galactic structure
March 21–27	ESO staff		Maintenance
March 27–April 1	Vogt	ESO	Eruptive variables
April 1–5	Garnier	ESO	Hβ photometry in Crux
April 5–16	Johansson	Uppsala	Stars in suspected open clusters
April 16–25	Blaauw	ESO	Hβ photometry in McCormick fields
April 25–29	Vogt	ESO	Eruptive variables
April 29–May 20	Rahe	Bamberg	Eclipsing binaries
May 20–26	Spite	ESO	Halo stars in red and infrared
May 26–29	Vogt	ESO	Ap stars
May 29–June 2	ESO staff		
June 2–10	Lodén	Stockholm	Local system of stars
June 10–20	Henriksson	Uppsala	Eclipsing binaries
June 20–July 4	ESO staff		
July 4–10	Garnier	ESO	Hβ photometry
July 10–26	Elst	Brussels	UBV photometry of RRs and standard stars
July 26–Aug. 5	Walter/Dürbeck	Tübingen/Hoher List	Southern W UMa systems
August 5–11	Smith	ESO	N galaxies, QSO sequences
Aug. 11–Sept. 23	Walter/Dürbeck	Tübingen/Hoher List	Algol systems, W UMa systems
Sept. 23–Oct. 2	Vogt/Wamsteker	ESO	Ap stars, Asteroid "44 Nussa"
October 2–9	de Groot	ESO	Standard stars
October 9–22	ESO staff		Maintenance
Oct. 22–Nov. 3	Häfner	Munich	Simultaneous photometry of SX Phe
November 3–20	Hoffmann	Hoher List	Search for BY Dra variables
November 20–26	ESO staff		
Nov. 26–Dec. 5	Vogt/Faúndez	ESO	Intermediate-band photometry of Ap stars
Dec. 5–14	Heck	Liège	uvby and Hβ photometry
Dec. 14–19	ESO staff		Maintenance
Dec. 19–Jan. 1	Heck	Liège	uvby and Hβ photometry

Table 4

Use of the Objective Prism Astrograph during 1975

Period	Observer	Institute	Programme
January 6–21	Vega/Havlen	ESO	Puppis OB stars
April 1–30	Vega/Westerlund	ESO	Crux
May 4–18	Vega/Westerlund	ESO	Crux, Centaurus
Oct. 24–Nov. 13	Azzopardi	Toulouse	Spectrophotometric study of the SMC

Table 5

ESO use of the Bochum 61 cm telescope during 1975

Period	Observer	Institute	Programme
Jan. 1–Feb. 1	Särg	Lund	UBVRI photometry of M giants
July 16–Aug. 1	Smith	ESO	UBV sequences for radio sources
August 1–26	Wargau	Bamberg	KZ Pav, YY Ceti, V 2617 Sgr
Aug. 26–Sept. 15	Thé	Amsterdam	M dwarfs and the missing mass
Sept. 15–Oct. 1	Oblak	Besançon	uvby and $H\beta$ photometry
October 1–13	Staller	Amsterdam	M dwarfs near the South Galactic Pole
October 13–18	Ardeberg	Lund	uvby and VRI photometry
October 18–22	Staller	Amsterdam	M dwarfs near the South Galactic Pole
Oct. 22–Nov. 3	Ardeberg	Lund	uvby and VRI photometry
November 3–10	Staller	Amsterdam	M dwarfs near the South Galactic Pole
November 10–30	de Groot	ESO	Spectroscopic binaries
December 1–2	Olander	Uppsala	Red stars in LMC
December 2–15	Lohsen	Hamburg	Eclipsing binaries

Blaauw and Degewij performed uvby and Hβ photometry of the F stars in the McCormick fields programme. They were used to check the amount of interstellar reddening in the direction of the north galactic polar cap for which photometry in the uvby system had been done. The suspicion that interstellar reddening is very small in these directions was confirmed, and this strengthened conclusions provisionally drawn from the photometry with regard to the density distribution of F stars of different metal abundances in the direction perpendicular to the galactic plane.

The first part of the McCormick programme of Blaauw, Tolbert und West has now been completed. Observations have been obtained in uvby for about 1,000 stars, mostly between 10^m and 12^m. Radial velocities of a number of faint F stars have also been measured.

Särg carried out UBVRI photometry of late-type giants at high and intermediate galactic latitudes at the Bochum telescope.

Thé and Staller continued their observations of M dwarfs for their study on the missing mass in the solar neighbourhood.

Plaut continued his observations in the Palomar-Groningen variable-star survey. The faint RR Lyrae observed in field 3 of this survey seem to confirm the results published in AA Suppl. **12**, 351, 1973. The observations of the fainter stars in Baade's galactic windows in Sagittarius seem not to be accurate enough to yield reliable magnitudes. The reason for this is most likely the very high density of faint background stars, which prohibit an accurate determination of the sky background.

Mermilliod obtained 300 measurements in the Geneva 7-colour photometric system for 130 stars (to the 12th mag) in the open cluster NGC 2516, together with bright field stars and standards.

Olsen conducted several uvby photometric programmes on the 50 cm Danish telescope. There are 941 stars in the AGK2 zones $-0°$, $-1°$ and $-2°$ brighter than $8^m.5$. In collaboration with B. Strömgren, J. V. Clausen and E. E. Mendoza, it is planned to analyse uvby photometry and MK spectral types for this unbiased sample of all spectral types. Olsen made about 800 observations for this programme, which is now 68 % complete. Also about 200 observations of components of visual binary systems were made in order to determine accurate individual absolute magnitudes for post-main-sequence stars, and 60 observations of FK4 stars, to be used by P. Grosbøl in his investigation of spiral structure.

Oblak measured 180 multiple stars in the uvby Hβ system at the 60 cm Bochum telescope. The results will be used in a study of different calibrations of absolute magnitudes and dereddening formulae and also of the ages, masses and chemical composition of the components.

Haug observed in UBV and Hβ 300 B stars in Vela ($l = 265°$) to study the interstellar absorption. He found a remarkably small and uniform absorption of 0.3 mag per kpc to distances of about 0.8 kpc.

Lyngå observed in the Strömgren system distant stars in Circinus.
Together with Wramdemark, he measured Schmidt plates in relation to a programme on the luminosity function for the Carinae arm.

Oyen continued the UBV photometry for the new provisional catalogue of O und B stars in Circinus. For the same catalogue, objective-prism plates were obtained at the GPO for the determination of radial velocities and spectral types.

In a joint programme with Schmidt-Kaler and Moffat, Maitzen obtained about 140 spectrograms with the RV Cass spectrograph of stars in 20 distant galactic clusters ($d > 1$ kpc), most of them only recently measured by Moffat and Vogt. A number of distant southern luminous stars was also included in the list. The mean internal error per plate in radial velocity is about 7 km/sec when about 10–15 lines (mostly H and He) contribute to the mean. Standard RV stars were also measured and mean internal errors of 2–4 km/sec obtained.

Andersen obtained spectrograms for two radial-velocity programmes. The first of these, with P. Grosbøl, comprises about 250 selected B8–A0 stars, mostly in the Bright Star Catalogue, which will be used in an investigation of the galactic spiral structure. The second programme, with B. Nordström, will complete the kinematic data for the B, A and early F stars in the Bright Star Catalogue. The programme contains about 450 stars. During the detailed quality inspection and cross-checking already carried out, more than 50 new peculiar stars of various types have been found.

Mrs. Amieux continued her observations of the open clusters Cr 135, IC 2395, NGC 2287, NGC 2516, NGC 3114 and NGC 3532. A sample of A and B stars centred at NGC 3114 shows two different radial velocities and thus permits the separation of field stars from the cluster stars.

Interstellar Matter

Danks, Houziaux and Manfroid have continued the spectrographic study of southern H II regions. Numerous lines were identified and measured in RCW 61, 62, 65, 71, 99, 107, 113 and 131, allowing them to derive information on the temperature, density, excitation and abundances of these objects, as well as on the structure of ionization fronts.

Dossin obtained new spectra for the long-range programme on planetary nebulae. The spectra are being analysed by Mrs. Acker in Strasbourg and Gleizes at Montpellier.

Some high-dispersion spectra obtained by Breysacher with the Echelec spectrograph have confirmed the existence of components in the strong interstellar calcium lines in OB stars near η Carinae. Further studies are being undertaken.

Danziger and Dennefeld undertook extensive studies of supernova remnants in the Magellanic Clouds and in our galaxy. Interesting effects related to the chemical composition of the interstellar matter in the Clouds were observed. Possible identification with X-ray sources were made.

Globular Clusters

Bernard observed globular clusters situated in the direction of the galactic centre and established UBV sequences around the globular clusters NGC 6256, 6304 and 6638. Integrated UBV magnitudes were determined of the clusters NGC 4590, 6256, 6304, 6401 and 6638 and the absorption in the direction of these clusters was estimated.

Alcaíno obtained photoelectric UBV sequences for the southern globular clusters NGC 362, 1851, 1904, 3201, 4590, 5927, 5986, 6266, 6397, 6656 and 7099. In each cluster 18 stars in the magnitude range $10 < V < 16.5$ were measured an average of three times.

Terzan continued his observations on globular clusters with the 1.52 m telescope for the detection of RR Lyrae stars with very short periods.

A possible quite distant globular cluster was discovered by Schuster and West on the Schmidt QBS plates.

Infrared Observations

Andriesse observed M 17 in four infrared colours.

Kreysa and Schultz continued their infrared observations. Eight of the eleven highly reddened IRC objects could be found and measured at 3.8 μ and two of the most intense at 11 μ. At 10 μ, a sensitivity ten times better than in earlier runs was reached. The search for infrared counterparts of OH sources resulted in 14 IR stars found to coincide closely with OH-line-emission sources. Day-time operation could be performed at 3.8 μ as well as at 11 μ.

A number of peculiar southern emission galaxies were observed in the infrared by Wamsteker. Studies of the infrared counterparts of molecular sources and of sources discovered in the AFCRL infrared rocket sky survey were begun.

Van Bueren, de Graauw and van de Stadt continued their experiments on heterodyne spectrometry. Observations were carried out of the Moon, Mercury, Mars and Venus and of η Car and W Hya. Results at different CO_2 laser transitions were compared with known stellar broadband fluxes and known temperatures of planets.

The Magellanic Clouds

Azzopardi observed three fields in the direction of the Bar and the globular clusters NGC 456, 460 and 465 of the Small Magellanic Cloud. 16 plates were obtained with an interference filter centred at $\lambda = 4370$ Å. The measurement of the equivalent width of Hγ of about 250 members ($V \leqq 14.0$) should permit a fair determination of the distance modulus.

Mianes observed in the Strömgren system 76 faint blue supergiants in the Large Magellanic Cloud at the Danish 50 cm telescope. He also measured 300 red stars in R and I in the Large Magellanic Cloud for the calibration of red plates taken at the GPO telescope.

Westerlund and Garnier completed their studies of faint blue stars in the wing of the SMC and of stars in the N 55 association in the LMC.

Westerlund, in collaboration with Richer (Vancouver) and Olander (Uppsala), obtained VRI photometry and also some spectra for a large number of carbon stars in the LMC. A study of M supergiants is also undertaken.

Breysacher and Westerlund observed WR stars in both Clouds with the Echelec spectrograph in order to determine the frequency of binaries.

Galaxies

Appenzeller and Fricke used a test plate (obtained by Schuster) to investigate the possibility of identifying Seyfert galaxies and QSOs on unwidened objective-prism plates taken with the ESO Schmidt telescope. A first inspection of the plate shows that such objects can indeed be identified easily on these plates from the characteristic pattern of their emission lines.

Garnier, Westerlund and Wlérick are carrying out a photometric study of quasars and N galaxies to analyse their variability.

A variety of objects were studied on the Schmidt plates of the Quick Blue Survey. Lauberts at Uppsala continued the systematic search of the plates while Blaauw, Danziger, Dennefeld, Havlen, Schuster and West found a number of interesting special objects.

Schuster and Westerlund obtained revised descriptions for the majority of 102 objects missing in the Revised NGC.

West observed 30 galaxies from the ESO/Uppsala lists at Las Campanas and at La Silla. Seven of these had emission lines.

Havlen and Quintana began a spectroscopic and photometric study of clusters of galaxies with possible X-ray emission. The double cluster CA 129-1 ist also being observed.

Tammann worked with A. Sandage (Pasadena) on the redshifts in the Virgo cluster. Contrary to earlier claims, there appears to be no dependence of the redshifts on galaxian type. Within six degrees from the centre, the mean redshift corresponds to a recession velocity of $1{,}100 \pm 68$ km/sec. They also continued their work on the extragalactic distance scale. Preliminary results indicate that the correlation between 21-cm line width and luminosity, recently discovered by Fisher and Tully, agrees well with a Hubble constant of 55 $km/sec^{-1}/Mpc^{-1}$.

X-ray Sources

In a joint programme of Chevalier and Ilovaisky, photometric data obtained at the 1 m telescope yielded simultaneous X-ray and optical observations of Sco X-1 and of Cen X-3. A close correlation was found between the well-known-flickering activity of Sco-1 and its X-ray flux. A search was made for an optical counterpart for the transient X-ray source A 1118-61 and a possible candidate was found. Spectroscopic observations at the 1.5 m were made simultaneously. X-ray observations with the Copernicus satellite were made possible by their participation in the guest observer programme managed by the Mullard Space Science Laboratory, University College London. Reductions are well in progress.

In a joint programme, de Loore, Hammerschlag, Hensberge, van den Heuvel and Zuiderwijk continued their search for optical candidates of X-ray sources. uvby photometry of Wray 977 as candidate for the X-ray source 3U 1223-62 resulted in the discovery of a clear 23-day periodic variation, which makes the identification of this star with the X-ray source very probable.

Radial-velocity measurements from coudé spectra of the optical companion HD 77581 (BO.5Ia) of the pulsating X-ray source 3U 0900-40 were used to accurately determine the mass of both the BO.5Ia supergiant and the neutron star in this system (21.2 $M_\odot$ and 1.61 $M_\odot$ respectively). Radial-velocity data for this star were also obtained by Dachs. Comparison of 1975 coudé spectrograms of the peculiar A supergiant CD-33°12119, candidate for the X-ray source 3U 1727-33, with spectrograms from 1974 revealed large radial-velocity variations. Identification of this star with the X-ray source is very likely.

Mauder obtained UBV photometry for Cen X-3 and WRA 977.

Dachs measured the Hα emission line strength of the Of primary in the X-ray binary HD 153919. Quasi-regular variations with the orbital period of the companion were found.

Dürbeck obtained UBV photometry of the optical counterpart of the transient X-ray source A 0620-00. A decrease in brightness of $0\overset{m}{.}5$ was observed over one month. Superimposed are sinosoidal variations with an amplitude of $0\overset{m}{.}07$ and a period of 3.92 days.

Binaries

Olsen obtained 200 uvby observations of 17 new double-lined spectroscopic binaries discovered by Andersen. Four new eclipsing systems were found.

Rahe took spectra of YZ Cha and DZ Mus for the derivation of their absolute dimensions. He made photoelectric observations of the eclipsing binaries BV 549 Sco, RV Crt and GG Vel which show pronounced period changes. For RV Crt, new elements could be derived. For BV 549 Sco, photoelectric and spectroscopic observations also yielded new elements.

Gieseking obtained with the GPO a series of objective-prism plates. This test series yielded the development of a new measuring and reduction method for the determination of relative radial velocities with the Fehrenbach prism. This method permits radial velocities to be measured with a mean error of the order of ± 8 km/sec for spectral types A and B and ± 4.5 km/sec for late spectral types. The radial-velocity curves of the eclipsing binaries RW CrA and BD −19°5170 were studied, the latter being a new one, discovered during the tests.

Henriksson carried out photometry with the ESO and the Danish 50 cm telescopes on the eclipsing binaries V 805 Aql, HR 6611, GY Tel, V 676 Cen and DV Aqr. As spectrometric orbits exist for V 805 Aql and HR 6611, it will be possible to determine absolute parameters.

For the Bamberg-Period-Checking Programme, Wargau observed the light-curves of KZ Pav, V 2617 and YY Cet. Due to poor weather conditions, only the light-curve of YY Cet could be completed.

Lohsen continued his observations of the eclipsing binaries in the Orion Trapezium. A minimum of ϑ^1Ori A occurred as predicted. BM Ori and BD 16°516 were also observed.

Vogt and Grønbech carried out an analysis of the eclipsing binary FZ CMa. The parameters of the system were obtained. The rotation of the components is faster than expected for the case of synchronous rotation.

Walter, in collaboration with Dürbeck, continued the search for Algol systems with gas streams at the 50 cm telescope, observing X Gru and V 505 Sgr.

Dürbeck observed together with Walter on the 50 cm telescope the W UMa systems ST Ind, RV Gru and AE Phe to study variations in the light-curves. With the B&C spectrograph he obtained 29 spectrograms at the 1 m telescope of the W UMa star AE Phe, covering a complete period of revolution. The star is a double-line spectroscopic binary with well-separated spectral systems.

Smith observed at La Silla and at Las Campanas a star identified by Wall and Cannon as coincident with the radio source PKS 1925-524. The star is a possible W UMa system with a period of 0.59064 day and a B amplitude of 0.370 magnitude.

Sterken analysed the uvby measurements of σ Sco carried out in 1972. The main period of this β CMa star increases again with respect to Van Hoof's 1962–65 values. During the time the star has been observed (1914–72), the period variation can well be described by a period of 23.2 years with an amplitude of 0.7 second.

In a joint programme by Jerzykiewicz, Sterken and Vogt an investigation was started on the behaviour of 79 southern early B stars brighter than $6^m.5$ which occupy the same area in the HR diagram as the presently known β Cep stars. It is hoped to increase the number of known β Cep stars and to improve the statistics of this type of stellar variability.

Metz and Häfner carried out simultaneous photometry and polarimetry of SX Phe and γ^2 Vel.

Marchal and Schneider have developed a complete reduction programme for the intensity conversion and the wavelength calibration of spectra. This programme was tested on spectra of the cepheids η Aql, χ Pav, S Nor, U Sgr and AX Cir, taken with large dispersion, and the data obtained simultaneously from UBV photometry. They studied differential velocities in the atmospheres of cepheids, using close multiplets at different depths with special filter combinations.

Solf observed a sample of 26 long-period M-type variables near maximum light and another 20 M-type stars at 12 Å/mm in the blue spectral region. Differential radial velocities will be derived for various groups of emission and absorption lines.

Photometry of extreme B- and A-type galactic supergiants by Sterken shows that short-period variations are definitely present in HD 160529. Most of the observed stars are variable with amplitudes up to 0.02 magnitude in V over medium-time scales (several days). Furthermore, the yearly mean values of 1973 and 1974 for each of the objects show that also annual variations with probably higher amplitudes are present. Monitoring of these stars will be continued. The inferred periods indicate that a pulsational mechanism is probably present. The periods increase with luminosity.

Hoffmann observed 13 dM and dMe stars in a photometric search for BY Dra variables. On-line reductions indicate that at least one of the observed stars is variable.

Mauder performed UBV photometry of quasi-periodic T Tauri stars in the Chamaeleon T association. He found that SY Cha, TW Cha and VZ Cha have very probably extremely low masses of much less than 0.5 solar mass.

uvby and Hβ photometry of field stars has been carried out by Heck and Manfroid on the Danish 50 cm telescope. Variability has been found in the uvby colours of some Ap, Be and Of stars.

J.P. Swings and Klutz have analysed the spectra of RX Puppis obtained at La Silla in 1972 and 1975, as well as one plate of the same object taken with the Palomar 200-inch telescope in 1972. The spectrograms show essentially emission lines of H (with P Cygni structure variable from night to night), O I, [O I], Ca II, [Ca II], Fe II and [Fe II]. The high excitation lines typical of a true symbiotic star that were reported by P. Swings and Struve in 1941 are now either absent or extremely weak, except for [Fe X] which was possibly present in 1972. It is suggested that RX Pup may be a nova-like or peculiar emission-line object exhibiting similarities to η Carinae.

Vogt continued his observations of eruptive variables. BV Cen was found to be a spectroscopic binary with a period of about 0.61 day; radial-velocity curves and light-curves were obtained. QU Car was observed simultaneously (with Smith) at Las Campanas and at La Silla to obtain photometric and spectroscopic data. With D. Contes, W. Krzeminski and C. Sterken an analysis of many years of observations of EX Hya is carried out.

Wolf and Dürbeck observed Nova Cygni with the 1.5 m telescope and the coudé spectrograph (12 Å/mm) during the first three nights following discovery. While the pre-maximum spectrum reveals only faint, shallow, blue-displaced absorption lines of H, He and a few other elements, emission lines appear in the second night (maximum), which increase in strength in the third night.

Identifications in the spectra of Nova Dor 1971 were made by de Groot.

Stellar Atmospheres and Compositions

A search for new magnetic stars was made by Wood.

In a joint programme with Hensberge, Zuiderwijk and Hammerschlag, de Loore obtained in a photometric programme the possible periods of the Ap stars HD 63401, 92664 and 81009.

In a joint programme of Groote, Haug and Hunger, observations of the spectrum-variable intermediate helium star σ Ori E were carried out simultaneously with the 1.52 m and 1 m telescopes. 20-Å/mm spectrograms and UBV colours were obtained.

Dachs with Modlinski performed a coarse analysis of the extremely peculiar Ap (Si, Ti, Sr, Eu) star HD 66318 in the open cluster NGC 2516. Indications for variability of the spectrum were found.

Vogt with M. Faúndez and H. M. Maitzen obtained uvby g_1 g_2 photometry for Ap stars and normal stars. The combination y g_1 g_2 is particularly suitable to measure the continuum depression at 5200 Å typical for Ap stars. Even marginal peculiarity can be identified.

About 30 uvby observations of G dwarfs by Olsen have been used by O. Melson in his thesis, to calibrate δ_{m1} values in terms of [Fe/H] ratios.

Hultqvist obtained spectra of F, G and K supergiants for his study on abundances. For the F and G stars, upper limits of the lithium to calcium abundances have been determined. The Ia stars show upper limits only slightly lower than the primordial abundance, and no conclusion about possible reduction of the Li abundance can be drawn. On the other hand, the Ib stars show substantial evidence for reduction of Li since stellar formation. Observational evidence from other sources suggests that mass loss during the main-sequence and blue-supergiant phases is likely to reduce the Li abundance for the Ia stars. For Ib stars, mass loss is more unlikely to be effective in reducing Li. The convective dilution of Li during a previous stage in the red region is probably the cause of the low abundance of Li in Ib stars.

Spectra of the peculiar Be stars with IR excess, GG Carinae, HD 87643 and CD −52°9243, obtained by J. P. Swings with the B&C image-tube spectrograph are presently being analysed in collaboration with M. Klutz.

Wolf obtained for Campusano sixteen coudé spectra of a number of A and B supergiants for the study of their chromospheres. Hα emission was found in HD 62623 and HD 154090. The former presents also a P-Cygni profile in Hβ and faint iron-emission lines.

Dravins obtained spectra of 90 F0 to G9 stars for his investigation on chromospheric emission in the Ca II H and K lines. Calibrated emission-line profiles have been obtained and equivalent widths measured. It has been found that, although the equivalent widths of K-line emission are much smaller in F than in G stars, the absolute chromosphere energy fluxes do not markedly change between F and G stars. The δ Sct-type variable ϱ Pup was followed simultaneously with the spectrographic and photometric telescopes. In the analysis (jointly with J. Lind and K. Särg), a transient chromosphere emission has been detected.

In his study on stellar granulation, coudé spectrograms of exceptionally high quality have been obtained of eight stars, mostly of spectral types F and G, using the new Jobin-Yvon holographic diffraction grating which, in a single-pass mode, eliminates all grating ghosts and drastically reduces the level of diffuse scattered light. The aim is to study convection cells in stellar photospheres through spectral-line asymmetries and

differential wavelength shifts, analogous to those caused by solar granulation in the solar spectrum.

Reimers took UV and red spectra of HR 3126, 3153 and 3120 which are members of the young galactic cluster NGC 2516. HR 3126, which is surrounded by the massive reflection nebula IC 2220, shows a marked circumstellar spectrum. The rate of mass loss is $\approx 10^{-7}$ M$_\odot$/a (for HR 3153: $3 \cdot 10^{-8}$). Therefore, the origin of IC 2220 cannot be connected with the present mass-loss phase.

Spectra have also been obtained, mostly in UV, of the stars R Dor, T Cet, ε Oct, δ^2 Gru, γ Ret, 62 Sgr, γ Phe, π Pup, α Ori, λ Vel, γ Cru, β Gru, γ Phe and β Ara. Some further standard stars have been observed in order to tie the absolute magnitudes from the Wilson-Bappu effect to the system of O. C. Wilson.

Dachs determined He I and He II line strengths quantitatively from 12- and 20-Å/mm coudé spectra for the O3V stars in η Car.

In a joint programme with Andrillat, Fehrenbach and P. Swings, Vreux continued the observations on Of stars.

Van Paradijs observed G, K and M giants at the coudé of the 1.52 m telescope on near-infrared (I-N) and yellow (IIa-D) plates. Line-blocking coefficients have been measured as a function of wavelength. Using these, R-I colour indices were calculated for scaled model atmospheres, with $3300 < T_{\rm eff} < 5000$ K, representing K-M giants. A comparison with available effective temperature determinations of late-type giants shows a good agreement.

All stars of IC 2391 earlier than F-type and some standards have been observed at 12 Å/mm by Breysacher and F. and M. Spite to determine rotation velocities.

Solar System

Some comets and asteroids were discovered on Schmidt plates by Schuster and West. Several IAU telegrams announced these discoveries.

Wamsteker, in collaboration with the astronomy group at NASA-MSFC, studied the short-term and spatial variability of spectral features on the major planets on the basis of a large number of SEC-vidicon spectra. He also observed 44 Nysa in a programme to study the thermal properties of the surfaces of asteroids.

Miscellaneous

Pacini in collaboration with P. Vitello (Cornell) studied the evolution of expanding non-thermal sources in an fully self-consistent framework. Thus the dynamics of the expansion is not assumed a priori, but is determined by the presence of the relativistic particles. In collaboration with V. Castellani and A. D'Ercole (Rome), some work was started to see whether the formation and rapid evolution of very massive stars may influence the star-formation process in and the chemical composition of interstellar clouds.

Joint Research with Chilean Universities

C. Anguita, F. Noël and their associates at the Departamento de Astronomía, Universidad de Chile, continued the work on the Danjon Astrolabe installed at the Cerro Calán Observatory.

This year they started long-term observations of the planet Uranus. These observations and those of Jupiter and the satellites of Jupiter previously obtained will contribute to the improvement of the orbital elements of the planets and also to the study of the systematic errors in the fundamental reference system.

L. Campusano of the Universidad de Chile spent the year on an ESO fellowship at Paris Observatory, Meudon. H. Quintana, also from the Universidad de Chile, arrived at ESO in Geneva for a year's stay.

Five students, Mrs. S. Rojas de Neupert, A. Sulic, Messrs. M. Faúndez, H. Neupert and N. Zárate from the Universidad de Chile in Santiago participated in scientific work at ESO.

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Annual Report 1974
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ESO Bulletin No. 12
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Libraries

To meet the requirements of the increased group of scientists and in view of the growing number of books and periodicals, the library in Geneva moved from the TP barrack to somewhat more comfortable and spacious surroundings.

702 new books were acquired in the course of the year. 351 of these remained in the Geneva library, 167 were sent to the library in Santiago and 184 to that on La Silla. A total of 170 subscriptions for periodicals for the three libraries were processed and a continuous flow of observatory publications as well as preprints from all over the world were received. Back numbers of several periodicals were purchased and acquisition lists for books, periodicals and preprints were sent to all ESO libraries and staff members. 544 volumes of periodicals were bound in the three libraries. As in previous years, cooperation with other libraries was excellent.

Meteorological Report

During the year there were 231 photometric nights (with six or more hours of uninterrupted clear sky). January was very bad with only 32 per cent of photometric nights. The total number of clear night hours was 2,808, the highest registered so far. Rain or snow fell on La Silla on May 31, June 1, 4, August 7 and 8.

Sky Survey and Sky Atlas Laboratory

Sixty-minute IIa-O plates for the ESO (B) Atlas were taken with the 1 m Schmidt telescope throughout 1975. A definite improvement in the quality and the progress rate was noted. By the end of 1975, more than 300 fields had been covered with accepted plates. The image quality was generally better, mainly because of the new TV direct focal guiding system.

New Schmidt dark-room equipment was installed at La Silla in January. By regular use of the freon wash machine, most dust has been eliminated from the plates and the optimization of the development has improved the plate uniformity.

By the end of the year, the Sky Atlas Laboratory had distributed 225 on-glass copies to each of 20 customers, and 250 on-film copies to 42 customers. A maximum of 52 glass plates and 200 films can be processed per day.

Nitrogen-sensitization tests of the 098-04 emulsions were very successful. Tests on the new 127-04 emulsion (IIIa-F)—an alternative for the red ESO plates—will be made early in 1976. It is expected to start taking the red plates for the ESO/SRC Atlas around the middle of 1976.

The Sky Atlas Laboratory continued to offer photographic service to astronomers inside and outside ESO. However, due to manpower limitation and the priority of the Atlas, several requests for finding-charts, reproductions for publication, etc. had to be delayed or turned down.

An important number of astronomers from ESO countries and from outside Europe visited the Laboratory during the year.

The Laboratory supervised the production and advertisement of "The First ESO Slide Set", consisting of 20 black-and-white 5 x 5 cm slides of spectacular objects in the southern sky.

ESO/Uppsala Collaboration

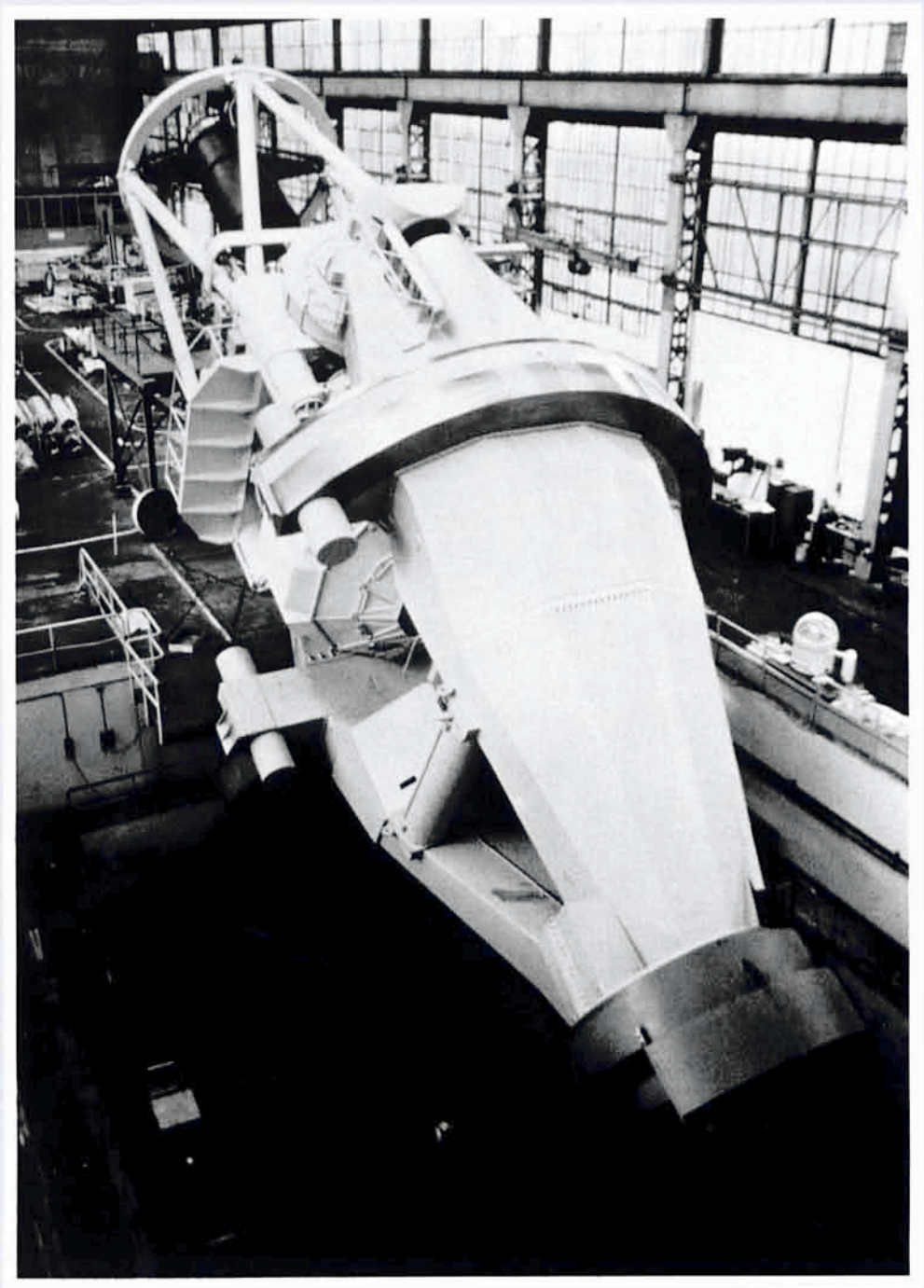
About 100 further fields were searched in 1975. By the end of the year, 166 fields were ready with a total of about 4,800 objects, 70 per cent of which are new. The third list (80 fields, 2,280 objects) was published in December 1975. Dr. A. Lauberts visited Geneva for photographical research in connection with the reproduction of the faintest details in images of galaxies on the ESO Schmidt plates. A double-exposure technique was worked out; it is described in a technical note from the Sky Atlas Laboratory (A. Lauberts: "On the Preparation of Rastered Enlargements On-film from the ESO (B) Plates", June 1975).

ESO/SRC Collaboration

Positives for the first 60 SRC plates in the ESO/SRC Survey of the Southern Sky were received in Geneva. A number of film copies of 47 fields were delivered to SRC for calibration.

The 3.6 m telescope — the largest instrument planned for ESO — is nearing completion. In 1975, the telescope was pre-assembled and thoroughly tested in Europe. The results of these tests turned out to be very encouraging and shipment to Chile is planned for early 1976. The photo shows the telescope in the assembly hall of Creusot-Loire at Saint-Chamond, near Lyon, France. ▶

3.6 METRE TELESCOPE PROJECT



During 1975, the work on the 3.6 m telescope building and dome advanced steadily towards completion in Chile, while the assembly and testing phase of the telescope itself and its associated control system was brought to a successful conclusion in Europe. One could therefore look forward to 1976 as the year of commissioning of the big telescope with its promise of bringing to fruition a project which had for many years been ESO's primary *raison d'être* and which had weathered many storms.

One of the most significant events of the year was a meeting on November 14, attended by representatives of astronomy in the member states (Profs. Strömgren, Bahner, Courtès) and those of ESO (Prof. Woltjer, Drs. Danziger, Laustsen, Richter, Wilson and van der Lans). Reports were made of the results of the tests carried out on the telescope, particularly the mechanical and controls aspect but also the results of tests on pointing and oscillation carried out using optical test methods. Basing themselves upon the data presented in these reports, the astronomers present considered that as far as could be judged from shop testing, the telescope performance could be deemed good.

As the emphasis shifted from Europe to Chile, staff was transferred correspondingly from Geneva to La Silla. Three staff members made the transfer in 1975 and several more prepared to make the move in the first months of 1976. In January 1975 the TP Division comprised 38 staff members and two visitors with eleven persons on contract from agencies, making a total staff strength of 51. By the end of the year this had risen to 40 staff members and two visitors with 12 staff on hire from agencies, making a total staff strength of 54.

Building Group

On February 15, the provisional acceptance was signed for all the concrete work of the 3.6 m building, CAT tower, service building and Danish telescope. This was marked by a reception on the site given jointly by ESO and the building contractor Interbeton, which was attended by many distinguished guests.

Thereafter building work proceeded on the insulation, cladding, electrical and sanitary installations and finishing work. By the end of the year the building was virtually completed and work had begun on the access road.

The erection of the dome began in February with the placing of the ring girder and arch girders. Thereafter the shell was erected and by the end of the year only the shutters and windshield were incomplete, while finishing and painting remained to be done in the new year. The CAT dome was also erected and required only the finishing touches to bring it to completion.

On the auxiliary construction programme the following progress was made: Dormitory 7 was provisionally commissioned in December, while the four dormitories and the clubhouse of the New Pelícano complex were nearing completion by the end of the year. The new storehouse was fully ready in the middle of the year. Work began on the maintenance workshop, and the civil engineering was completed by the end of the year. In December the contract for the new office and library building was placed with the Chilean firm Navarro, while that for the astro-workshop was placed with Interbeton. Both should be ready in the second half of 1976. Contracts were also placed for the new heating plant, improvement of heating, water and electricity networks, all of which are expected to reach completion in the course of 1976.

Optics Group

This group was strengthened by the recruitment of two optical engineers at the beginning of the year—one as a visitor for one year. Thus the group was in a position to devote more time to the equipping of the laboratory as an assembly/test facility, to the telescope adapters, to auxiliary instrumentation, optical design (and associated software) and collaboration with ESO-Chile.

One of the major activities of the group was the development of optical adjustment and test procedures for the 3.6 m telescope when it is installed. Based on rigorous Hartmann testing, the procedures were derived from a programme developed by KPNO which was extended by ESO. This required a significant software effort, and trial runs were made at the Pic-du-Midi Observatory 1 m telescope.

These Hartmann tests will finally clarify the precise influence of the prime mirror cell axial support adjustment. Further theoretical analysis has clearly demonstrated that the cell/mirror combination should in any event be well within specification, even in the worst theoretical case.

In conjunction with the other groups in TP the adapters were brought to a final design. In the case of the prime focus adapter the original design was simplified and adapted to accommodate the Gascoigne plate correctors. The contract for the optics was awarded to the firm SIRA, while that for the mechanics was awarded to Göttingen University. The contract for the blue and red Gascoigne plates was awarded to REOSC in the middle of the year. Calculations were completed for a doublet and triplet corrector for the prime focus, and the decision was reached to proceed for the moment only with the blue and red triplets for which tenders were invited towards the end of the year.

Further work was carried out in the design of coudé dispersive instrumentation, including the coudé scanner and classical coudé spectrograph. In view of the costs, however, a decision on the design of the coudé spectrograph was postponed and emphasis given to an extended form of échelle scanner.

Following considerable discussion on Cassegrain spectrographic equipment, it was decided to purchase from Boller & Chivens a low-dispersion spectrograph.

The optical laboratory facility has been built up and is equipped with, among other things, an optical test bench, photometer and interferometer.

Further work was carried out for the CERN/Serpukhov project in the design of optical systems for Cerenkov counters. In addition, the leader of the optics group, R. N. Wilson, was invited to be optical consultant in a working group convened by ESA in the field of space astrometry.

Mechanical Group

The year's major activity was undoubtedly the assembly and test phase of the telescope in the St. Chamond factory of Creusot-Loire. The proximity of this firm to Geneva has been a great boon, for it is difficult to see how such a close cooperation and supervision could otherwise have been achieved. Testing of the assembled telescope began in February and had been satisfactorily completed in November. The tests led to a num-

ber of improvements in the functioning, including reduction of the friction of the polar axis, elimination of backlash in the main gears, damping of oscillations in the top-unit spider, reduction of temperature difference between oil and cooling water, elimination of deflection differences between primary and secondary mirror cells. Also many design details were finalized. Thus although the test period lasted longer than expected, it gave rise to many improvements. Moreover, the soundness of certain design features, sometimes regarded as doubtful, was conclusively proven. This was the case for the choice of a spherical rather than cylindrical surface for the horseshoe, the arrangement of the hydrostatic declination bearings, the small deflection of the polar shaft with its combined horseshoe/fork mounting, the rapid automated exchange of top units and the smooth functioning of the precision helical spur gears.

In May, an open day and a press conference were organized jointly with Creusot-Loire to demonstrate the operation of the assembled telescope to the press and the public.

Dismantling of the telescope began on November 22, and by the end of the year, all the parts were dismantled and packed ready for shipment to La Silla. At this time, one of the engineers of the group was transferred to Chile to supervise the on-site erection of the telescope in its building. The remainder of the assembly team will join him in early 1976.

At the end of the year, mirrors 5 and 3 were brought to the assembly hall in Geneva, the former for testing with its control system, the latter for mechanical design improvement.

The aluminizing plant was completed at HVEC (USA) in October and factory-accepted in November. This unit, specially designed for the 3.6 m telescope optics, measures some 4 m x 4 m x 3 m and will be installed in the ground floor of the 3.6 m building. Under test the plant produced a coating of 600 Å with less than 5 per cent variation in thickness (this variation is extremely difficult to measure). The aluminizing plant develops and maintains a vacuum of 2×10^{-6} Torr after about two hours of pump-down.

Approximately half the design work of the CAT was completed during the year. However, the priority given to the completion of the 3.6 m telescope, its adapters and basic instrumentation led to the remainder of the design work being re-scheduled for mid-1976.

A great deal of work went into the adapters. The design of the prime focus adapter was simplified and adapted to take the 50 mm Gascoigne plate. The very complex Cassegrain adapter was fully designed and the call for tenders issued by the end of the year.

The 4-channel photometer was completely designed, manufactured and assembled in the course of the year. It was designed entirely by ESO and built by Göttingen University.

Controls Group

The major activity of this group also was the testing of the assembled 3.6 m telescope. The installation of the components for the control system (motors, encoders, limit switches, etc.) was carried out in parallel with the assembly of the telescope parts.

Testing began in April and ran in conjunction with the mechanical test programme. A van had been specially equipped for this purpose. Fitted out as a miniature electronics laboratory, this van contained the control equipment for the telescope as well as measuring instruments, tools and components and played an important role in the test phase.

The testing resulted in several modifications and improvements, the most striking of which was the development of a "direct-access" feedback system through the spur gears for damping the mechanical vibrations of the telescope. This system, using accelerometers to detect the forces which give rise to oscillations, is extremely effective.

The control system of the 3.6 m telescope serves primarily for controlling the operation of the telescope and its instrumentation; but it is envisaged that the controls of the Schmidt, Danish 1.5 m and ultimately the CAT will be linked into the same network, thus offering extended possibilities for these telescopes. Moreover, the computer system has been devised in such a way that data-reduction programmes can also be run. For example, sample calculations on observing programmes can be made during the observations to give an on-line validity check to the astronomers.

An identical system has been retained in the laboratory in Geneva for test and development purposes, and is proving useful especially in the field of instrumentation, which has become another major activity of the group.

The new control system installed in 1974 on the Schmidt telescope worked well throughout 1975. Improvement of the mechanical and control system has allowed much higher stability by eliminating gear blacklash and reducing the effect of wind forces, etc. These improvements allow the Schmidt a much higher precision as well as fine correction of the declination axis positioning.

OTHER TELESCOPES AND AUXILIARY INSTRUMENTS

General

Since June 1975 the Technical Research Support Group (TRS) is responsible for all telescope and instrument maintenance on La Silla. Also improvements and modifications to instruments are executed by the TRS—this of course on consultation with staff astronomers. The TRS consists of the mechanical and electronics sections, the telescope operations group and the optical laboratory. At the end of the year, all TRS activities had been concentrated on La Silla, with the exception of parts of the mechanical section which would remain in Santiago for another two months. A good coordination of activities between the TRS and the TP Division in Geneva has been established in the course of the year.

Programmes for preventive maintenance have been developed by the mechanical and electronics sections.

The newly created telescope operations group has as its main activity the daily support of visiting astronomers, which consists of change-over of equipment, photographic plate preparation, minor repairs and testing of equipment. The group has become fully functional during the second half of the year, which appears to have resulted in a marked improvement of the services rendered to visiting astronomers.

Furthermore, a smoothly running plate service, providing test plates, calibrations and data on gain, etc., has been organized. All photometric filters have been remeasured and new transmission curves plotted. The testing of photomultipliers has now been started. A training programme to further increase the quality of the support given to visiting astronomers has been initiated.

The infrastructure required for the optical laboratory, installed on the ground floor of the 1 m telescope building, was prepared early this year and all equipment for the laboratory is at present delivered. The first use of the laboratory has been made; a three-stage image-tube was adapted for use as an eyepiece to the Echelec spectrograph, and a laser adaption to the coudé spectrograph, required for the testing of the new holographic grating, was prepared.

Telescopes

New wind-screens were installed in the 1.5 m and 1 m domes and a new tracking system with handset at the 1.5 m telescope.

A new drive system with an HP 2100 computer was installed at the 50 cm telescope, following continuous troubles with the old system. All necessary interface equipment was constructed and the corresponding software written.

Several improvements were made to the Schmidt telescope during full-moon periods. The mirror handling equipment was improved. A mirror-invarrod contact device was installed to secure the position of the mirror with respect to the photographic plate. The focal reading was modified by introducing a linear encoder. The stability of the polar axis was improved by mounting a new connection system between axis and gear wheel. A cradle positioning device allowing accurate azimuth and elevation corrections was designed and manufactured. Preparations for the manufacturing of a new corrector plate for the ultra-violet wavelength region were started.

Echelec

Some complementary optical tests of the Echelec spectrograph were carried out. They confirmed that the instrument is operational in a conventional mode, i.e. with a 600 l/mm plane grating giving a dispersion of 65 Å/mm in the blue. In the echelle mode, i.e. with two crossed gratings (4.5 Å/mm), less good results have been obtained. The echelle grating, ruled in 1962 and purchased about ten years ago, seems to be responsible. A new echelle of better quality will be installed in 1976.

Some improvements were made in the operation of the Echelec; the three units can now be connected by two light-proof tunnels, and a three-stage image-tube has been successfully installed for the guiding of faint objects.

The Lallemand-type electronic cameras with photocathode of ∅ 30 mm arrived in March. After some tests in laboratory, these cameras were used on the Echelec spectrograph for astronomical observations.

The Echelec with 600 l/mm grating and electronic camera will be available for visiting astronomers starting January 1976.

Infrared Photometer

A complete multi-filter and aperture photometer for infrared observations (detector: liquid He-cooled Ga-Ge bolometer) was acquired from Kapteyn Observatory. Data-acquisition systems are being developed to combine this instrument efficiently with the 1 m telescope, and various other improvements are still to be made before the instrument may be offered to visiting astronomers.

A Blum hygrometer has been delivered to La Silla and will be installed early next year to provide a continuous record of the atmospheric water vapour content above La Silla. The problems of the manufacture of liquid helium have been solved by a joint effort with AURA in La Serena.

Other Instruments

A holographic grating has been installed in the coudé spectrograph of the 1.5 m telescope.

Various tests were made on the spectrum scanner. It was decided to replace the channeltron photomultipliers by a Quantacon with Peltier cooling, to provide off-set guiding and to make miscellaneous other improvements. Owing to the heavy workload of the TRS, implementation will have to await the next year.

A two-channel photometer is currently on order from Hoher List Observatory and should arrive early in 1976. With two stars simultaneously observable, the instrument ist particularly suited for observing rapid variables.

The 1 m photometer has been equipped with a new motor-driven filter wheel, while the polarimeter has been modernized. Various data-acquisition programmes are being written for these instruments and also for the 50 cm photometer.

A second E-M image-tube holder was constructed for the Boller & Chivens spectrograph. Extensive tests of this spectrograph are being made to trace the source of some apparent stability problems.

Swiss Telescope

A small telescope was installed by astronomers from the Geneva Observatory with the aim of conducting a programme of photometry in seven colours. By the end of the year, observations had been started.

BUILDINGS AND GROUNDS

Establishments in Chile

The construction programme at La Silla made rapid progress. The buildings for the 3.6 metre telescope and the CAT, the new warehouse, the maintenance workshop and dormitories 9, 10, 11 and 12 ("New Pelícano") and the associated clubhouse, all were essentially completed by the end of the year. Contracts were awarded for the last two buildings: the office-library building and the mechanical-electronic workshop. Unfortunately the new utility distribution system will not be completed before the second half of 1976 and as a result the occupants of some of the buildings still face somewhat unsatisfactory conditions.

Miscellaneous improvements and maintenance were made to the telescope buildings and the living quarters. An unusual winter snow storm caused much damage to the roads which in places had to be rebuilt. The airstrip which is now regularly used was extended to 1,600 metres. A cabin for safety equipment and for a first-aid station are being installed at the airstrip.

The increased activity on the mountain also led to an increase in the consumption of utilities. The water-wells were completely cleaned. With daily pumping of 94 m^3, they are functioning close to their maximum capacity. Total electrical power production was 773,000 kwh which required 390 m^3 of diesel fuel oil. Another 203 m^3 of fuel was used by the heating plant.

Regular maintenance was required for 55 cars and buses and for 13 other units of civil engineering equipment.

ADMINISTRATIVE MATTERS

In Europe, 1975 brought the ratification and subsequent entering into force as of July 25, 1975, of the Multilateral Protocol on Privileges and Immunities of ESO in its European member states.

The most important financial aspect was the exemption from national income taxation, which was replaced by a system of internal tax, levied on the salaries of ESO personnel.

In the field of finance, the ESO Council adopted the new contribution formula for the years 1975 to 1977. The corresponding new shares and the previous shares of the member states in financing the Organization are given below.

Country	ESO formula (1975–77)	Previous ESO formula (1972–74)
Belgium	8.29	8.08
Denmark	4.72	4.70
France	33.33	33.33
Germany	33.33	33.33
The Netherlands	10.93	10.15
Sweden	9.40	10.41
	100.00	100.00

Also, on recommendation of the Finance Committee and its Working Group established for this purpose, the ESO Council approved a new version of the Financial Rules. The Working Group and the Administration will now take up the corresponding up-dating and revision of the Internal Financial Regulations.

The restructuration of ESO in Chile, regarding both organization and staff, was well under way and lead already towards the end of the year to improvements.

In Europe, the Office of the Director-General in Hamburg had to be relocated in November from Bergedorfer Straße 131 to Alte Holstenstraße 1.

This relocation—due to a change of ownership in the building—came unexpectedly and at a very unfortunate time since, in connection with the ESO Council's acceptance of the German offer to establish the European centre of ESO at Garching near Munich, another removal to provisional offices in Garching is expected to take place in the rather near future.

At the end of the year, the administrative group of the TP Division in Geneva was made part of the general ESO Administration. It serves all ESO establishments in Geneva, including the Scientific Group, the Sky Atlas Laboratory and the TP Division.

New policies concerning the local staff in Chile, started in 1974 with the improvement of salaries, were pursued in 1975 with a comprehensive job review and a re-assessment of the allowances.

The financial situation in 1975 was negatively influenced by large parity losses due to the revaluation of the Swiss franc, which could only be absorbed through severe measures of economy. The final 1975 figures (see opposite page) reflect an excess of expenditure and income over forecast which is due to submitting all salaries of international staff to internal taxation, thus leading in equal amounts to higher cost of salaries and a corresponding income.

With the redefinition of the future policy of the Organization by the ESO Council at its December 1975 meeting, member states also adopted a middle-term financial forecast which, on the basis of 1975 prices, foresees contribution ceilings for the years 1977, 1978 and 1979 of DM 32.5, 30.0 and 27.9 million respectively.

These ceilings, which may need adjustment depending on cost increases over these years, ensure the completion of the 3.6 m telescope with much of its initial auxiliary instrumentation, the termination of the auxiliary construction programme on La Silla and cover the running cost in Europe and Chile.

Budget Statement 1975

(in DM 1,000)

Expenditure

Budget Heading	Approved Budget	Transfers	Revised Budget	Expenditure (incl. commitments and unused credits carried over to 1976) for Directorate Hamburg	Establishment in Chile	3.6 m TP Division in Geneva	Total
1 Personnel	16,158	14	16,172	4,726	10,232	5,991	20,949[1]
2 Operations	7,825	⁄. 333	7,492	1,127	4,103	1,506	6,736
3 Capital outlays	15,043	3,500	18,543	384	6,481	11,678	18,543
4 Sky Survey Project	736	—	736	674	—	—	674
TOTAL EXPENDITURE	39,762	3,181	42,943	6,911	20,816	19,175	46,902
Reserve for cost variation	3,181	⁄.3,181	—	—	—	—	—
GRAND TOTAL EXPENDITURE	42,943	—	42,943	6,911	20,816	19,175	46,902

Income

Budget Sub-heading	Estimate	Actual (incl. receivables)
90 Contributions from member states	32,000	32,000
91 Unused appropriations from previous years	5,599	5,599
94 Sale of Sky Atlas	591	361
95 Miscellaneous	4,753	9,940
TOTAL	42,943	47,900

[1] Including 5,196 internal tax for the years 1972–74, compensated by the same amount under income, sub-heading 95 "miscellaneous".

Budget for 1976

(in DM 1,000)

Expenditure

Budget Heading	Directorate Hamburg	Establish-ment in Chile	3.6 m TP Division Geneva	Scientific Group	Total
1 Personnel	2,559	6,922	4,770	3,516	17,767
2 Operations	1,026	3,968	1,487	855	7,336
3 Capital outlays	232	3,988	8,966	141	13,327
4 Sky Survey Project	871	—	—	—	871
	4,688	14,878	15,223	4,512	39,301
RESERVES					
Reserve for cost variation (6%)					2,353
TOTAL EXPENDITURE					41,654

Income

Budget Sub-heading		Estimate
80	Contributions from member states	32,500
81	Unused appropriations from previous years	4,117
82	Sale of Sky Atlas	591
84	Internal tax	2,930
85–89	Miscellaneous	1,516
TOTAL INCOME		41,654

(a) Representation of nationalities

In the accompanying table we present some information on the representation of nationalities among the international staff and on the share of telescope time among visiting astronomers based in the various member countries. Because of the large annual fluctuations we also present the total over the last five years. The figures for the telescope time have been arrived at by assigning a weight 2 to the 1.52 m telescope, a weight 1 to the 1 m telescope and a weight $^1/_3$ to the other telescopes.

With the same formula the total observing time in 1975 was divided as follows: visiting astronomers of member countries 64 %, ESO staff and tests 34 %, others 2 %.

Member state	Number of employees	Number in %	Financial share in % (1975)	Observing time in %	
				1975	1971–75
Belgium	7	7.4	8.3	11	10
Denmark	7	7.4	4.7	5	6
France	25	26.3	33.3	22	33
Federal Republic of Germany	38	40.0	33.3	33	29
The Netherlands	13	13.6	10.9	13	11
Sweden	5	5.3	9.4	16	10
Total	95				
Other	14				

(b) Purchases

The totals of purchase orders or contracts placed by the various establishments in the period October 1, 1974 to September 30, 1975, broken down by value, were:

	TOTAL	Chile	Hamburg	Geneva
Value below DM 10,000	3,112	2,254	392	466
Value DM 10,000 to 100,000	90	18	38	34
Value exceeding DM 100,000	7	—	—	7

COUNCIL, COMMITTEES, WORKING GROUPS

The Council of ESO met three times, on April 29/30 in Munich, on October 1 in Geneva and on December 2 in Hamburg.

The April meeting was held in Munich to inspect the site at Garching (near Munich) which the Government of the Federal Republic of Germany had offered for the establishment of the Organization's headquarters. Visits were also paid to the neighbouring Max-Planck Institutes for Plasmaphysics and for Extraterrestrial Physics. A good part of the meeting was devoted to the discussion of a new structure for ESO both in Europe and Chile. Agreement could be reached on the new organizational structure in Chile, which the Director-General was instructed to speedily implement. All technical and research activities as well as several administrative services were to be concentrated on La Silla.

The October meeting was devoted to further search for the optimum structure of ESO in Europe.

At the December session, the Council took resolutions on the future structure of ESO in Europe, with a strong scientific-technical centre to support the 3.6 m telescope project, and for the promotion and coordination of astronomical research in the member states, on the middle-term financial and personnel planning, and on the establishment of the Organization's European headquarters at Garching.

A working group was appointed for the planning of the headquarters. A second working group will review the functions of the various scientific and technical committees in relation to the new structure of the Organization.

The Committee of Council met on April 11 in Lyon, on September 2 in Amsterdam and on November 11 in The Hague.

The Finance Committee met on April 10 in Lyon, on September 30 in Geneva and on December 1 in Hamburg. These meetings dealt with the financial aspects of the new organizational structure and its implementation within budgetary ceilings that respected the austere economic situation in most member states.

The Scientific Policy Committee met on November 17 in Munich. It examined the tasks proposed for the scientific group that would be established under the new structure.

The Observing Programmes Committee held meetings on May 28/29 in Uppsala and on November 25/26 in Hamburg. The applications for observing periods 16 (Oct. 1975 to April 1976) and 17 (April 1976 to Oct. 1976) were examined. The heavy overdemand for observing time again made the task of the Committee difficult.

The Instrumentation Committee held meetings at Geneva on April 8/9 and November 18. The April meeting reviewed the status of the 3.6 m telescope project which neared completion. It also examined the present status of the auxiliary instrumentation planning and the future prospects.

The November meeting reviewed the shop acceptance report for the 3.6 m telescope which gave the green light for the shipment to Chile. The Committee also examined the future tasks for the Telescope Project Division under the new organizational structure, and various questions relating to spectrographic instrumentation.

APPENDIX

List of Members of Council, Committees and Working Groups per January 1, 1976

Council

Belgium:	P. Ledoux
	M. Deloz / L. Poulaert
Denmark:	K. Gyldenkerne
	B. Strömgren (President)
	P. A. Koch
France:	J.-F. Denisse (Vice-President)
	A. Alline
Federal Republic of Germany:	I. Appenzeller
	C. Zelle
The Netherlands:	H. G. van Bueren
	J. H. Bannier
Sweden:	P. O. Lindblad
	M. Fehrm

Committee of Council

B. Strömgren, President

J. H. Bannier	L. Biermann
J.-F. Denisse	G. Courtès
P. A. Koch	M. Deloz
P. O. Lindblad	G. Wlérick
C. Zelle	

Scientific Policy Committee

L. Biermann, Chairman

J. Lequeux	J.-C. Pecker
P. G. Mezger	P. Swings

The President of Council and the chairmen of the Finance Committee, the Instrumentation Committee and the Observing Programmes Committee have a standing invitation to attend the SPC's meetings.

Finance Committee

M. Deloz (Belgium), Chairman

Belgium:	L. Poulaert
Denmark:	H. Grage
France:	L. Amigues
Federal Republic of Germany:	C. Zelle
The Netherlands:	P. J. Fierst van Wijnandsbergen
Sweden:	J. Gustafsson / B. Samuelsson

Instrumentation Committee

G. Courtès, Chairman

K. Bahner	D. J. Malaise
J. Borgman	P. E. Nissen
R. Cayrel	E. H. Schroeter
L. Delbouille	A. Wyller
Ch. Fehrenbach	

Observing Programmes Committee

Member	*Substitute*
G. Wlérick, Chairman	J. Lequeux
E. P. J. van den Heuvel	P. S. Thé
E. B. Holmberg	A. Elvius
L. Houziaux	C. de Loore
K. Hunger	Th. Schmidt-Kaler
M. Rudkjøbing	P. E. Nissen

Working Group for Financial Rules and Regulations

M. Deloz, Chairman

L. Amigues	H. Grage
P. J. Fierst van Wijnandsbergen	W. Sandtner
G. Friborg	

Working Group for the Planning of ESO Headquarters

H. G. van Bueren	P. O. Lindblad
M. Deloz	B. Strömgren
J.-F. Denisse	C. Zelle

Working Group for the Review of the Functions of ESO Committees

I. Appenzeller
L. Biermann
A. Blaauw
G. Courtès
J.-F. Denisse
G. Gahm
K. Gyldenkerne
P. Ledoux
G. Wlérick
L. Woltjer

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Headquarters Chile	Alonso de Cordova 3107, Vitacura. Casilla 16 317 — Santiago 9, Chile. Telephone: 285006. Telex: 40853. Telegrams: ESOSER — Santiago de Chile.
Guesthouse	Gustavo Adolfo 4634, Santiago de Chile. Telephone: 484254
La Silla Observatory	c/o Santiago Headquarters address. Telephone: La Serena 3048

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