



ESO Workshop on Optical Studies of X-ray Sources

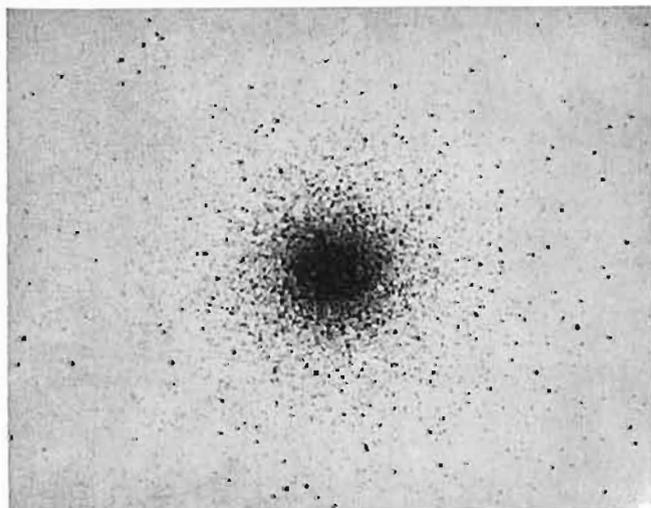
The first of what is to be a series of workshops on different topics has just taken place in Geneva at the ESO Scientific-Technical Centre. The purpose of these workshops is to gather together a number of European astronomers working in a well-defined field of research or of instrumental development to review the present status of knowledge, to compare methods and results, and in particular to coordinate future plans. In order to achieve these aims, it is of obvious importance that all European groups active in the chosen subject be represented. Also, the workshops should be as informal as possible and have a relatively small number of participants.

The first workshop took place from April 28-30, 1976 and dealt with optical observations of compact X-ray sources. There are at least a dozen groups working in this field in Europe and they use a variety of techniques:

spectroscopy, photometry, ultra-rapid photometry, etc. . . . Theoretical interest is also very high. The workshop was therefore attended by about thirty especially invited scientists from all ESO countries as well as from England, Italy and the USA.

After an initial series of review talks on the properties of compact X-ray sources in different spectral ranges, the various groups presented their activity. The attendance of some specialists in X-ray astronomy was particularly useful. They not only described their data but also presented the opportunities which now exist (or are likely to arise in the near future) for coordinated observations. It is obvious, especially when dealing with variable sources, that the value of both optical and X-ray data greatly increases when simultaneous observations exist in the other spectral range. Indeed, the topic discussed was a typical example of the need which often arises in modern astronomy to gather and coordinate information resulting from quite different channels such as optical, radio and X-ray astronomy. A specific discussion dealt with future plans for optical observations of various individual X-ray sources both in the northern and in the southern sky.

The association of compact X-ray sources with close binary systems and globular clusters has undoubtedly added a new motive for interest in the classic and already fundamental investigation of these objects.



Globular cluster NGC 1851 (R.A. = 5^h12^m ; Decl. = -40°) from which X-ray bursts have been reported on February 20, 1976 (IAU Circular 2913). Reproduced from ESO Quick Blue Survey plate 1240 (field 305). 60 min. exposure, Ila-O + GG 385, ESO 1 m Schmidt telescope.

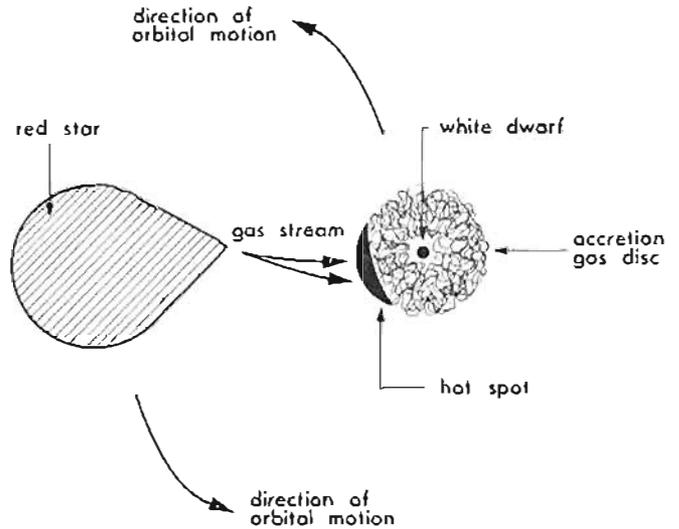
Dwarf Novae

Dr. Nikolaus Vogt, ESO staff astronomer in Chile, is a specialist in dwarf novae, and during the past years he has been busy improving our knowledge about these interesting objects. Here he reviews his programme:

Dwarf novae are small brothers of the X-ray binaries: an extended red star delivers gaseous material towards the second component, a white dwarf. The material arrives at quite a high velocity, accelerated by the gravity of the white dwarf, and does normally not hit the surface of the white dwarf immediately, but forms an accretion disc of hot gas which surrounds the white dwarf. This disc and especially its "hot spot"—i.e. the place where the gas stream from the red component falls onto the disc—are the most prominent light sources of the entire system. This model resembles that of the X-ray binaries, but the masses and dimensions of dwarf novae are much smaller, about one solar mass for each component. Nevertheless, soft X-rays were recently detected in one of the nearest dwarf novae, SS Cyg.

More than twenty years ago, Kraft detected the binary nature of dwarf novae on account of eclipses and other periodic variations in the light-curve and radial velocity. And it is more than 100 years ago that the first star of this class was detected, with its characteristics and spectacular behaviour: a normally very faint star brightens for a few days, 2-5^m above its normal magnitude. These outbursts occur at irregular intervals between ten days and several months. The eruptive behaviour resembles that of the novae, but the outburst amplitudes are smaller, thus the name "dwarf nova".

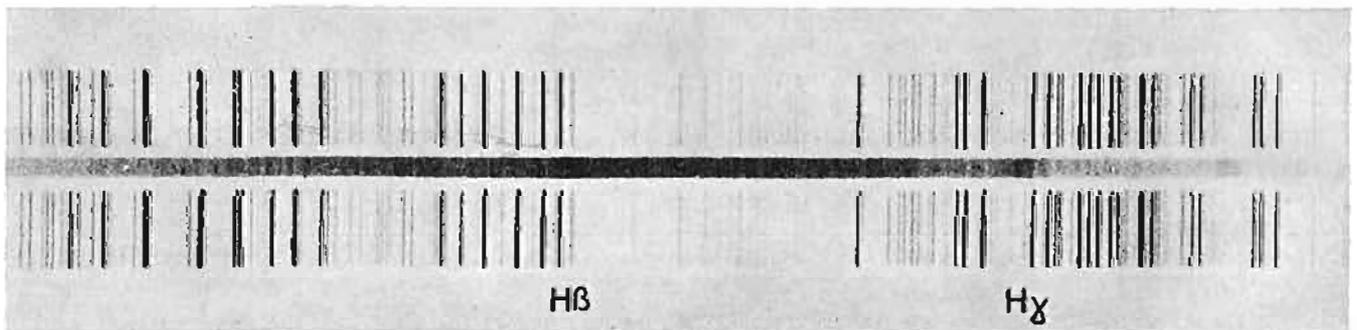
With these short notes we leave the field of certain knowledge. We do not know as yet which physical processes rule the observed properties. Even the location and origin of the spectacular outburst is still controversial: is the white dwarf responsible, due to a hydrogen-burning burst after accretion of hydrogen-rich gas onto its surface? Or is it the disc, or even the red component that creates the outburst? Doubts also arise if one tries to explain the oscillations with 15-30 sec. period which were observed in some of the dwarf novae. This could be white-dwarf pulsations, but they could also originate in the orbital motion of the innermost parts of the disc.



Dwarf nova model, schematic.

In order to improve the observational basis, N. Vogt has obtained photometric and spectroscopic observations of several dwarf novae since 1972. Occasionally, simultaneous observations were made with up to three telescopes at La Silla, as for instance in December 1974, together with visiting astronomers R. Häfner and R. Schoembs from Munich, or in April 1976 with J. Breysacher (ESO). The work concentrated especially on the three stars VW Hyl, EX Hya and BV Cen, for which long photometric and spectroscopic series were obtained with the best possible time resolution. It is fascinating to observe these stars, and every observing night is full of surprises: will our "friend" outburst tonight? Will he oscillate? Will he show a strong flickering, or is he "boringly" constant tonight?

The data of our dwarf nova observing programme are partly published, but most are still being analysed. Hopefully, they will help to answer some of the above-mentioned questions. However, they certainly also pose new problems; e.g. when we detected in VW Hyl a hump in the light-curve which repeats every 111 min. during outburst, while its orbital period is only 107 min. What is the physical meaning of another period, 4 per cent longer than the orbital? A new feature—unexpected, observed, not understood. Science is like the old Greek legendary snake Hydra with her nine heads. If you cut one off, two new heads grow.



Spectrogram of the dwarf nova BV Cen, taken by J. Breysacher on April 4, 1976 with the Echelec spectrograph. Dispersion 124 Å/mm, exposure 50 min. The hydrogen lines Hβ and Hγ are visible in emission and show a double structure. This structure is variable in a time scale of a few hours. The emission lines originate in the disc, while the narrow absorption lines correspond to the red stellar companion.

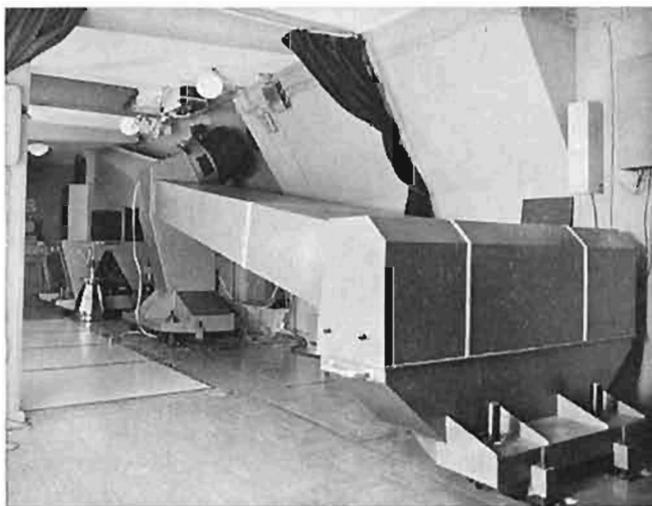
The "Echelec" — A New Spectrograph for ESO

ESO staff astronomer Dr. J. Breysacher reports from La Silla:

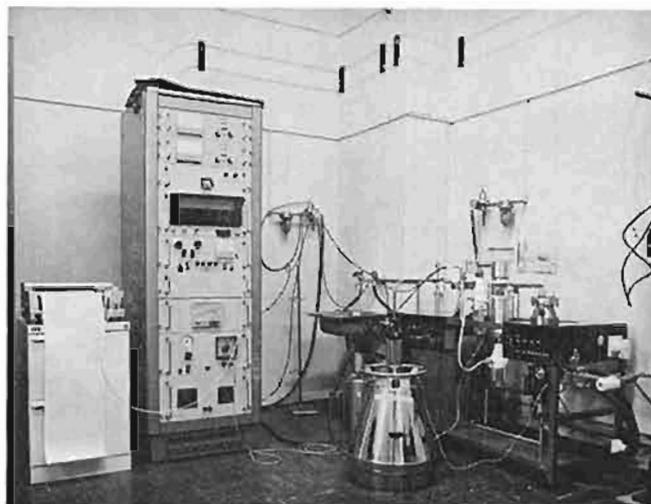
Two similar models of the Echelec spectrograph, designed by A. Baranne for the coudé focus of the 1.52 m telescope, exist at present. One, the prototype, is working at the Observatoire de Haute-Provence and the second was recently installed on La Silla. The instrument is composed of three independent units connected by two light-proof tunnels, the distance between the extreme units being about seven metres. It is positioned in the east-west direction, on the concrete of the telescope pillar in the coudé room. The central unit can be removed very easily, thus permitting a rapid exchange with the other big coudé spectrograph.

The detector normally used with the Echelec is the Lallemant-Duchesne "caméra électronique", but the spectrograph can also be operated with an image tube and direct photography. The electronographic camera is electrostatically focused, the accelerating potential is 25 kilovolts and S-11-type photocathodes of 30 mm diameter are used with it. The magazine holds twenty plates. The camera gives a magnification of about 0.6. A special laboratory was constructed on the second floor of the 1.5 m telescope building for the preparation of the equipment which takes about twenty hours and demands great care.

In the "echelle mode", i.e. with two crossed gratings, the dispersion in the blue is 4.5 Å/mm. The mean exposure time for a star of magnitude $B = 10$ is about 2^h30



The ESO Echelec spectrograph.



The "caméra électronique" during its preparation in the laboratory.

for a spectrum widened to 0.20 mm. The spectrograph may also be used in a conventional mode by suppressing the transmission grating and exchanging the echelle grating with a first-order grating. The presently available first-order grating gives a dispersion of 74 Å/mm in the blue at a cathode of the camera. The mean exposure time for a star of magnitude $B = 14$ is one hour.

During the past six months, the Echelec has been used frequently. Various programmes were carried out by visiting and staff astronomers: identification of X-ray sources, a study of Wolf-Rayet stars in the Magellanic Clouds, high-dispersion observations of interstellar calcium lines, determination of stellar rotation in open clusters and high-time resolution spectroscopy of eruptive variables. The first results will soon appear in print.

Optical Identification of a Galactic X-ray Source

Dr. H. Mauder from the University Observatory in Tübingen, Federal Republic of Germany, recently identified a southern X-ray source optically. This is the second X-ray source identified with an ESO telescope on La Silla. The first, Cen X-3, was found by Dr. W. Krzeminsky from the Warsaw University Observatory, using the ESO 1 m photo-metric telescope in May-August 1973. Dr. Mauder reports:

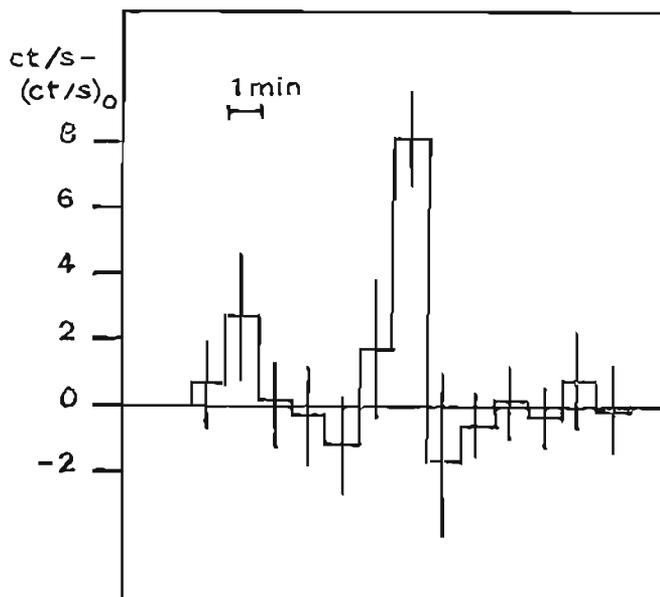
It is of great interest to identify galactic X-ray sources with optical stars, since it has turned out that the X-ray emission in these objects is due to accretion of matter onto compact, collapsed stars in binary systems. Studying the normal optical components in those systems gives much information on the nature of compact stars; in some cases it has been possible to show that the compact component must be a neutron star; one system may even contain a black hole. Until now, only eight binary X-ray sources have been definitely identified with optical stars, which can therefore be studied in

ERRATUM

Due to an error discovered only in the printing-press, nearly the whole edition of the March 1976 issue of the "Messenger" has been printed as No. 1.

Three numbers of the "Messenger" were already published in 1974 and 1975, and the last issue, therefore, was No. 4. We apologize for this misfortune and inform the readers that Nos. 1, 2 and 3, which had a more limited distribution, are no longer available.

The editors



Mean light-curve from all the observations, folded with the period of 11.657 minutes. The bars are mean square errors.

much detail. A very famous example is Cen X-3, which was found by Krzeminsky at ESO. Now it has become possible to identify another source of similar type.

From observations by the Ariel 5 and the Copernicus satellites it was found, in 1975, that the UHURU source 3U1223-62 shows a periodic X-ray variation with a period of 11.64 ± 0.02 minutes. In 1973, Vidal suggested the 11^m emission-line B-type supergiant WRA 977 to be the optical counterpart of 3U1223-62. However, at that time, it was not possible to confirm this identification. I therefore decided to look for some indication of the X-ray period in the optical light of WRA 977.

During a stay on La Silla in March 1976, the ESO 50 cm photometric telescope was used in the pulse-counting mode for observations in the U band, with a time resolution of two seconds. On three different nights, a total of five runs was obtained, each lasting for about forty minutes. There seemed to be several small peaks of approximately one minute duration. The peaks were not always present, but whenever they were visible, their separation was 11.657 minutes or multiples

Relocation of the ESO Administration from Hamburg to Munich

Following the Council decision of December 1975, to establish the European Headquarters of ESO at Garching, near Munich (cf. "The Messenger", No. 4, March 1976), the Office of the Director-General is doing a first step towards that direction and moves, on July 1, 1978, from Hamburg-Bergedorf to Garching.

This move will simplify ESO's involvement in the construction activities for the Headquarters, improve the communications with the ESO departments in Geneva and facilitate the preparations for their removal to Garching, which will take place in about three years time.

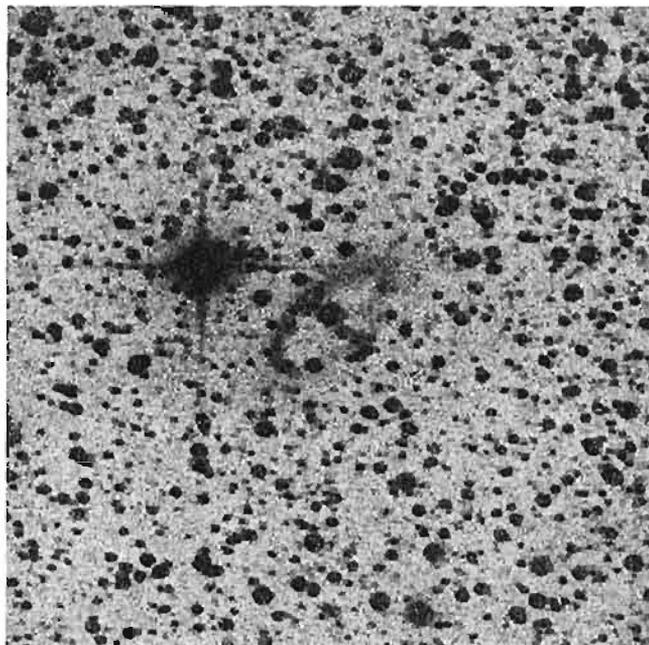
Therefore, from July 1, 1978, the Office of the Director-General will be located at **Schleißheimer Straße 17, D-8049 Garching (Munich)**, not far from the site that will house the ESO Headquarters.

of this interval over all nights, well consistent with the X-ray periodicity. Folding the data with this period in intervals of one minute yielded a significant pulse structure. Thus, WRA 977 and 3U1223-62 should indeed be counterparts.

In the meantime, additional UBV observations with the ESO 50 cm telescope and with the 50 cm Danish telescope have been obtained, as well as a set of 20 Å/mm coude spectra with the ESO 1.52 m telescope. Due to the faintness of the object, exposure times up to eight hours were necessary! It will be interesting to see what can be learned about this system, when the optical observations are carefully analysed during the coming months.

The Riddle of the "Smoky Ring" Solved

Take a look at this diffuse ring, which was found last year on a very deep (21^m5-22^m0), red ESO Schmidt plate. What do you think it is? The position is close to the Milky Way equator: (l, b) = (311°, 2°5). It was reported in a recent note in *Astronomy & Astrophysics* (46, 139) by ESO astronomers H.-E. Schuster and R. M. West. They believed that it could be a planetary nebula, although of rather peculiar shape. However, an extragalactic origin could not be entirely excluded.



This question has now been answered. A perfect 135 Å/mm spectrum, obtained on April 1, 1976 with the 1 m telescope at the Las Campanas Observatory (ESO's neighbour to the north) reveals the strong emission lines of a planetary nebula, very strongly reddened by interstellar absorption. Furthermore, Dr. N. Sanduleak of the Warner and Swasey Observatory, Ohio, USA, has found that the central star in the ring is of spectral type B9 V, by means of plates taken with the Curtis Schmidt telescope on Cerro Tololo (ESO's neighbour to the south). So, although the ring was "only" a planetary nebula, it gave rise to a nice collaboration between the three major observatories in the Atacama desert!

3,500 New Southern Galaxies Discovered in ESO/Uppsala Observatory Collaboration

The ESO/SRC Atlas

Astronomers had the first deep look into the northern sky some twenty years ago, when the Palomar 48" Schmidt telescope surveyed the sky north of 30° declination. This survey, which was published on paper prints and on glass copies as the National Geographic Society-Palomar Observatory Sky Atlas, had a tremendous impact on optical astronomy. Many new galactic and extragalactic objects of great interest were found and most new radio-sources are still identified from this atlas. No wonder that astronomers were looking forward to a similar survey in the south, covering that part of the sky which the Palomar 48" Schmidt (latitude $+30^\circ$) could not reach.

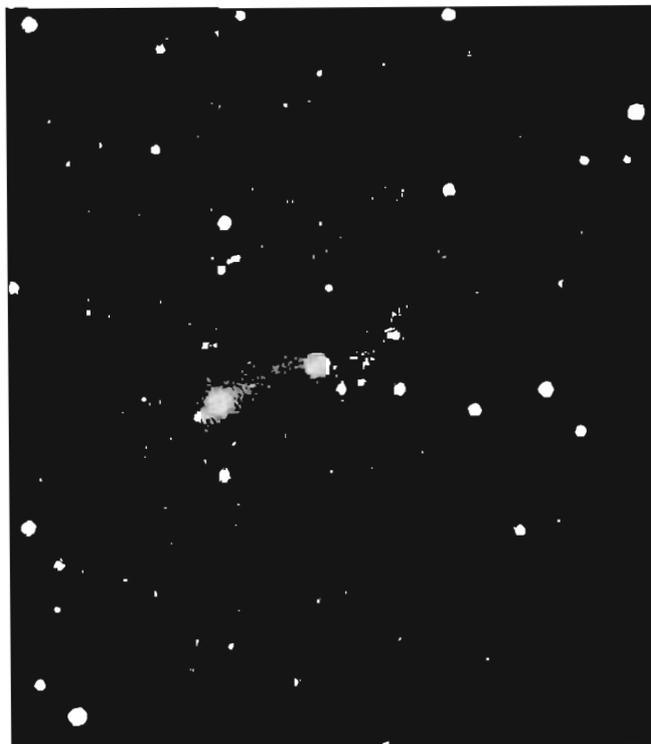
With the advent of two large Schmidt telescopes in the southern hemisphere, the ESO 100 cm Schmidt on La Silla and the 48" Schmidt at Siding Spring (Australia) of the Science Research Council of the United Kingdom (SRC), it became possible to carry out a southern survey. It was agreed to make a joint ESO/SRC two-colour atlas, the blue plates to be taken with the SRC Schmidt in Australia and the red plates with the ESO Schmidt in Chile. The first part of this atlas is now being published by the ESO Sky Atlas Laboratory in Geneva. It will be the subject of an article in a future issue of the "Messenger".

The ESO (B) Atlas

To produce the ESO/SRC Atlas is a long affair, due to the number of plates and the very strict quality criteria that must be satisfied before a plate is accepted for



Seyfert galaxy ESO-116-IG15, discovered on ESO (B) Atlas in the joint ESO/Uppsala programme. Radial velocity 8,600 km/s.



Interacting galaxy ESO-147-IG03. Radial velocity 12,600 km/s.

this survey. The need for a quick look into the southern sky was felt by many astronomers, in particular those associated with the large radio-telescope in Australia and the three new large optical telescopes in the south, the Anglo-Australian 3.9 m at Siding Spring, the CTIO 4.0 m on Cerro Tololo, Chile, and the ESO 3.6 m on La Silla. It was therefore decided, in 1973, to carry through, as quickly as possible, a preliminary blue survey of the southern sky from -90° to -20° declination with the ESO Schmidt telescope. More than three quarters of this survey have now been completed. It has been named the "Quick Blue Survey" or the ESO (B) Survey. The corresponding ESO (B) Atlas is being published by the ESO Sky Atlas Laboratory.

The ESO/Uppsala Search

In order to improve the usefulness of the ESO (B) Atlas and to help astronomers preparing their observations of southern celestial objects, ESO has been collaborating, since 1973, with the Uppsala Observatory in the identification of known objects and the discovery of new ones on the ESO (B) Atlas. The search programme identifies:

- (a) star clusters listed in the Budapest Catalogue,
- (b) planetary nebulae listed in the Perek and Kohoutek Catalogue,
- (c) galaxies with diameters larger than 1 arcminute listed in the NGC and IC catalogues and modern catalogues, and
- (d) disturbed galaxies down to the smallest possible size.

The ESO/Uppsala lists are published periodically in Astronomy & Astrophysics Supplement Series. While listed planetary nebulae and stellar clusters mostly com-

prise known objects, the situation is quite different for galaxies. Numerous new galaxies are listed, all the way from humble dwarfs to giant ellipticals, not to forget the dramatic scenery of interacting systems. By April 1976, 191 fields (4,474 sq. deg. in total) have been investigated out of the 471 atlas fields south of $-27^{\circ}5$ (11102 sq. deg.). Of the more than 5,500 objects which were found in these 191 fields, 70 per cent are new discoveries, including some 3,500 hitherto unknown galaxies. When mapping the apparent distribution of 3,593 galaxies (including interacting systems) with diameters larger than 1 arcminute, regions of high number densities can be recognized at (12^{h} , -45°) and (18^{h} to 21^{h} , -65° to -45°). Very few galaxies are of course found near the galactic plane. Most fields south of -45° have now been investigated.

Spectroscopic Observations of Galaxies in the ESO/Uppsala Lists

The ESO/Uppsala lists have already been extensively used by southern observers. At ESO, image-tube spectra have been obtained of several interesting galaxies in a pilot programme. This has resulted in the discovery of at least five new Seyfert galaxies. ESO and the Uppsala Observatory now collaborate in obtaining spectra of the most interesting ESO/Uppsala galaxies. Observing time has been allotted in July-August 1976 with the ESO 1.5 m telescope for the first concentrated effort in this important "treasure hunt" programme. Participating astronomers are Drs. Bergwall, Ekman, Lauberts and Westerland (Uppsala), and Drs. Breysacher, Muller, Schuster and West (ESO).

Day-time Observations with the 1 m Photometric Telescope

The efficiency of a telescope is measured not only in the amount of light it is able to collect, but also in the total observing time. A small telescope in a good climate may be much more useful than a big one in a cloudy place. Here Dr. W. Wamsteker, ESO staff astronomer, reports how to make even better use of the clear skies above La Silla:

The effective observing time available on the ESO 1 m telescope has recently been doubled. Because observations in the infrared are, similarly to radio observations, not very seriously disturbed by the bright daylight sky, it is possible to make observations at these wavelengths 24 hours a day.

The ESO 1 metre photometric telescope with its sophisticated telescope control system was selected to be the most appropriate telescope for the acquisition of infrared observations. To detect astronomical infrared signals, special requirements are posed on the telescope which could be fulfilled by the 1 m.

At ESO-Chile, an intricate linkage has been established between the telescope control system and the data acquisition system by Mr. Rönnbom and Dr. Wamsteker. This combined system was in full use for the first time in February 1976, for a joint observing programme of Wamsteker (ESO), Schultz, Kreysa, Sherwood (all from the Max Planck Institute for Radioastronomy, Bonn), using a sensitive InSb detector system designed by Dr. Kreysa. The observations were very successful and clearly showed the capabilities of such a system. During the day, the telescope was used in a fully automatic scanning mode to study the galactic centre. Six new infrared sources close to the galactic centre were discovered.

This first experience with a radioastronomical approach to infrared observing has been very encouraging and it is expected that after more experience the system can be improved and will also be applicable to other ESO telescopes.

The ESO Library in Geneva



The ESO Librarian-in-Chief, Miss E. Sachtschal, has been in touch with astronomy and astronomers for several years.

Gracefully responding to the editor's request, she here gives her impression of this important service:

One year ago, the ESO library in Geneva moved from the TP barrack to somewhat more comfortable and spacious surroundings with a splendid outlook to the Jura mountains.

In spite of the increased floor area, the library has just enough space for the next two years until the move to its final location in Munich. There, 250 m² are expected to satisfy all the needs of a modern astronomical library.

The library staff in Geneva tries to fulfil "nearly" all the literature wishes of the increased ESO group of astronomers and to make them happy by unearthing for them "Faint and Nearby Stars, Galaxies and Nebulae", even unseen "Black Holes", not to forget comets; in brief, anything printed in books, periodicals and atlases—and to complete the collection as far as the ESO library budget allows.

The most recent discoveries and news in astronomy in form of preprints coming from all over the world (in exchange to ESO papers) are also displayed in the library.

The library, "centre of the Astronomical Cosmos of ESO", has the tendency to a relativistic expansion, and there is "pulsating and rotating" life already around it in the form of theoretically driven, heated discussions.

It is the intention to bring in the "Messenger", from time to time, a brief review of certain astronomical problems, written by astronomers who have worked on them with ESO telescopes. Professor Adriaan Blaauw, Director-General of ESO from 1970 to 1974, and now Professor at the Leiden University, is one of the foremost authorities on the structure and kinematics of our Galaxy. We are much indebted to Professor Blaauw for having so positively responded to our request.

The McCormick Areas Programme

A. Blaauw

For several years now, work has been done with the La Silla telescopes on what we call the "McCormick areas programme". The following is a description of its aims and present status.

Its principal aim is to contribute to the studies of evolution in our Galaxy, especially its local evolution. The problem of the evolution of the Galaxy as a whole has been the subject of a variety of studies by many authors in recent years. Broadly speaking, we imagine the Galaxy to have acquired its present structure and composition as the result of a development starting with the gravitational collapse from a larger, probably roughly spherical gaseous mass in which star formation took place since the beginning. The present structure of the Galaxy then is the result of the initial conditions—among which the total angular momentum—and the time over which this process has been taking place. Understanding of the properties of the Galaxy in terms of such a theory of evolution is important also in connection with the interpretation of observations of other stellar systems; their evolution appears to have led to the well-known great variety of types of extragalactic systems.

Unravelling the evolution of the Galaxy as a whole is a very ambitious programme of which only small bits can be taken up at this time. One of these bits, and an obvious one, is the question of the local evolution. That is: can we understand the local properties of our Galaxy—i.e. those of its local content of gas and stars—as the product of the evolutionary process mentioned before? The approaches to this problem made so far appear promising. It is important in this context to realize that the majority of stars now present in "our" region of the Galaxy must have been formed under rather similar conditions, namely the conditions prevailing at distances between, say 8 and 12 kiloparsecs from the galactic centre. We base this statement on the study of the individual motions of the stars which shows that the region of star formation for most of them must have been within this ring-shaped zone. It is in this sense that we may speak of the local evolution—an evolution largely independent of, for instance, the remarkable processes taking place in the central regions of our Galaxy.

Basic observational information for these studies are the local relative amounts of interstellar matter and stars, and for each of these constituents, the chemical abundance distributions. The abundance distribution in the interstellar matter is considered to be the product of the initial composition (hydrogen, helium) and enrichment with heavier elements as a consequence of the formation of stars and their ejection of processed (enriched) gaseous material. The abundance distri-

bution of the stars depends on how the rate of star formation has changed in the course of time and on the gradual change in the chemical composition of the gas out of which the stars were formed.

In the frame-work of these investigations, we consider that an important piece of information is, within the local "zone", the variation of the local properties with the distance from the galactic plane. Whereas all the population up to, say 2,000 parsecs from the plane must be considered to belong to the local zone, this variation with distance from the plane must provide information relating to a basic feature of the local evolution: the gradual decrease of the thickness of the layer of gas out of which the stars were formed. Particularly the latest stages of the flattening of the system may well be revealed by the study of the stars accessible to our observational programme, as these do cover the last two-thirds or so of the estimated age of the Galaxy.

The McCormick areas programme has a bearing especially on the latter aspect. It aims at determining the properties of the local population up to distances of several kiloparsecs from the galactic plane by, first of all, studying the population in the direction of the galactic poles. Stars are classified according to their ages and chemical abundances by means of narrow-band photometry and these data are supplemented by measures of the kinematics of the stars (proper motions and radial velocities) and spectral classifications.

So far, photometry and proper motions have been finished in the polar cap areas which allow a first exploration of the problem. The photometry, although not of significant accuracy for the discussions of individual stars, has already revealed that there is a statistical relation between the mean chemical composition of the stars and the distance from the galactic plane in the sense anticipated on the assumption that the youngest and more metal-rich stars are more strongly concentrated to the galactic plane than the older ones. We find that over the distance range from 200 to 700 parsecs, the mean metal content decreases by a factor of about 0.5, in line with predictions based on the study of those stars which now are located near the plane but whose individual orbits reach well above or below it. For the study of this metal-content variation at larger distances from the plane, these predictions are insufficient and we will have to rely principally on the further results of our programme.

Our photometry was carried out partly on La Silla and partly at Kitt Peak Observatory in Arizona, USA. The proper motions, all measured at the McCormick Observatory in Charlottesville, Virginia, USA, are complete for the areas in the polar caps and the provisional analysis confirms the difference in kinematical behaviour we

would expect for stars of different ages and different distances from the galactic plane.

One of the intriguing questions within the context of the general problem of the local evolution is that of the occurrence of old, metal-poor stars. Theory so far has not satisfactorily accounted for the relatively small proportion of such stars in our local sample. A check on their real proportion is therefore especially desirable. One of the current surveys on La Silla, executed with the "Grand Prism Objectif" (GPO) aims at picking out

such "underabundant" old stars by searching for them in and around the McCormick areas at high and intermediate galactic latitudes.

An interesting feature of the McCormick areas programme is its broad base of international collaboration. Apart from Dr. West of ESO and myself are also involved Drs. C. R. Tolbert, Ph. Ianna and Katy Garmany of the McCormick Observatory, and Dr. R. A. Bartaya of the Abastumani Observatory in Georgia, USSR.

The ESO 3.6 m Telescope Control System Departs for La Silla

The ESO 3.6 m telescope control system, which left Geneva on May 2, 1976 for La Silla, has been developed by the Controls Group of the TP Division. It incorporates many novel features, some of which have also been implemented in other ESO control systems, notably those for the ESO 1 m photometric, the ESO Schmidt, and the Danish 1.5 m telescopes. The first two have in effect served as operational prototypes for several years (cf. ESO Technical Report No. 6, May 1975).

Although based on the same principles, the 3.6 m control system will have the possibility of a more automatic operation and more precise presetting and tracking, thereby facilitating the optimal use of the available observing time.

In addition to the integral computer (System 1) that serves as controller for all hardware components of the telescope, a larger computer configuration (System 2) serves as an operator for System 1. It performs continuous corrections for the telescope flexure, the refraction caused by the terrestrial atmosphere, and other reproducible non-linearities. It also allows the observer to prepare an observation file on the computer's disc storage and to edit his files by means of an alpha-nume-

ric terminal. Several of these terminals are available and may be used simultaneously.

System 2 is also ready for connection to other, similar "front-end" computers, for instance the computer connected to a photometer or a spectrograph with a scanner.

Several months will now pass, before the System 2 computer will really start serving astronomy. It may be compared to the 3.6 m telescope building, which had to be erected basement first, although the astronomical observations take place only on the upper floors. To begin with, System 2 will be used for development and running-in of programmes, to test the electronic hardware, and later for the important check-out of the large optical elements by Hartmann and coma tests.

Upon arrival on La Silla, the 3.6 m telescope control system will first go to work in the so-called "1-metre mode", in which the System 1 computer does the job alone, without help from System 2. However, when a more detailed knowledge of the pointing, focusing, and alignment performance of the mechanical and optical structures becomes available, System 2 will gradually be charged with responsibility for these tasks.



Main desk of the ESO 3.6 m telescope control system in the ESO assembly hall before departure to La Silla.

The 3.6 m Telescope on La Silla

The 3.6 m telescope project is progressing well reports Dr. S. Laustsen from La Silla. The transfer of the mechanical parts from the ship to the mountain was supervised by D. Plathner from the ESO TP Division. This is his story about four exciting days:

In the morning of April 7, 1976—after a long trip of about eight weeks—the Spanish motorship "Riviera" finally arrived in Coquimbo with the mechanical parts of the 3.6 m telescope in its hold.

An armada of 23 heavy trucks was lined up opposite the ship: more than 450,000 kg were waiting for unloading... 36 truck drivers and helpers, 56 dockers and about a dozen Creusot and ESO people had to coordinate their work. Walkie-talkies snarled their commands. The first boxes showed up and were placed onto the trucks, accompanied by excited shouts from the dockers.

An exciting and for the uninitiated visitor somewhat complicated show began. Truck after truck was ordered to the shipside and one or more boxes were lowered by the crane. The loading of the trucks was planned in great detail, and the trucks were called upon according to the appearance of the crates.

Already at 5 p.m., 80 per cent of the cargo had been safely loaded according to the planning, and it became clear that the operation would be finished a day earlier than expected.

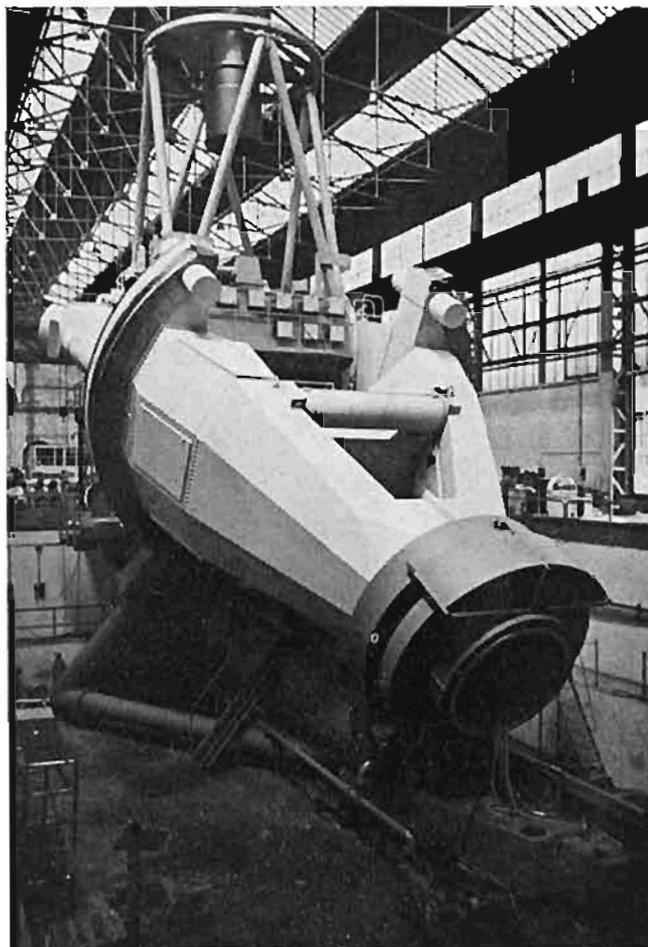
Early the next morning, a 500 m long row of heavily-loaded trucks were waiting for the signal to leave for Pelicano. At 7.30 a.m., the police escort switched on its flash lights, the whole area was trembling by the motor noise and the precious caravan got under way. The speed was low and the sun came out early so that the check-point of Incahuasi—about 100 km north of Coquimbo—was reached only after lunch time.

ESO had provided for a rolling restaurant, and an excellent meal was served to more than fifty people aside the Panamericana under the burning sun.

At 3 p.m. everybody continued and started the attack on "La cuesta de pajonales", the last high pass before the turn-off of the ESO road to Pelicano. There the big trucks arrived at sunset and were halted on the "ring-road" of the camp, giving a nearly perfect imitation of an old prairie-schooner camp.

The third day was full of problems. Nearly all trucks had difficulties in climbing certain passages on the La Silla road. Two heavy front-loaders and two big scrapers had to give permanent assistance to the trucks (which were only 60 per cent charged) and pull them through the sharp bends at kilometre 5 and up the last steep slope from pumping station No. 2.

But also this day could be finished successfully. At about nine o'clock in the evening, all trucks had reached the parking area on the top of the mountain. As unloading had already started the previous day, it was only a matter of hours on the fourth day, before the boxes were all stored in the area around the Danish and GPO telescope buildings.



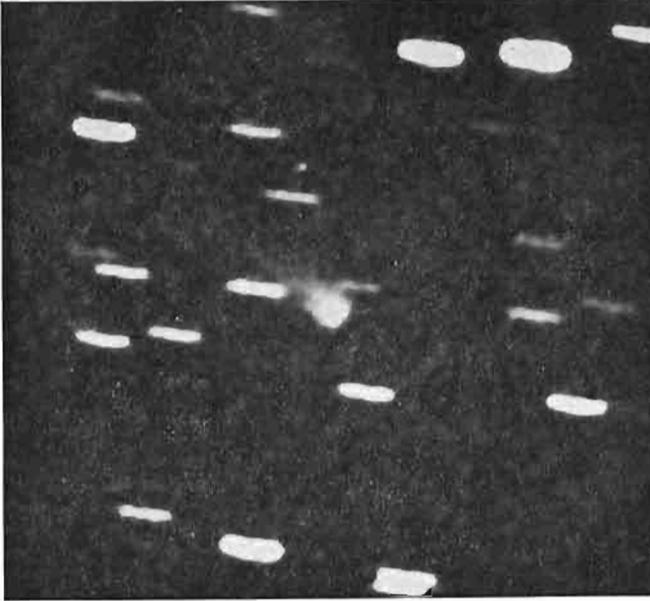
To end this story about excellent cooperation and goodwill of all participating people, it should be added that the last box had not yet touched the ground when the crew of Creusot were already working with their motor-saw to open the crates and to prepare the king-size Meccano of the ESO 3.6 m telescope for assembly.

Another Fine Comet from ESO

The European Southern Observatory was certainly not built for the noble art of comet-hunting, nor does this kind of astronomy constitute one of ESO's main lines of research. Nevertheless, the name of ESO was recently connected with two important discoveries of "haired stars".

Comet Schuster (1976c)

The third comet of 1976 was found on March 1, 1976 by Dr. Hans-Emil Schuster, in charge of the ESO Schmidt telescope. He noticed the faint, diffuse trail on a plate taken for the ESO (B) Survey a few nights before. Observations on March 2 to 6 confirmed the comet and a first orbit by Dr. B. Marsden, Cambridge, Mass., USA, showed that Comet Schuster was very far from the Sun. Further observations at ESO and other observatories around new moon on March 30, made it possible to confirm that the comet has the largest perihelion distance on



Comet Schuster on March 6, 1976, 40 min. exposure with ESO 1 m Schmidt telescope.



Comet West on March 4, 1976, 10 min. exposure by C. Pallard (CERN) and B. Pillet (ESO) from Col de la Faucille, near Geneva.

record, 1,030 million kilometres. The perihelion passage took place already in January 1975, but no plates appear to have been taken early 1975 in the corresponding direction.

With its large distance (on June 1, 1976, Comet Schuster is 1,138 million kilometres from the Earth, almost as far as the planet Saturn), this comet will never become a bright object. However, its present apparent magnitude (16–17) indicates that it is indeed a very large comet. It is a most interesting object and will certainly be observed with large telescopes during the coming years.

Contrary to comets close to the Sun, the icy nucleus of Comet Schuster may be observed directly without interference of surrounding gases (the coma), and its albedo (ability to reflect light) may be determined. This in turn gives important information on the constitution of the cometary nucleus, which is believed to be a small piece of material left over at the formation of the Solar System.

Comet West (1975n)

Proving once more that predictions about the brightness of comets are difficult if not impossible, this comet (cf. the "Messenger" No. 4, March 1976, page 8) reappeared on the eastern morning sky in early March, almost 2 magnitudes brighter than foreseen. It thus became one of the brightest in the 20th century and was observed intensively by amateur and professional astronomers alike. Some results have already been published in the IAU Circulars. Of special importance were the discovery of CO^+ in the coma during extreme ultraviolet observations from a NASA rocket and the measurement of two OH emission lines at 1665 and 1667 MHz with the NRAO 91 m radio telescope. The head of the comet broke into four pieces at the time of perihelion passage, probably due to internal stresses from the intense heating by the Sun. The four nuclei slowly disperse under continued observation by those astronomers who hope that the relative motion may give clues to the comet's mass, a quantity largely unknown for comets.

Comet West now recedes quickly from the Sun and, due to perturbations from the major planets, it will only return in about one million years from now.

The ESO Guesthouse

Imagine that you sit twenty or more hours in a narrow seat in the cabin of a plane, packed to the limit with passengers, their bags, boxes and any other conceivable kind of container for "hand"-luggage; imagine that you finally, after those long hours, step out in a foreign city, a foreign country, on another continent, even another hemisphere. Or imagine that you are on your way back to Europe after several, possibly many weeks of hard observing on La Silla, that place where even hard-boiled observers finally start mumbling secret prayers for just one, oh just one night with enough clouds to . . .

The pioneers of ESO could very well imagine this. And they also knew the remedy: a quiet place in Santiago de Chile, where tired astronomers could regain their forces before and after their observing runs. They found the ideal place, a fairly large private house on Calle

Gustavo Adolfo 4634, in the residential area Vitacura. In 1965, the house was bought at a very reasonable price and it has ever since been known as the ESO Guesthouse or the "Casa de Huéspedes".

In the four years from 1965 to December 1968, the house accommodated the administrative office of ESO in Santiago, before the Vitacura Headquarters was ready.

Almost all European astronomers who have observed on La Silla have also spent at least some days in the Guesthouse. During periods of peak load, it has been necessary to lodge astronomers and other visitors in hotels, but a recent transformation has now brought the capacity up to twelve simultaneous guests. This should hopefully take into account the expected increase in the astronomer influx, when the ESO 3.6 m and the Danish 1.5 m telescopes come into operation.

Mrs. Hilde Fritsch, who lives at the Guesthouse, takes care of the daily management. A long-time resident of Santiago, she joined ESO in her present function already in 1969, and innumerable are those astronomers and other visitors who have profited from her friendly help and expert advice. Her guidance to those first-time visitors to Santiago who "just want to buy something typical for their wives, etc." is legendary—and how many would have visited profitably Santiago's famous "Mercado Persa" without her help?

For those ESO employees who bring their family to Chile, the ESO Guesthouse has been a very useful initial station in Chile. No doubt, many wives have learned here some of the subtle differences between European and Chilean housekeeping!

Three Chilean staff and one outside help are employed in the ESO Guesthouse. The garden is extremely well kept and so is the house. Some people, in distant Europe or passing quickly through Santiago, have expressed the view that keeping the ESO Guesthouse is not necessary. But very few astronomers, if any, who have returned from the desert surroundings on La Silla to the lush greenery of the ESO Guesthouse will agree hereto.



The ESO Guesthouse

ESO BOOKLET. A 16-page, two-colour booklet on ESO is now available from the ESO Administration in Hamburg. It has been compiled by Mr. E. Shaw, Geneva, editor of "Europhysics News".

The booklet gives brief background information about ESO and its history, the La Silla Observatory, the ESO Scientific-Technical Centre in Europe and, not the least, the astronomical research carried out at ESO.

The ESO booklet will be sent to those who already receive the "MESSENGER". Further copies are available on request.

Please note the change of address from July 1st, 1976 (cf. p. 4).

STAFF MOVEMENTS

Since the last issue of the "Messenger", the following staff movements have taken place:

ARRIVALS

Hamburg

Calixte Stefanini, French, head of personnel

Geneva

Leon Lucy, British, astronomer (paid associate)

Jacqueline Bergeron, French, astronomer (paid associate)

Gonzalo Alcalá, Chilean, astronomer (student)

Chile

Erik de Brey, Dutch, administrative officer

DEPARTURES

Hamburg

Jean-Claude Carreau, French, head of personnel

Geneva

John Danziger, Australian, senior astronomer

Christophe Faraut, French, systems programmer

Dominique Liège, French, clerk-typist

Chile

Louis Campusano, Chilean, student

Jean Pallsson, French, administrative clerk

ALGUNOS RESUMENES

Seminario sobre estudios ópticos de las fuentes de rayos X

Con fecha 28-30 de abril de 1976, el primero de una serie de seminarios se ha llevado a cabo en Ginebra en el Centro Científico-Técnico de ESO.

El propósito de estos seminarios es analizar el presente estado de conocimientos, comparar métodos y resultados, y en particular coordinar planes futuros.

El primer seminario se refirió a las observaciones ópticas de las fuentes compactas de rayos X. Hay por lo menos una docena de grupos trabajando en este campo en Europa y estos usan una inmensa variedad de técnicas.

Al seminario asistieron unos treinta científicos especialmente invitados de todos los países de ESO, como también de Inglaterra, Italia y los Estados Unidos.

El sistema de control del telescopio de 3,6 m parte a La Silla

El 2 de mayo de 1976, el sistema de control del telescopio de 3,6 m partió de Ginebra hacia La Silla. Este sistema ha sido desarrollado por el Grupo de Control de la División TP e incorpora varias innovaciones, algunas de las cuales han sido implementadas también en otros sistemas de control de ESO.

ESO, the European Southern Observatory, was created in 1962 to . . . establish and operate an astronomical observatory in the southern hemisphere, equipped with powerful instruments, with the aim of furthering and organizing collaboration in astronomy . . . It is supported by six countries: Belgium, Denmark, France, the Federal Republic of Germany, the Netherlands and Sweden. It now operates the La Silla observatory in the Atacama desert, 600 km north of Santiago de Chile, at 2,400 m altitude. Seven telescopes with apertures up to 1.5 m are in operation; a 3.6 m telescope will become operational in 1976. The astronomical observations on La Silla are carried out by visiting astronomers—mainly from the member countries—and, to some extent, by ESO staff astronomers, often in collaboration with the former.

The ESO Headquarters in Europe will be located in Garching, near Munich, where early in 1979 all European activities will be centralized. The Office of the Director-General (mainly the ESO Administration) is at present in Hamburg and the scientific-technical group in Geneva, at CERN (European Organization for Nuclear Research), which since 1970 has been the host Organization of ESO's 3.6 m Telescope Project Division.

ESO has about 120 international staff members in Europe and Chile and about 150 local staff members in Santiago and on La Silla. In addition, there are a number of Fellows and Scientific Associates.

The ESO MESSENGER is published in English four times a year: in March, June, September and December. It is distributed free to ESO employees and others interested in astronomy.

The text of any article may be reprinted if credit is given to ESO. Copies of most illustrations are available to editors without charge.

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Printed by Lütcke & Wulff, Heidenkampsweg 76 B, 2000 Hamburg 1, Fed. Rep. of Germany

La Casa de Huéspedes de ESO

En Santiago de Chile hay un lugar ideal donde los astrónomos pueden recuperar sus fuerzas después del viaje de Europa a Chile y después de las observaciones en La Silla: la Casa de Huéspedes en Calle Gustavo Adolfo 4634, en el sector residencial de Vitacura.

Casi todos los astrónomos europeos que han observado en La Silla han pasado por lo menos algunos días en la Casa de Huéspedes. En período de mucho trabajo ha sido necesario hospedar astrónomos y otros visitantes en hoteles, pero cambios recientes han logrado poder tener una capacidad para tener doce visitantes a la vez. Esperamos que esto sea suficiente para el pronto y esperado aumento de astrónomos cuando el ESO 3,6 m y el telescopio danés de 1,5 m comiencen a operar.

Folleto ESO

Un folleto sobre ESO de 16 páginas en dos colores está desde ahora disponible en la Administración de ESO en Hamburgo.

Este folleto da una pequeña información acerca de ESO y su historia, el Observatorio en La Silla, el Centro Técnico-Científico ESO en Europa y la investigación astronómica llevada en ESO.

El folleto ESO será enviado a aquellos que ya reciben el « Mensajero ». Ejemplares adicionales pueden ser obtenidos a pedido.

Cambio de la Administración de ESO de Hamburgo a Munich

El 1.º de julio de 1976, la Oficina del Director General de ESO se cambia desde Hamburgo-Bergedorf a Garching, cerca de Munich, donde la sede principal europea de ESO será construida (ver « El Mensajero » N.º 4, marzo 1976). La nueva dirección es:

ESO
Oficina del Director General
Schleißheimer Straße 17
D-8049 Garching (Munich)

First ESO Slide Set Now Available!

The European Southern Observatory is happy to announce the first photographs from the ESO 1 m Schmidt telescope in Chile. They are available in the form of slide sets consisting of 20 5 x 5 cm, black-and-white slides with brief descriptions, and show some of the southern sky's most spectacular and beautiful objects, including the Magellanic Clouds, The Eta Carinae nebula and Omega Centauri.

The price of this magnificent slide set is Swiss francs 16.— (or the equivalent) for Europe, and US\$ 6.— by surface mail to all other countries, or US\$ 8.50 by airmail (to be paid in advance).

Send cheque or bank draft to:

EUROPEAN SOUTHERN
OBSERVATORY
Alte Holstenstraße 1
D-205 HAMBURG 80

COMMERZBANK, Hamburg,
Account No. 8104442

Please note the change of address from July 1st, 1976 (cf. p. 4).

† M. Alain Beal

We deeply regret to announce the death of Monsieur Alain Beal, mechanic of the Creusot team now erecting the 3.6 m telescope on La Silla.

Monsieur Beal died on April 26, 1976 from the consequences of a fall from a height of eight metres in the telescope building.

He was thirty years old, married and lived in St. Chamond, France. He had already taken part in the test assembly of the 3.6 m instrument in Europe.

All who have worked with him feel deeply the loss of a young colleague who was always most friendly and cooperative.

D. Plathner

LATEST NEWS

3.6 m Horseshoe in Place

La Silla, May 26, 1976. Dr. S. Laustsen, in charge of the ESO 3.6 m telescope project, informs that the big horseshoe (diameter 9 metres, weight 37 tons) has now been mounted. The hydraulic system has been installed and oil will be pumped into the pads of the hour axis in a few days time, so that this axis can then be turned by hand. The assembly of the 3.6 m telescope is proceeding very well indeed.