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The ESO VLT Project: Current Status

Since the last report about the ESO Very Large Telescope in the *Messenger* (**44,** 37; June 1986), this project has passed an important milestone on its way towards realization. More than 80 scientists and engineers from the ESO member countries (and beyond) met in Venice by the end of September 1986. During one week they made a detailed assessment of this ambitious undertaking, which aims at the construction of the world's largest optical telescope. There was unanimous agreement that the present concept is near the optimal, that it is technologically feasible and can be realized within approximately 10 years after funding has been decided upon, and that it will allow European astronomers to perform new and spectacular investigations of the universe, unparalleled elsewhere. Completion is aimed at in 1998 but part of the VLT may become operational already in 1993.

The "Workshop on ESO's Very Large Telescope II" was held on the premises of the Giorgio Cini Foundation, Venice, Italy, from September 29 to October 2, 1986. The four days of discussion were appropriately closed with a very positive appraisal of the VLT project by Mr. Luigi Granelli, Italian Minister for Coordination of Scientific Research and Technology. The minister emphasized the important impact of the project on European science and technology and also stressed the leading role of Europe in this field.

During its meeting on October 3, 1986, the ESO Scientific and Technical Committee (STC), decided to recommend that the present concept of the VLT project be provisionally accepted

Model of an 8-m unit telescope.

The Italian Minister for Coordination of Scientific Research and Technology, Mr. L. Granelli (right), and the Director General of ESO, Professor L. Woltjer, at the Second VLT Workshop in Venice.

by the ESO Council. It is expected that the definitive, detailed project proposal will be presented in April 1987 and that a final decision, including the financing by member states, may be taken later in 1987. The cost of the VLT proper is estimated at 309 million DM plus 48 million DM for auxiliary instrumentation.

The ESO VLT project consists of an array of 4 telescopes, each of which has a single-blank mirror with a diameter of 8 metres, resulting in a total, equivalent aperture of 16 metres. The telescopes can be used individually or combined, depending on the type of observations, giving an unprecedented degree of flexibility and greatly enhancing the observing efficiency. During the past two years, several specialized Working Groups have evaluated the scientific programmes which can be envisaged with the ESO VLT. Among these, observations of the faintest and most distant quasars and galaxies will have a profound impact on cosmology, the study of the structure and evolution of the universe in which we live. High-resolution spectral observations will allow a detailed chemical analysis of individual stars in our own and in other galaxies, contributing to our knowledge of the evolution of galaxies and the genesis of elements. When used in the interferometric mode, the VLT will achieve angular resolutions in the milliarcsecond range and permit observations of the innermost regions of for instance starforming areas and galaxy nuclei which may have black holes near their centres. These are but a few of the many, extremely interesting observational possibilities with the ESO VLT which were identified by the Working Groups and discussed in Venice.

The technologically most advanced auxiliary instrumentation is needed to perform these observations and much time was dedicated to this central subject. A great variety of instruments, imaging and spectroscopic, visual as well as infrared, were proposed. Based on these suggestions, a preliminary fundamental instrumentation payload for the VLT will now be established and circulated for further discussion in the user community. It was stressed that it is the intention to involve national laboratories in the member countries in the construction of these complicated, high-technology instruments, although a major part of the necessary funds will have to come through ESO.

Among the still unresolved questions is the choice of a site for the VLT. Detailed meteorological observations have confirmed the excellency of the La Silla site, but even better observing conditions may possibly be found on the top of mountains further north in the Atacama desert. Following local investigations, a promising site has been identified at Cerro Paranal, about 150 kilometres south of the town of Antofagasta. There is a clear consensus that the "seeing" (a measure of the atmospheric turbulence which degrades the sharpness of astronomical images) will play a decisive role in the choice of the VLT site. However, other considerations like cost of development of a new site must also be taken into account. In this context, a reduction in operating costs may be obtained by extended use of remote control of the VLT, for instance from Europe. This is now thought feasible, in particular after a very successful experiment earlier this year, during which a 2.2 m telescope on La Silla was controlled via a computer-to-computer satellite link by astronomers at the ESO Headquarters in Garching.

Since the Venice Workshop, several meetings have been held in the member countries and the ESO scientists and engineers have given informative talks about the VLT in a variety of places. With the support of the Institut National des Sciences de l'Univers (INSU) and its director, M. Berroir, a VLT press conference took place at La Villette, Paris, on November 13. The ESO Finance Committee discussed the VLT project during its meeting later in November, as will the ESO Council, when it meets at the ESO Headquarters on December 11 and 12, 1986.

In order to keep to the tight VLT schedule, ESO is engaged in an extensive preparatory programme. Since the time schedule is set by the acquisition of the optics, some work on a prototype 8-m blank should start already in 1987. Both conventional mirror materials, but also aluminium and steel are being tested at ESO. All mirrors will be exceptionally thin in order to reduce weight and thereby significantly save cost. ESO has recently successfully tested the principle of "active" optics, by computer controlling the surface of a thin 1 metre mirror. This new concept will play a decisive role in the VLT, so that it can achieve a superior performance when it enters into operation.

Note that the Proceedings of the Venice Workshop and a VLT Slide Set are now available from ESO; see the advertisement in this issue of the *Messenger*.

The Editor

Open House at ESO-Garching

On October 25, 1986, the science institutes in Garching again jointly organized an Open-house day. Preparations were made at ESO during the weeks before, establishing a well-defined path through the ESO Headquarters with demonstrations and exhibitions along the route.

When the doors opened at 9 a.m., several visitors were already waiting outside and during the next 7 hours, the overworked ESO staff guided about

2,500 interested persons through the building, compared to about 500 the years before. Whatever the reason, an unprecedented number of persons had decided to take the opportunity to visit our organization and learn about our work. Each of them was welcomed at the entrance and received an ESO brochure. The models of the Very Large Telescope and the New Technology Telescope were much admired and the auditorium was filled to the very limit when the ESO film was shown every 30 minutes. In the terminal room, the advanced image processing systems caught the eyes of computer-minded persons and the children enjoyed the instantly plotted TV pictures. The names and orbits of minor planets again attracted much interest and the major pictorial exhibition about ESO and the science which is done at La Silla led to extensive discussions. At the exit, there was a hectic sale of ESO pictures and slides and many orders were received during the following days from people who had taken along the Picture and Publications Catalogue.

The overwhelming, but extremely welcome influx may be taken as a sign of the greater visibility of ESO.

New Light on the Binary Planet Pluto-Charon

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Earthbound observers currently witness a rare celestial phenomenon that will only recur in about 120 years. Presently the plane of Charon's inclined orbit around Pluto is sweeping over the inner solar system allowing mutual occultations and transits of the planetary disks to be observable from earth (cf. Fig. 1).

Since the shapes of the resulting light curves reflect the geometry of the system, we may hope to determine the relative sizes and albedos of the two bodies with much better accuracy than previously possible. This technique is of course well known in astronomy as much of our knowledge of stellar radii for instance has been derived from the analysis of the light curves of eclipsing binaries.

Due to the expected errors in the rel-

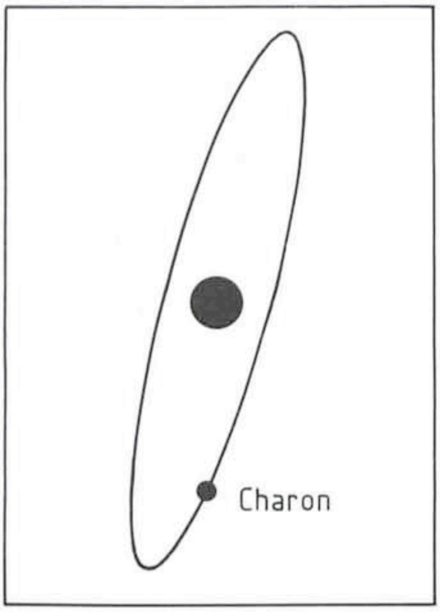

Fig. 1: *The $6\overset{d}{.}4$ orbit of Charon around Pluto as seen from earth a few years ago. The orbital inclination with respect to the plane of the sky is now near 90 degrees.*

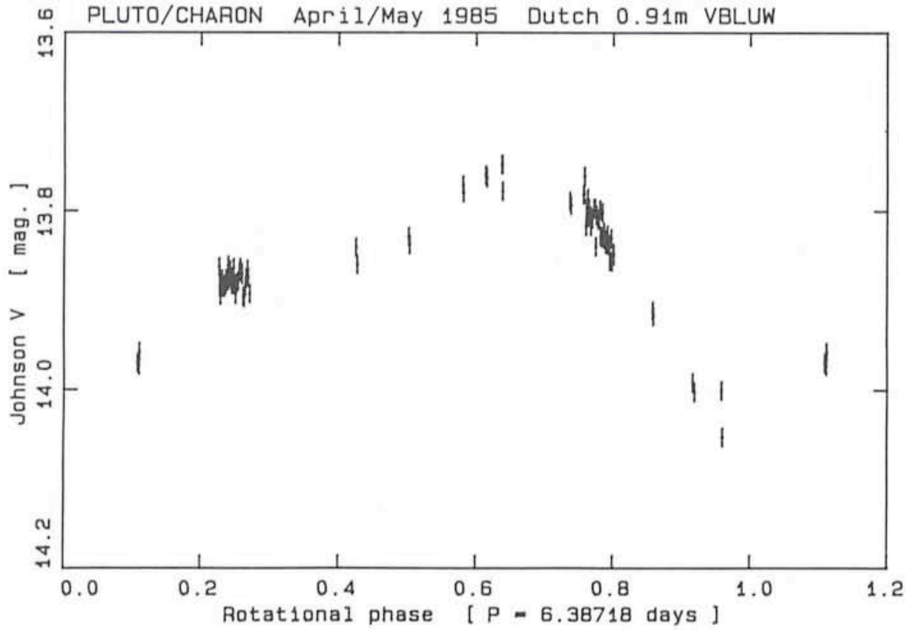

Fig. 2: *The rotational light curve of Pluto observed in 1985 April/May with the Dutch 90 cm telescope. Note the rapid decline in brightness between rotational phases 0.7 and 0.95. Conjunction of Pluto and Charon appear around phases 0.25 and 0.75 where the coverage is densest (cf. Fig. 4).*

evant systemic parameters of Pluto/Charon, the onset of the mutual eclipse series was uncertain until about 2 to 3 years ago.

We started to search for these events in 1982 with the Walraven photometer on the 0.9 m Dutch telescope on La Silla in the course of an observing programme which was mainly aimed at a photometric study of massive X-ray binaries and cataclysmic variables.

In a previous issue of the *Messenger* Baier, Hetterich and Weigelt (1982) reported on their speckle interferometry of Pluto and Charon which subsequently has allowed important refinements of the orbital parameters.

The Rotational Light Curve of Pluto

Although we did not observe any eclipses before April 1986, we have, nevertheless, been able to cover the relatively smooth but asymmetric rotational light curve of Pluto. As shown in Fig. 2, the planet's visual brightness presently varies between 13.8 and 14.0 in its 6.4 d cycle. This period has first been determined by Walker and Hardie (1955). Since then, the "absolute" mean magnitude V (1.0), which is related to the brightness the planet would have if it were placed one astronomical unit from both the sun and the earth, has increased by 0.3 mag. At the same time, the amplitude of the rotational light variations has become significantly larger.

This result has been interpreted by the fact that the rotational axis of Pluto is highly inclined with respect to its orbit around the sun and that some years ago we were looking more onto one of the relatively bright poles, whereas now we see Pluto in an equator-on configuration with dark and bright regions unevenly distributed over the surface of the planet.

To our surprise, Pluto's (synodic) rotational period, quoted in recent publications, has not been substantially refined from the value (6.3867 ± 0.0003) derived more than 20 years ago. Some authors did not even distinguish between the observed (more or less synodic) and sidereal (intrinsic) rotation rate.

For the determination of the sidereal value one needs to know the relative orientation of the rotational axis with respect to the orbital plane around the sun. Since there is now good reason to believe that Pluto's equatorial plane

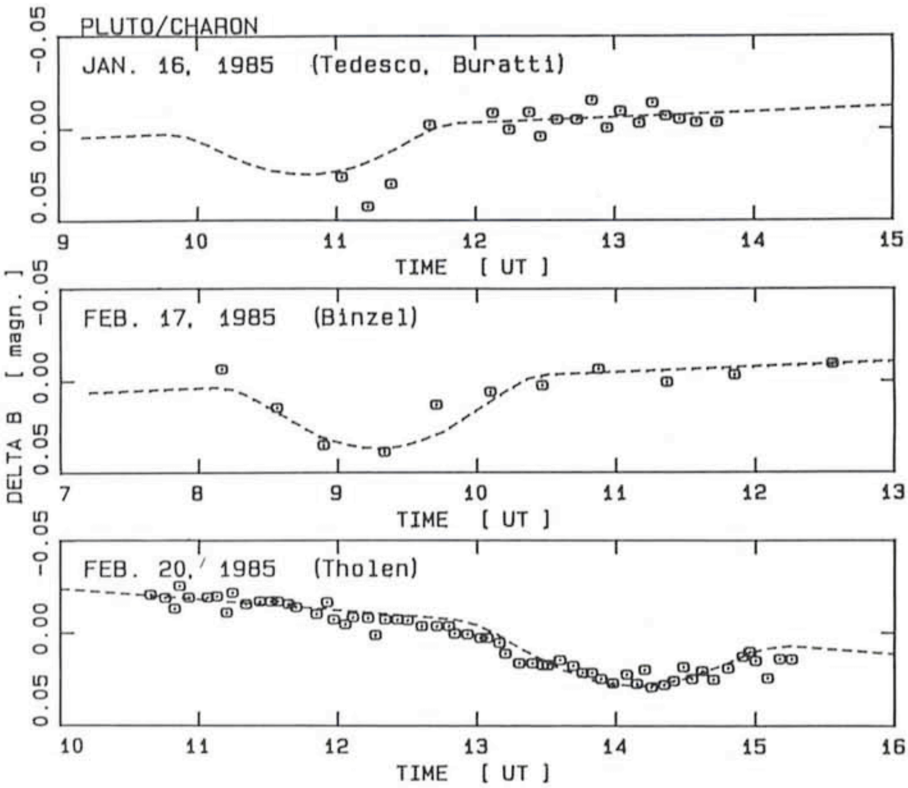

Fig. 3: *The first mutual eclipses of Pluto and Charon reported by Binzel et al. (1985) in early 1985. The dashed line represents our model light curve.*

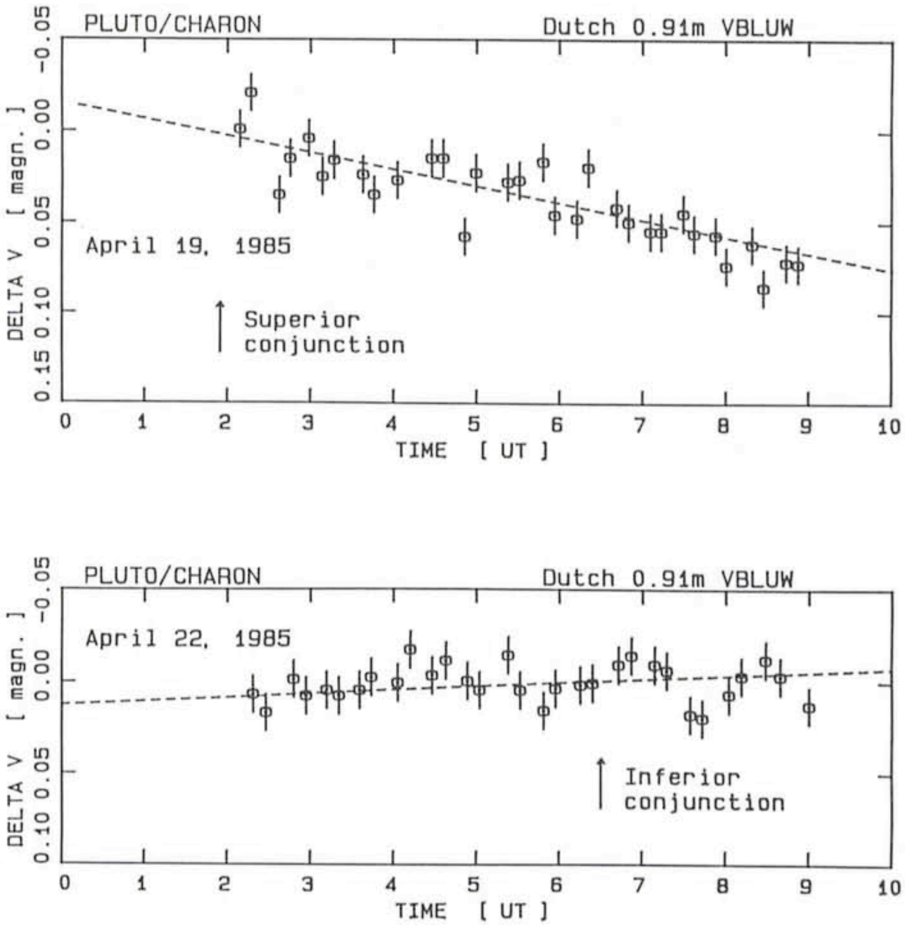

Fig. 4: *The light curve near expected eclipses on 1985 April 19 and April 22. Note that no events appear to be present only 2 months after the last observations by Tholen (cf. Fig. 3).*

coincides with that of Charon's orbit, this exercise can easily be done.

Assuming that the rapid decline in brightness, which was also a prominent feature in the earlier light curves, corresponded to the same rotational phase, we derived a much improved sidereal rotation period of Pluto, namely 6.38718 ± 0.00009 d.

Eclipse Observations

In early 1985 the first shallow eclipse events were observed near preopposition quadrature (Binzel et al., 1985; cf. Fig. 3). We obtained quasi-continuous measurements with the Walraven photometer attached to the Dutch 0.9 m telescope on April 19, 1985, and on April 22, 1985, when Charon was suspected to be at superior/inferior conjunction. No eclipse-like event was seen in either of these observations to a limit of about 0.01 mag (cf. Fig. 4). Due to its yearly motion around the sun, the earth apparently had moved away from the Pluto-Charon orbital plane during Pluto's opposition period. Thus, the eclipse series ceased in 1985 and probably started again by the end of the year.

On April 2, 1986, a transit of Charon in front of Pluto, and on April 18, 1986, an occultation of Charon by Pluto were observed with the ESO/MPI 2.2 m and the Danish 1.5 m telescope, respectively, using CCD direct-imaging techniques which allow high precision intensity measurements even if sky conditions are not strictly photometric. Both observations started with the event near mid-eclipse (the ingresses occurred while Pluto was beyond airmass 2.0) and yielded unexpectedly deep minima (cf. Fig. 5).

The analysis of the light curves was done using models for eclipsing binaries with spherical components assuming no limb darkening.

Seven parameters are of importance: the ratio of the satellite's radius to the planetary radius, the planetary radius (in units of the distance between the centres of Pluto and Charon), the albedo ratio Charon/Pluto, the apparent inclination of the satellite's orbital plane with respect to the plane of the sky, the binary (sidereal) orbital period P and the times of inferior/superior conjunctions.

Due to the difference between the direction to the sun and to the earth as viewed from Pluto/Charon, the light curves may be complicated by shadow transits which occur displaced in time relative to the eclipse events. At the dates of our observations, the shadows of Pluto/Charon projected onto the celestial sphere preceeded the planetary disks. Thus, shadowing affected only the ingresses of the events which were not observed by us.

The observations were corrected for light time effects, the varying orbital longitude of Charon at superior conjunction and the variable apparent inclination of Charon's orbit.

Parameters of the Pluto/Charon System

Combining our observations with the early events reported by Binzel et al. (1985) we made a multi-parameter least-squares fit using the model light curves. It is interesting to note that the allowed range of parameters is also strongly restricted by the non-detection of eclipses in April 1985. The best solution yielded the physical parameters of the system given in Table 1.

The radii of (1100 ± 70) km derived for Pluto and of (580 ± 50) km for Charon are significantly lower than those found by previous observers using speckle interferometric techniques who reported radii of Pluto to be in the range of 1300 . . . 2000 km. On the other hand, our values are consistent with the Pluto upper limit ($<$ 1700 km) obtained from far-infrared observations (Morrison et al., 1982) and the Charon lower limit of 600 km derived from stellar occultation work (Walker, 1980). Note that older textbooks quote values in excess of 2500 km!

From the planetary radii and the total mass of the system (0.0017 earth masses; Tholen, 1985 we find a systemic average density (2.1 ± 0.5) g/cm^3 which is comparable to that of the major satellites of the outer planets.

These results do not confirm suggestions based on earlier density estimates of less than 1 g/cm^3 that Pluto consists mainly of frozen volatiles. The geometric albedos of the occulted areas of Pluto and Charon (0.63 ± 0.10, 0.49 ± 0.10, respectively) are similar to those reported for Triton and the icy satellites in the Jovian and Saturnian systems (Klinger, 1985) and are, furthermore, consistent with the detection of methan ice on Pluto.

Assuming that the derived albedos are typical for the whole surfaces, we find Charon should be covered with slightly darker material than Pluto.

The sidereal orbital period of Charon resulting from our eclipse analysis agrees within the error limits with the sidereal rotational period of Pluto. The deviation from corotation must be less than 0.003 %! The orbit of Charon seems to be perfectly circular with an upper limit to the eccentricity ($e \cos \omega$) of 0.002. This confirms that the Pluto-Charon system is completely tidally evolved.

The present series of eclipses is estimated to continue until 1990 with central eclipse events expected for 1987. Further observations of mutual eclipses will improve the determination of the physical parameters of the system and allow to analyse the influence of non-uniform albedo distribution on the form of the eclipse/transit light curves. Combining all available eclipse observations will yield gross albedo maps of one hemisphere of each component.

Since no planetary mission to Pluto is scheduled in the near future, this kind of investigation will remain the only opportunity to improve our knowledge about the outermost known planet in the solar system. Even Space Telescope will hardly provide the resolution to observe surface structures on Pluto or Charon.

Comparison with Recent Results Reported by Other Groups

After submission of our investigation to *Astronomy & Astrophysics* and publication of the ESO press release PR 09/86 we have learned that (not unexpectedly) several groups of American astronomers have also analysed their eclipse observations in a similar fashion.

Dunbar and Tedesco (1986) derived the radii of Pluto and Charon to be 1150 ± 50 and 750 ± 50 km, respectively.

On the other hand, according to the Dec. 1986 issue of *Sky and Telescope*, Tholen and Buie estimated radii of 740 and 420 km which, however, were later revised (Tholen, private communication) to be 1145 ± 46 and 642 ± 34 km.

In particular the latter results are in excellent agreement with our findings.

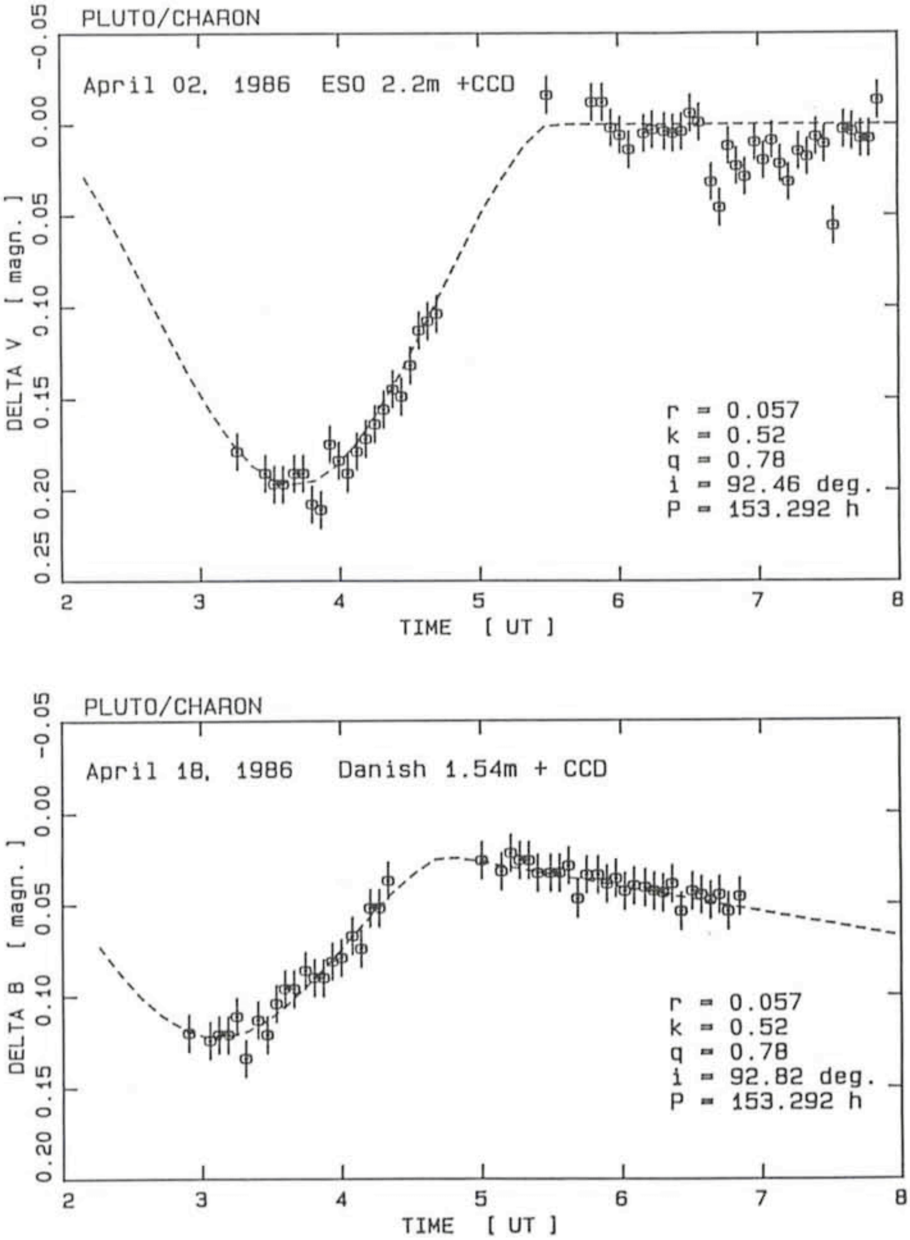

Fig. 5: *Mutual eclipses with depths of 0.20 and 0.13 mag, respectively, are visible in our CCD light curves on 1986 April 2 (transit of Charon in front of Pluto) and April 18 (occultation of Charon by Pluto). As in Fig. 3 and 4 our model is superimposed on the observed light curve.*

	Pluto	Charon
Radius (km)	1100 ± 70	580 ± 50
Orbital radius (km)	19130 ± 460 (Tholen, 1985)	
Average density (g/cm^3)	2.1 ± 0.5	
V (1.0)	− 0.56 ± 0.10	1.10 ± 0.10
Mean geometric albedo	0.63 ± 0.10	0.49 ± 0.10
Bond albedo	0.19. . . 0.25	
Sidereal rotational period (d)	6.38718 ± 0.00009	
Sidereal orbital period (d)	6.38718 ± 0.00013	
Inclination (degrees)	94.3 ± 1.5 (Tholen, 1985)	
Ascending node (degrees)	222.04 ± 0.13	
Orbital longitude (degrees)	79.2 ± 0.3	
Eccentricity (e cos ω)	< 0.002	
Epoch (JED)	2445000.5	

Table 1: *Physical parameters and orbital elements of the Pluto/Charon system adopted from our "best fit".*

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Grid Processing of Large Photographic Plates

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1. Introduction

We have investigated a new method ("grid processing") for mechanical agitation during development of large, photographical plates. It appears to be superior to the classical tray-rocker, both in terms of efficiency and uniformity, and without any loss in resolution. We believe that this method may become important in astronomical photography, once it has been thoroughly tested and automated.

Development of large, photographic plates poses difficult technical problems, in particular concerning the uniformity over the plate surface. Various methods have been devised, but so far none have been able to match the "tray-rocker", which was introduced into astronomical photography by the late Wm. C. Miller. Following his advice, several tray-rockers were acquired in 1973 by the European Southern Observatory. They have since been in use for development of original Schmidt plates at the La Silla observatory and in the production of glass copies for the various sky atlasses which are being made at the ESO Sky Atlas Laboratory in Garching. Thousands of plates have been processed this way and much experience is now available about the optimum tuning of the rocking and rotation rates, the amount of developer, how to immerse the plate in the developer, etc. (West and Dumoulin, "Photographic Reproduction of Large Astronomical Plates" [ESO Sky Atlas Laboratory, 1974]; "Photographic Reproduction of Large Astronomical Glass Plates: Some Problems and Pitfalls [*AAS Photobulletin* **23,** 3, 1980]).

The many virtues of the tray-rocker method include reliability, handling ease and good reproducibility, i.e. the possibility of producing identical copies in large numbers which is of great importance in atlas work. However, there is at least one shortcoming: the plate centre is always (slightly) less developed than the edges because of variation in agitation, introduced by the wave geometry. This is problematic, especially since the photometric calibration wedges are placed near the edges. It should be noted, though, that this effect is less evident on Schmidt plates, where the plate edges are less exposed than the centre due to vignetting in the telescope – in fact the two effects partially compensate each other. Another problem is that the tray-rocker rotation and rocking rates must be kept rather slow in order to maintain an acceptable uniformity (and to avoid splashes). This reduces the efficiency.

We have performed many experiments with our tray-rockers over more than 10 years, but now believe that there exists no simple modification of the classical tray-rocker, which will significantly improve its performance.

2. The Grid Method

Looking for alternative methods, we were inspired by the KODAK Versamat 17 automatic developing machine, which is used at the ESO Sky Atlas Laboratory for processing of 40 × 40 cm atlas film copies. In this machine, the vertical motion of the film, combined with horizontal agitation (jets of developer) gives remarkably uniform results.

The grid method, which will be described here, does not appear to have been used much in the past. The only reference which we have been able to find, concerns machine development of cinema films, more than 40 years ago. In our set-up, a metallic grid moves rapidly back and forth in the developer, just above the emulsion.

All tests were made with 30 × 30 cm, 3 mm thick KODAK Process plates (resolution ~ 200 lines/mm), which are used for the production of the glass-based ESO/SRC Atlas of the Southern Sky. The plates were exposed uniformly by a point light source at 5 m distance and developed at 20°C in Kodak D76 developer.

The initial tests were made with a hand-held grid from a refrigerator, with the plate in vertical (as in the Versamat 17 machine) or horizontal position. Although the early results were similar in both positions, the latter was much more convenient for the operator and vertical tests were discontinued. The method immediately showed promise and a special tray with fitting plateholder (both 38 cm × 50 cm) and a corresponding grid (38 cm × 41.5 cm) was built (Figure 1). The grid bars are cylindrical with a diameter of 3 mm.

The most important parameters were now varied, e.g. the distance between the grid bars, the distance between emulsion and grid and the depth of developer over the emulsion.

We found that it is very important that the individual bars are randomly spaced, otherwise patterns may develop. Our grid has 35 bars with a mean distance of 11 mm. A distance of about 1 mm between plate and grid is optimal and the grid must be flat to within ± 0.1 mm. If the plate-grid distance is too large, say 5 mm, the uniformity of development is lost and a wave pattern results. If the distance is too small, there is a risk of scratching the plate. The minimum depth of the developer is

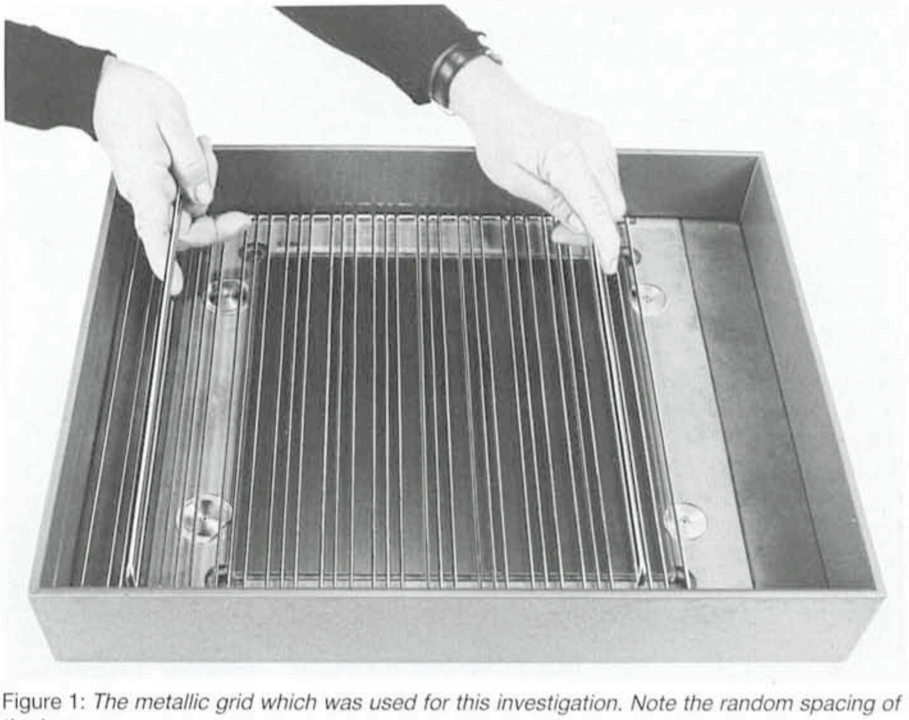


Figure 1: *The metallic grid which was used for this investigation. Note the random spacing of the bars.*

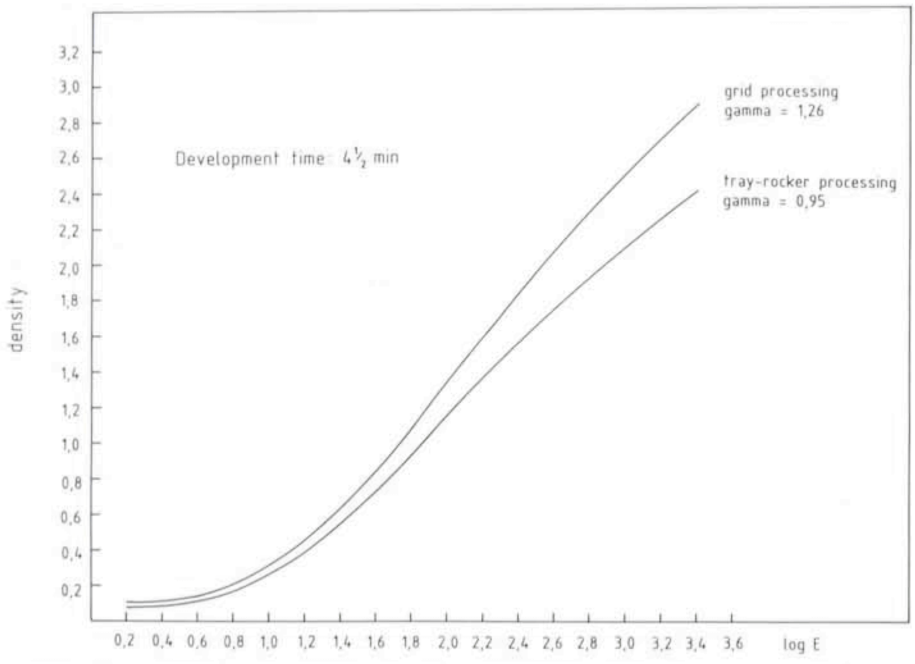


Figure 2: *Comparison of tray-rocker and grid development characteristic curves for KODAK Process plates.*

about 7 mm, corresponding to 1.8 liter per plate, but we found that the efficiency increases if more developer is poured in, at least up to a total of 2.3 liter, i.e. a depth of 10 mm.

The motion of the grid above the plate is not very crucial, as long as the operator tries to make it random. A convenient, optimum cycle period (back and forth) is about 1 second. The maximum, lateral distance from motion reversal to reversal is about 90 mm. The motion is therefore rather violent. Clearly, a most important result is the need to "randomize" the grid and its motion in order to avoid standing waves and thereby non-uniform development.

3. Results

All tests for which the results are shown here, were made at the optimum settings, as outlined above. The only variable parameter was the development time. In all cases, control plates were developed with an optimally tuned tray-rocker (40 × 40 cm tray, 7 mm developer depth above plate = 2.3 l in total, 1.5 rotation/min, 18 rocks/min). It should be noted that the normal development time for atlas plates is 4.5 min. Figure 2 compares the characteristic curves of the two methods at development time 4.5 min. The grid method is clearly the more efficient. Figure 3 shows the achieved mean density as a function of development time. Again, the grid method is more efficient, although the difference becomes somewhat smaller with increasing time.

In order to investigate the uniformity, the plates were divided into 16 × 16 = 256 squares and the ANSI Diffuse density was measured with a GRETAG densitometer in the middle of each square (2 mm circular aperture). Figure 4 compares the measured, central density profiles (heavy line). The mean densities are indicated with thin, horizontal lines. For the grid method, the measurements were perpendicular to the direction of the grid motion. The tray-rocker edge effect is clearly seen. The apparent deterioration of the grid method with time, cf. the 12 min. profile, may be partly due to operator fatigue resulting in less-than-optimal motion of the grid.

The mean densities and r.m.s. values, based on 256 measurements on each plate, are given in Table 1. Figure 5 compares the uniformity of two plates, developed in the tray-rocker and by the grid method, respectively. Repeated operations proved that the grid developing method is extremely well reproducible.

We find that the grid-method is superior to the tray-rocker, both in terms of efficiency and uniformity, without any loss of resolution. These findings are of great interest for the atlas work at the ESO Sky Atlas Laboratory. With increased efficiency, the processing time necessary to reach a desired density and gamma, decreases and more plates can be handled in the same time. With greater uniformity, the sensitometry (calibration) on copies of original atlas plates will be more accurate, especially because the calibration wedges normally are situated near the plate edges. The method also offers great promise for very large plates, e.g. 50 × 50 cm, and has a potential for use in the graphics

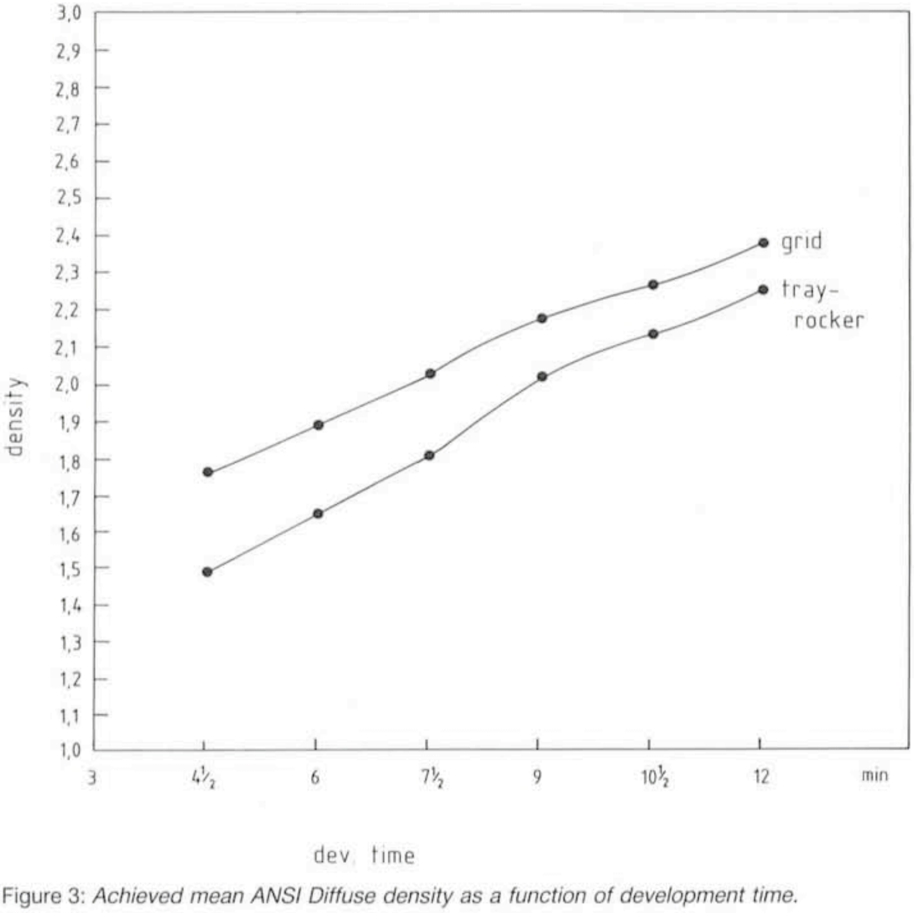


Figure 3: *Achieved mean ANSI Diffuse density as a function of development time.*

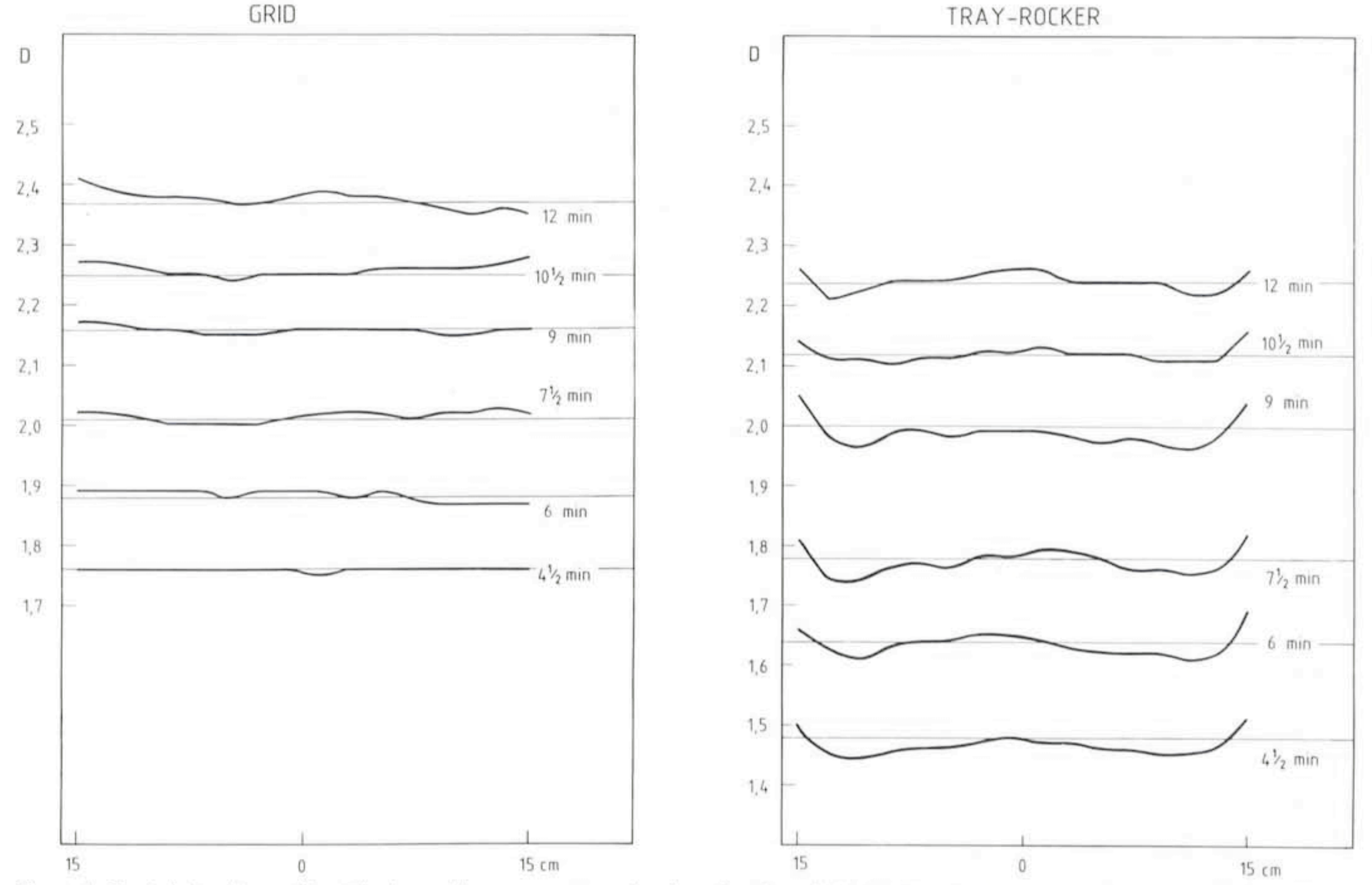


Figure 4: *Central density profiles. The heavy lines are measured values (for the grid in the direction of motion). The thin lines indicate the achieved, mean density.*

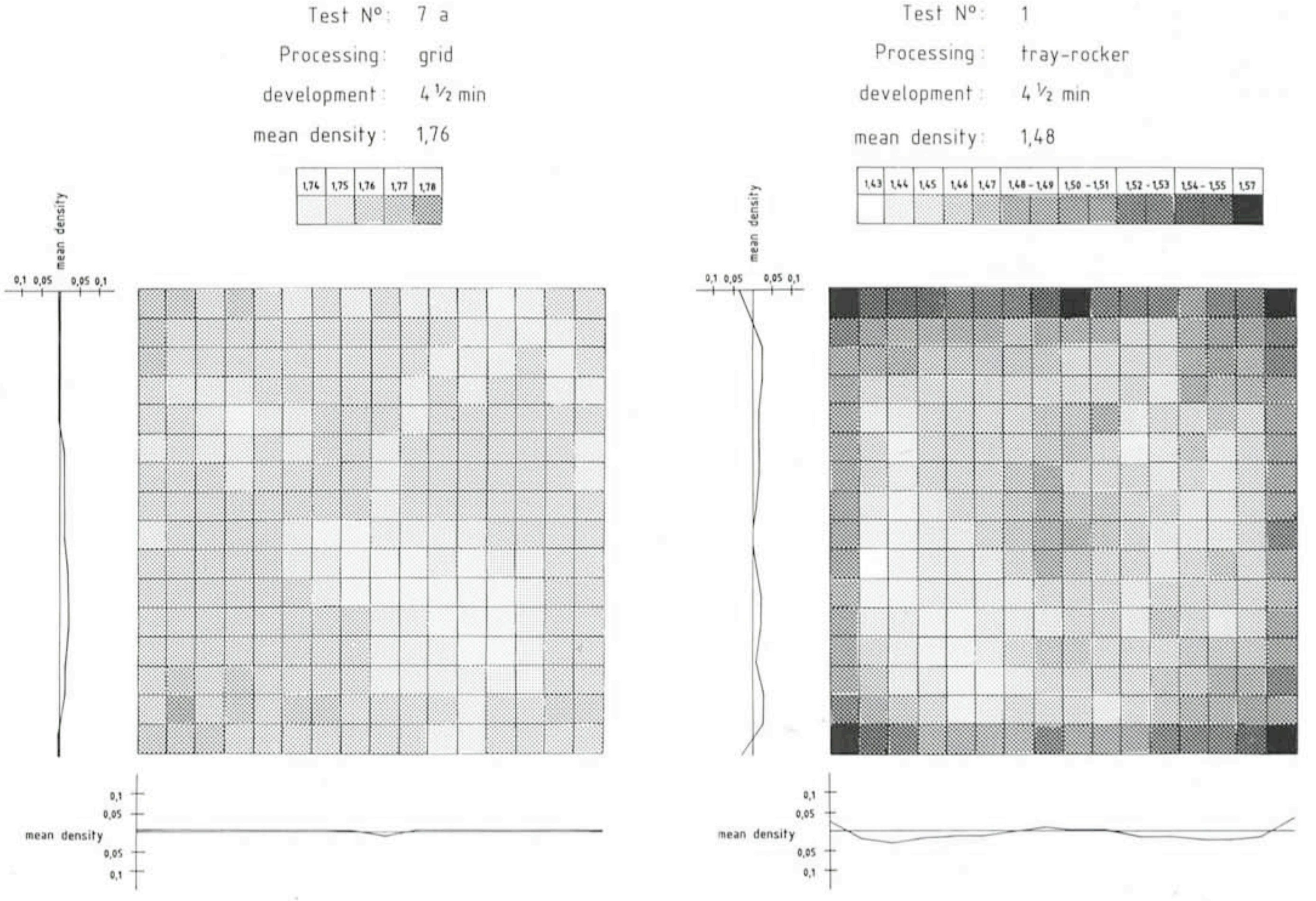


Figure 5: *Comparison of the uniformity achieved by the tray-rocker and the grid methods. The central density profiles in the two directions are shown.*

industry, especially in those areas where extreme uniformity is desirable (stamp matrices, etc.).

4. An Automatic Grid Developing Machine

It is obviously desirable to investigate whether these results are also valid for astronomical emulsions (IIa, IIIa, IV, etc.). For this purpose, and in order to improve the stability of the test conditions, an automatic grid developing machine has been built at the CERN mechanical workshop in Geneva, Switzerland (Figure 6). In this machine, the grid agitation is ensured by a motor. There are two motions, one that moves the grid rapidly back and forth and another that more slowly shifts the center of the first motion. In this way, it is avoided that the extreme positions of the grid are always in the same place. The speed can be changed, but since the two motions are produced by the same motor, they are not entirely independent. The initial tests showed that some wave patterns still remain; apparently the human operator is better than the machine in this respect! However, when the plate is moved manually and randomly, during the automatic grid motion, excellent results have been obtained, both in terms of efficiency and uniformity (Table 1).

Table 1: Mean densities and r.m.s. values

Dev. time	Tray rocker		Grid (manual)		Grid (machine)	
(min)	Mean D	r.m.s.	Mean D	r.m.s.	Mean D	r.m.s
4.5	1.475	0.037	1.756	0.008	1.970	0.010
			1.746	0.010		
			1.718	0.011		
6.0	1.644	0.030	1.878	0.011		
7.5	1.784	0.032	2.009	0.012		
9.0	1.996	0.033	2.156	0.011		
10.5	2.123	0.049	2.250	0.016		
12.0	2.235	0.030	2.369	0.018		

The mean ANSI Diffuse density and the r.m.s. values are calculated from measurements in 256 points. Data are given for three plates which were developed 4.5 min. with the grid method, in order to demonstrate the reproducibility.

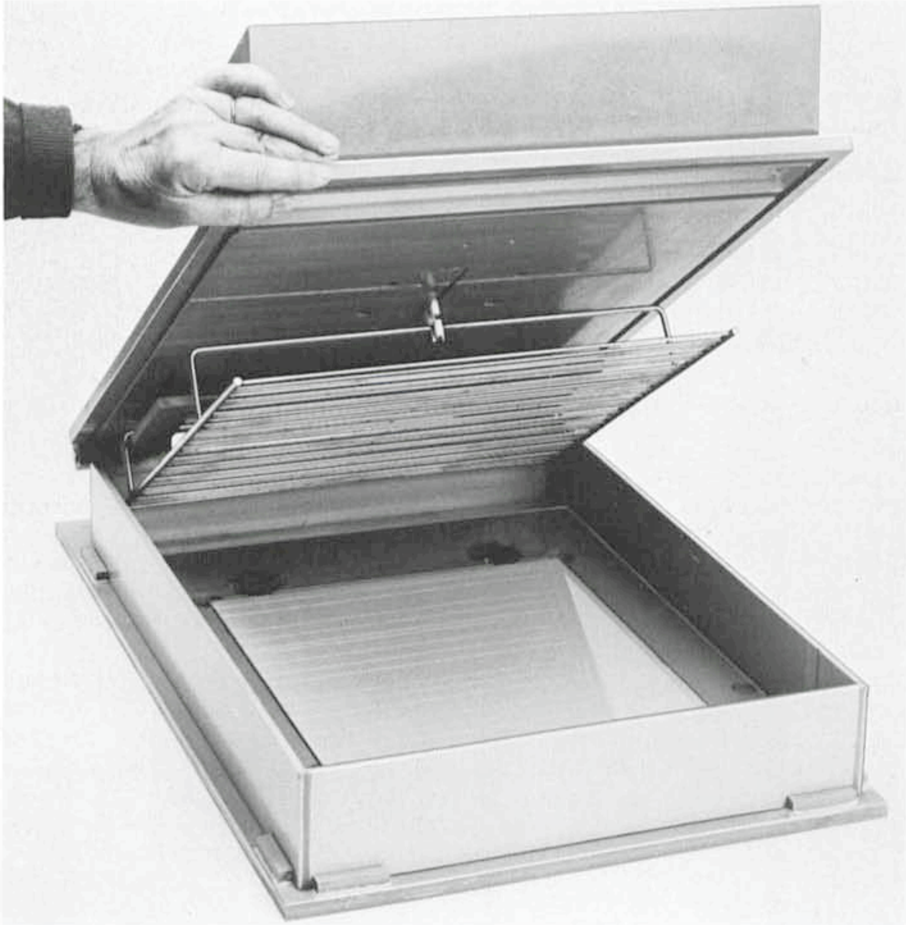


Figure 6: *Automatic grid developing machine. The motor is contained in the lid.*

Mechanical modifications are therefore now being made in order to "decouple" entirely the first two motions and to add a third, that is a slow motion of the plateholder and the plate. As soon as it is ready, we intend to test the new machine with plates from the ESO 1 m Schmidt telescope. If the present results are confirmed, the tray-rocker will be replaced with the grid machine. The greater efficiency and uniformity will clearly be of importance for achieving the best possible use of the Schmidt telescope.

VLT Documentation

Since the last issue of the *Messenger*, the following documentation about the ESO Very Large Telescope project has become available.

A **VLT Slide Set** has been produced in a very limited edition and reflects the status of the project by November 1986. It is provisional and future editions will be updated as more details of the project become defined. The set consists of 20 slides and may be obtained by sending DM 35,– (the equivalent of the cost price plus postage) to the address below.

The **Proceedings** of the Second Workshop on ESO's Very Large Telescope, which was held in Venice, 29 September – 2 October 1986, have now been edited by S. D'Odorico and J.-P. Swings. The 448 page volume comprises more than 35 papers and records the important discussions that took place at the meeting. It is available at a price of DM 40.– (including surface mail postage), from:

ESO Information and Photographic Service
Karl-Schwarzschild-Strasse 2
D-8046 Garching bei München
Federal Republic of Germany

In addition, the VLT Brochure is available free of charge (only one copy per order) in four different languages: English, French, German and Italian. A small number of the technical VLT Reports, announced in *Messenger* 45 (September 1986), are also available.

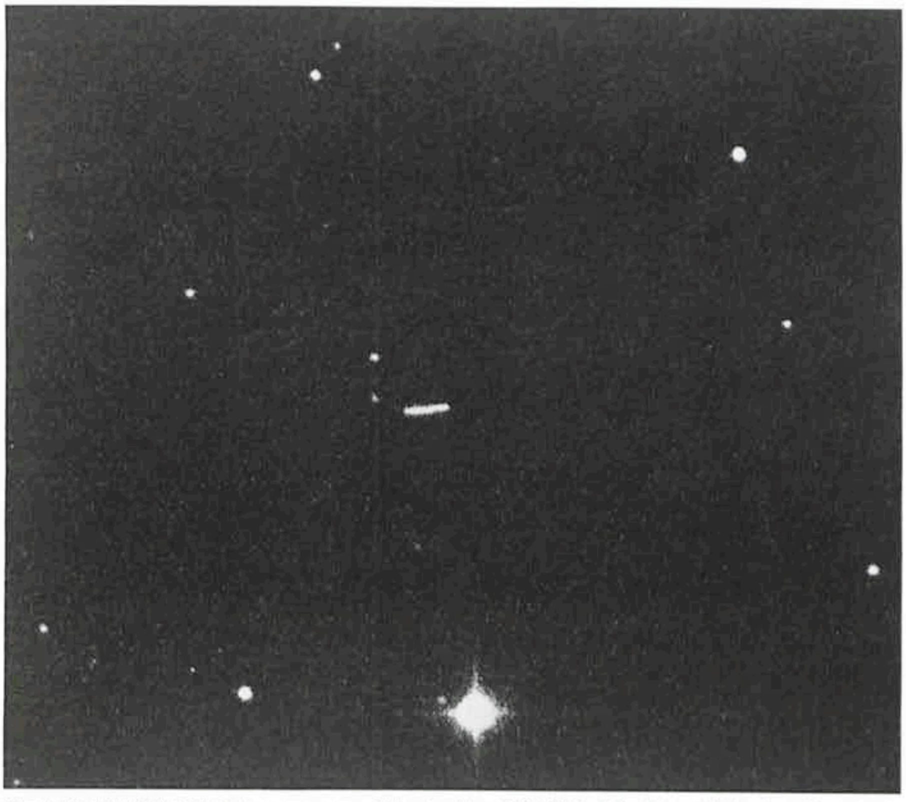
Welcome Back, MALLY!

By late 1986, more than 3,500 minor planets, with diameters from a few hundred metres to several hundred kilometres, have been registered and given a number. Their orbits have been determined with great precision, so that their positions in the sky are well known at all times. Most of them have also received a name by the astronomers who discovered them.

Unfortunately, a few of these planets have "disappeared" in the meantime. Minor planet (1179) MALLY is one of these. It was discovered on March 19, 1931 by Karl Reinmuth, Staff Astronomer at the Landessternwarte Heidelberg. He first saw the image of MALLY on a photographic plate, exposed at the 72 cm reflecting telescope and showing a sky field in the constellation Virgo. He measured MALLY's positions on this and some other plates which were obtained until May 13, 1931. From these measurements, it became possible to compute MALLY's orbit in the solar system; it then received a number and Reinmuth gave it its current name.

By chance, nobody observed MALLY during the following years and when an attempt was finally made in 1936, MALLY could no longer be found. Apparently, the orbit which was computed in 1931 was not accurate enough and the International Astronomical Union officially had to declare MALLY as "lost".

In order to solve this long-standing problem and to find MALLY again, Drs. Lutz Schmadel (Astronomisches Rechen-Institut, Heidelberg, FRG) and Richard M. West (ESO) recently remeasured Reinmuth's photographic plates with the ESO S-2000 measuring machine in Garching, achieving a higher accuracy than what was possible in 1931. A new, more accurate orbit was computed but due to the unavoidable uncertainty in extrapolating forward in time, MALLY could still be anywhere within a large sky area by 1986. A substantial number of photographic plates that had been obtained with various telescopes during recent years were searched, but no images of minor planets were found which could be identified with MALLY. The catalogue of all registered observations of minor planets (more than 400,000) was checked but none belonged to MALLY. Finally, it was decided to obtain new photographic plates of the sky region in which MALLY was expected to be seen in early 1986. These plates were obtained by Hans-Emil Schuster, ESO Staff Astronomer, with the ESO Schmidt telescope in March 1986. Almost 100 images of minor planets were identified on each of these plates.



The trail of (1179) MALLY, as seen on a 30-min. blue ESO Schmidt plate obtained on March 12, 1986.

Extensive computations showed that one of these images might be MALLY. A new orbit was computed, based on the positions from 1931 and the assumed one from 1986. This new orbit indicated that images of MALLY should be visible on three other ESO Schmidt photographs, obtained for another astronomical research programme in December 1979. And indeed, such images were found at the expected places. Finally, Schmadel and West also found MALLY images on two plates taken with the Schmidt telescope on Mount Palomar, California, USA, in 1952 and on one plate obtained with the SERC Schmidt telescope at Siding Spring, Australia, in 1983. All this evidence definitely proves that MALLY has been found again, after having been missing for no less than 55 years.

With the recovery of MALLY, only five minor planets are still "lost". Theay are "(473) NOLLI" (last seen in the year 1901), "719) ALBERT" (1911), "(724) HAPAG" (1911), "(878) MILDRED" (1916) and "(1026) INGRID" (1923). Those cases will be even harder to solve.

STAFF MOVEMENTS

Arrivals

Europe:

DIERICKX, Philippe (B), Engineer/Physicist
GROENEN, Eddy (B), Assistant Head of Administration
LIVELY, Susan (GB), Technical Secretary
PIERRE, Marguerite (F), Fellow
RAVENSBERGEN, Marius (NL), Electronics Engineer

Chile:

HÖÖG, Torbjörn (S), Electro-Mechanical Engineer
JOHANSSON, Lars (S), Associate (Telescope Scientist) SEST
WHYBORN, Nicholas (GB), Associate (Microwave Engineer) SEST

Departures

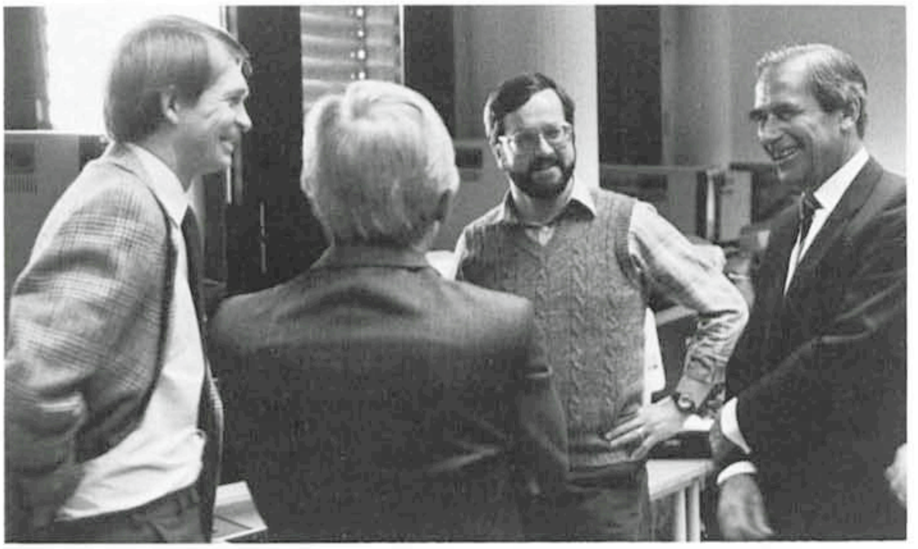
Europe:

BINETTE, Luc (CDN), Fellow
BRINKS, Elias (NL), Fellow
GATHIER, Roelof (NL), Fellow
KELLY, Nessan (IRL), Administrative Clerk
LOPRIORE, Sergio (I), Mechanical Engineer
MISCHUNG, Norbert (D), Senior Mechanical Engineer

Chile:

MERTL, Vaclav (CH), Electronics Engineer

The Swiss Ambassador and Consul General Visit ESO



The Swiss Ambassador to the Federal Republic of Germany, His Excellency Mr. Charles Müller, and the Swiss Consul General in Munich, Mr. Kurt Welte, visited the ESO Headquarters on October 14, 1986 for information about ESO and its current projects. The picture was taken during a demonstration of the ESO MIDAS image processing system (from left to right: Preben Grosbøl, the Consul General, Klaus Banse, the Ambassador).

ESO Pictorial Atlas is Underway

Right on time for ESO's 25th anniversary, Springer-Verlag will publish a pictorial atlas of the southern sky authored by S. Laustsen, C. Madsen and R.M. West. It would appear to be the first time that one of the leading astronomical institutions has endorsed such an astronomical picture book for the general audience. It will present 237 photographs (including 90 large-size colour and an approximately 120 cm long folding plate) in an unprecedented quality of reproduction and printing.

Part 1 of the book is devoted to photographs taken with ESO telescopes on La Silla and showing extragalactic phenomena. Numerous objects inside the Milky Way Galaxy are described in part 2, and part 3 presents pictures of minor bodies in the solar system with an emphasis on the latest pictures of Comet Halley. The fourth and last part of the book gives a portrait of ESO as an astronomical research institution. A comprehensive glossary and indexes of plate data and objects shown in the book will make the volume even more useful.

The work is well underway. The painstaking reproduction of the photographs has been accomplished under the close supervision of C. Madsen, the translation of the English original text into German has been completed and the texts for the English and German editions are at the typesetters. Negotiations with licence publishers are taking place in the UK, France, Italy, Spain, The Netherlands, Denmark and the Soviet Union. Even the difficult question of the main title has been solved in two of the languages.

"Entdeckungen am Südhimmel" and "Exploring the Southern Sky" will be published in May 1987, a corresponding French edition will be out a few months later.

ESO Press Releases

The following Press Releases have been published since the last issue of the *Messenger*. The distribution list now contains about 350 addresses of editors, science journalists and others, who contribute to the dissemination of news about science. Members of the press are welcome to apply for inclusion to the ESO Information and Photographic Service.

PR 08/86: The ESO Very Large Telescope: One More Step Towards Reality (4 October).

PR 09/86: First Accurate Determination of the Sizes of Pluto and its Moon (5 November).

PR 10/86: Long Lost Planet Found Again (4 December).

Wide Angle Photography of the Milky Way

C. MADSEN, ESO, and S. LAUSTSEN, Institute of Astronomy, Aarhus

Introduction

Since astronomers began to use photography on a scientific basis, a number of pictures of the Milky Way band, or large parts thereof, has been made. Barnard (1890, 1927) produced a series of fine Milky Way photos. Later attempts by Rodgers, Whiteoak et al. (1960), Schmidt-Kaler and Schlosser (1972), Sivan (1974) and others resulted in impressive pictures, either in the form of panoramas or extreme wide-field views, mostly in well defined (narrow) spectral bands. The most famous depiction of the Milky Way, however, is not a photograph but a drawing made by hand. This was made by M. and T. Keskula at Lund Observatory, and it has become the standard representation of the Milky Way band in textbooks.

A new panorama has recently been produced at ESO. This panorama differs in some respects from most previous images of the Milky Way band. With no filter being used and the emulsion sensitive to visual light, the general impression of the panorama is similar to the impression when watching the Milky Way on the night sky.

As explained below, the resolution is of the order of 1 arcminute, or about the same as that of the unaided human eye. However, 11th magnitude stars are visible on the panorama. The full panorama is currently being reproduced for use in a forthcoming book with the title "Exploring the Southern Sky". Here it will appear as a four-page spread with a total length of approximately 120 cm, and it is our hope that in general it will serve educational purposes.

Selecting the Instrumentation

The photographic plate provides an ideal detector for large-field survey work in the Milky Way. The surface brightness of the Milky Way is easy to reach with the speed of standard spectroscopic plates. In addition the combination of high resolution and a large field is of importance. To obtain a wide field of view, observers have either built special instruments or resorted to more or less standard off-the-shelf camera equipment. We felt that the latter possibility should be investigated, although it was evident that the choice would be very limited. A survey of the market led us to test the Hasselblad SWC camera at the ESO optical laboratory.

The SWC camera is fitted with a Carl Zeiss Biogon 1 : 4,5/38 mm lens. This lens covers 72° (horizontally) at a plate size of 56×56 mm^2. This gives a scale of 1 mm = 1°17′, or 1′ = 0.013 mm. The lens itself exhibits a minimal distortion (barrel distortion, 0.3 % at r = 30 mm). From k = 8 (k describing the nominal aperture), the lens is practically free of coma, a particularly annoying problem in connection with wide-angle photography of point objects. However at k $\geqq$ 8, the light collecting area becomes prohibitively small, requiring excessive exposure times. The lens has little vignetting, although the $\cos^4$ law (decrease of illumination by oblique rays due to the geometry of image formation by lenses and the compression of the exit pupil for oblique rays) obviously leads to a noticeable light fall-off towards the edges of the field.

As far as resolution is concerned, a calculation on the basis of Rayleighs's Limit ($\theta = 1.22\ \lambda/d$ radians), assuming a wavelength of 5500 Å, gives a theoretical minimum resolution angle at full aperture (1 : 4.5/38 mm = 8.44 mm) of not less than 16.″3. However, a complex refractor consisting of a large number of lens elements can hardly be expected to yield such a resolution in practice, due to lens aberrations leading to a reduction of contrast. In fact, the effective resolution was measured to be of the order of 1′.

Overall, the performance of the lens with respect to chromatic aberration, astigmatism and curvature of field turned out to be fully acceptable, and following careful sampling of a number of lenses on the optical test bench, a camera was selected for practical tests on the sky.

Which Emulsion?

Keeping the optical performance of the lens in mind, we initially chose the Kodak Technical Pan TP-2425 emulsion for our tests. This emulsion, which was based on the Kodak Solar Flare Patrol film, reportedly has a resolution of 400 l/mm (at a test-object contrast of 1000 : 1) and 125 l/mm (at TOC 1.6 : 1) with development in POTA.

The spectral sensitivity extends to approx. 7000 Å, and with an increased red-sensitivity (peak sensitivity falling in the UV, in red around 6500 Å and again around 6800 Å) this of course implies that galactic emission nebulae will show up very well.

This emulsion can be developed to fairly high γ-values (2.8–3.8 in Kodak D-19), which is necessary to achieve a good detection of faint objects.

The TP-2415 is a rather slow material. Fortunately, however, it is fairly easy to hypersensitize. Everhardt (1980), West et al. (1981) and others have reported speed increases up to 8.9 times by baking in forming gas.

At the time of our tests the TP 2415 was available in the form of 35 mm and $4 \times 5''$ sheet film. We therefore chose to use (cut-down) sheet film in Hasselblad sheet film holders.

Initial Sky Tests

The first sky tests were carried out at a private observatory at Herrsching, Ammersee, in southern Germany. With the camera mounted at the top end of a small telescope, and the latter being used for tracking and guiding, the film was exposed for 60 min. at full aperture, which was deemed necessary in spite of some residual coma. Stars of $m_v = 11$ were recorded with a resolution of 1′. It turned out, however, that the film did not (always) stay flat in its holder during the exposure, thus leading to a partial defocussing. It was therefore ultimately decided to abandon the TP 2415 (proper) in favour of the Kodak 153-01 emulsion, which is the TP-2415 emulsion coated on glass. The main photographic characterics are more or less the same, with the main differences being somewhat lower sensitivity and a slightly different characteristic curve. For the final observations, the 153-01 was exposed for 90 min. following 8 hrs baking in forming gas at 60°C.

The Observations

The northern part of the Milky Way was photographed from the Observatorio del Rocque de los Muchachos on the isle of La Palma, using the 60 cm reflector of the Royal Swedish Academy as tracking instrument carrying our tiny camera.

The southern part as well as the Milky Way centre was photographed from La Silla in March 1985. Here, the 40 cm GPO was used. In addition to the plates needed for the panorama, a few other plates were obtained, including some plates of the twin Magellanic Clouds together with the Milky Way, shown in the 1984 ESO Annual Report.

Printing the Panorama

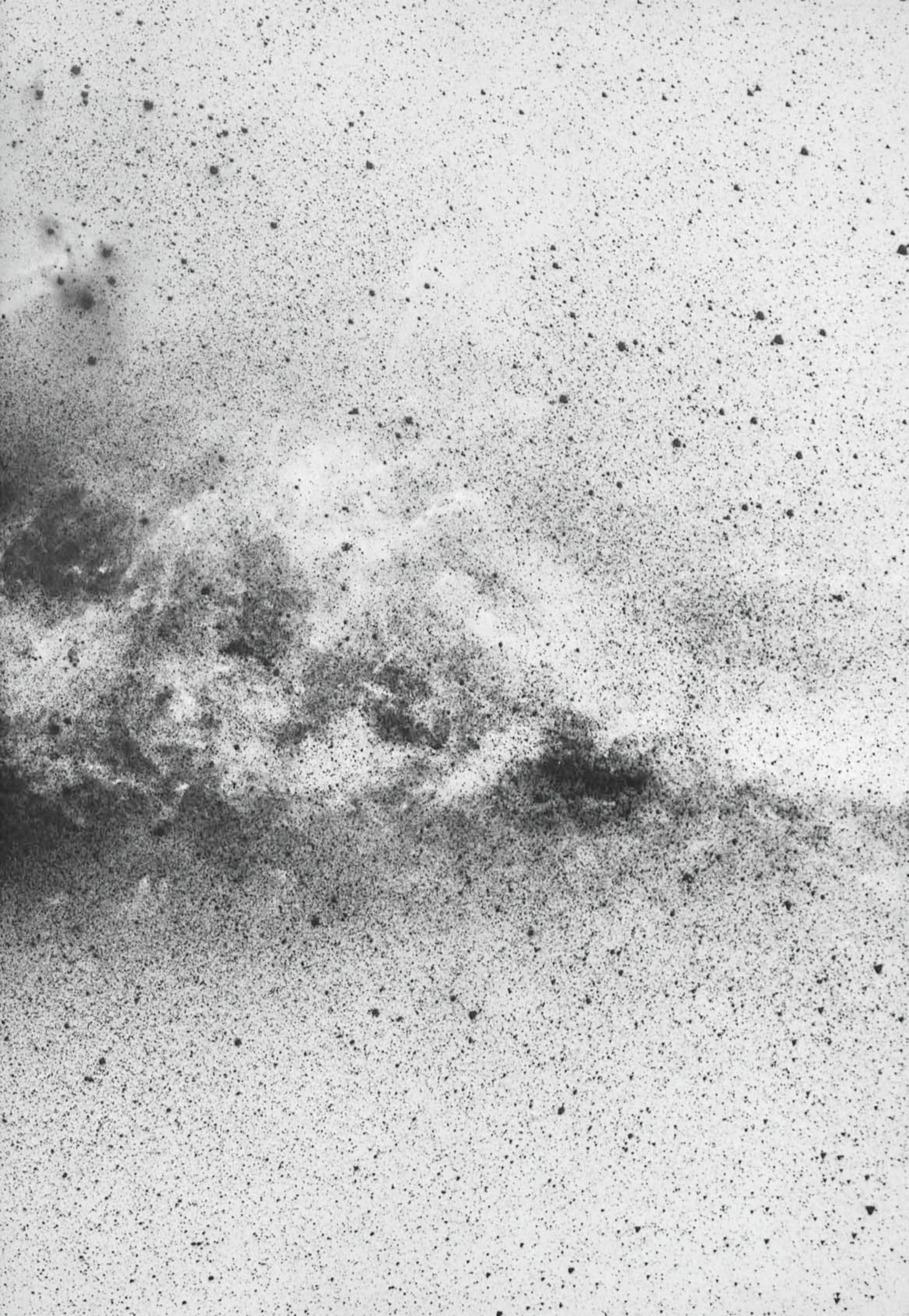
Following the successful completion of the observations, the work started on printing the panorama. The final picture comprises 8 individual pictures. Each of these pictures originally exhibited differing sky background densities, partly due to the natural vignetting and partly because of varying zenith distance. To reduce these effects as much as possible the field actually used was limited to a little more than $45 \times 60°$. Each plate was enlarged onto a copy film of 24×24 cm^2 and, during the copying phase, flat field masks were used to compensate the inherent vignetting. Each frame was fitted with a thin line to mark the galactic equator, and finally the copy films were printed onto photographic paper. During the enlargement and final printing, enlargement factors were carefully chosen in order not to introduce additional distortion.

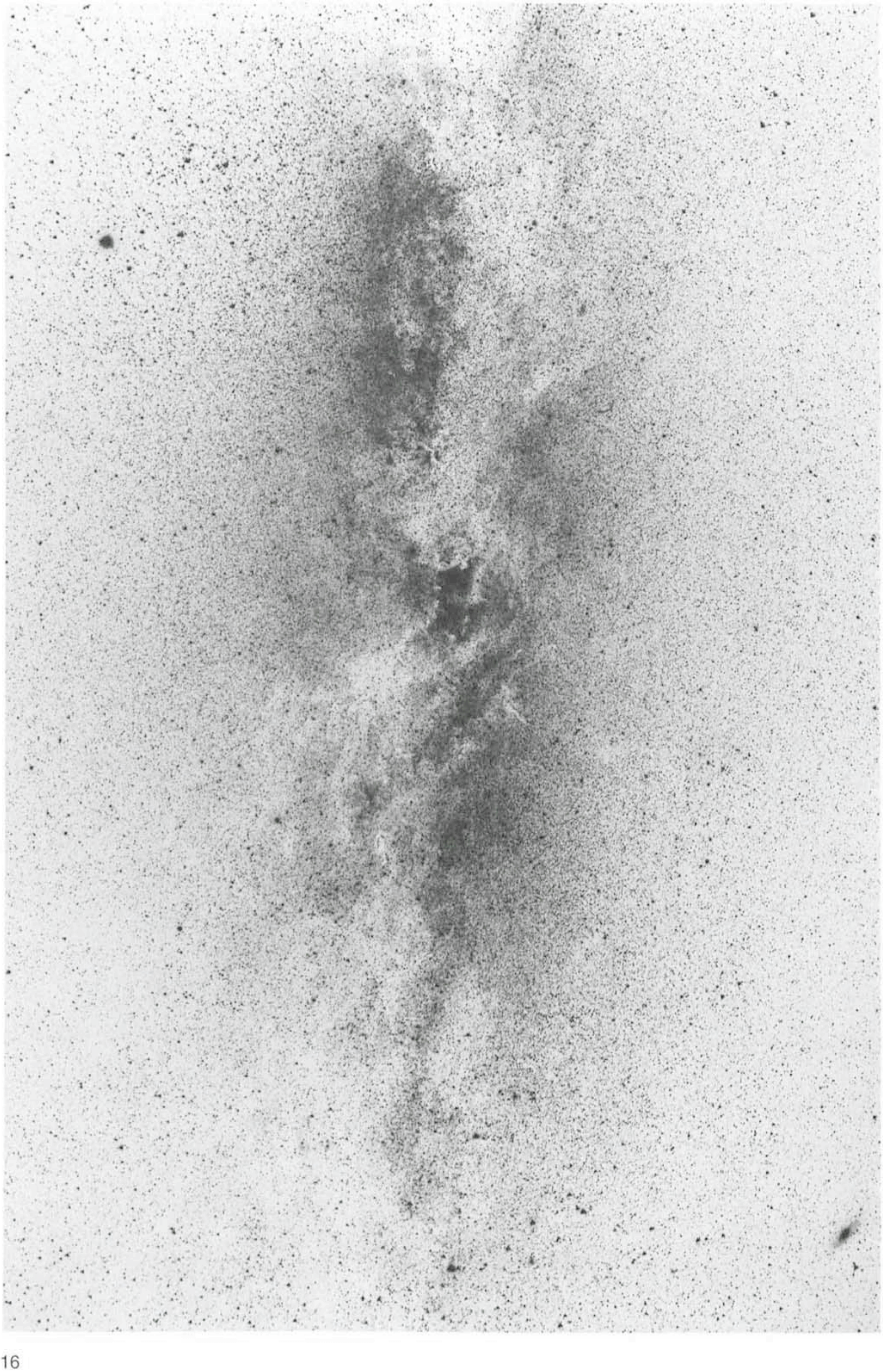
Finally the 8 prints were merged to form the panorama. Care was taken to ensure a good fit, which however was only possible along a narrow band around the galactic equator. While the camera field is flat, the distances in the sky are measured along great circles on a sphere. The plates consequently exhibit a "varying" scale, and some objects unavoidably appear twice along the edges of the merged images.

Acknowledgements

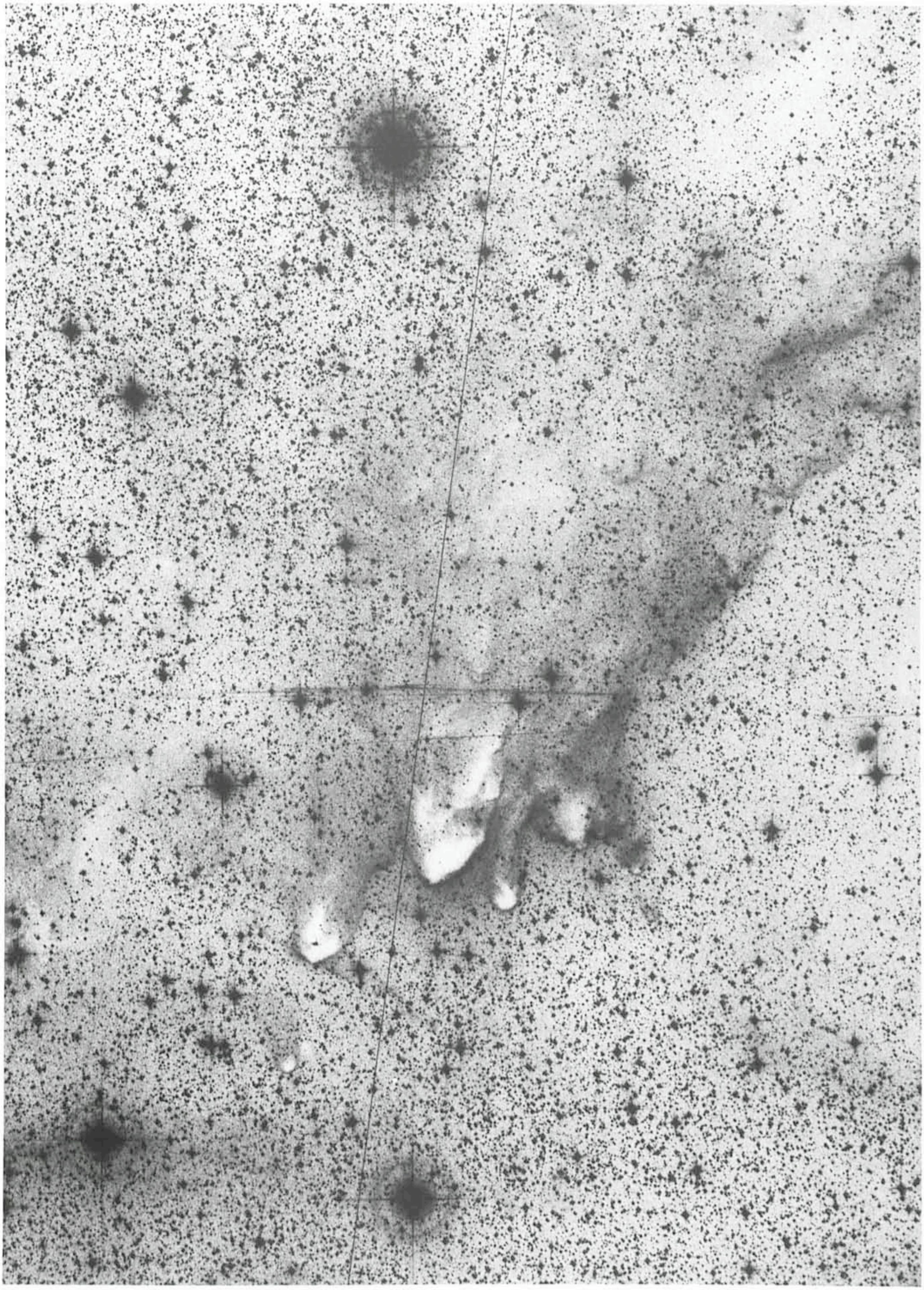
Our thanks are due to B. Buzzoni of the ESO optical laboratory (Garching), the staff of the Technical Research Support at La Silla, Mr. P. Stättmeyer (Herrsching, FRG), P. Corbern and the staff of the Swedish Telescope on La Palma. Furthermore, we should like to thank Messrs. James Polack A/S (Denmark) and J.A. Lundberg of Victor Hasselblad AB (Sweden) for their assistance.

One of the plates used for the panorama is reproduced on the following two pages. It shows the central bulge of the Milky Way with its myriad of stars. The central part of the galaxy is of course hidden behind the extended dust clouds in the galactic disk. The field shown here covers approximately 70 × 50°. The coma is of course visible in the outer regions of this image. In the panorama, only around 45° of each field is used, thus minimizing the effect of this aberration. ▸





Another wide-field view shows the Milky Way in Cassiopeia, Cepheus and Cygnus with North America Nebula (NGC 7000) almost at the centre. The field also includes M 31 as well as the Cygnus loop. The field size is the same as the previous picture.



From the forthcoming ESO book "Exploring the Southern Sky": Cometary globules in the Gum Nebula. Reproduced from a plate obtained with the ESO Schmidt telescope for the ESO/SRC Atlas of the Southern Sky.

Ten Times More Halo Dwarfs Now Within the Reach of the CAT

P. FRANÇOIS, Paris-Meudon Observatory

Introduction

The determination of detailed elemental abundances in the atmosphere of stars is interesting for many branches of Astrophysics. The huge amount of information obtained with high resolution spectroscopy is useful, for example, to test the model of nucleosynthesis in the stars during their life as well as the final stages of nucleosynthesis of the elements in stars. This last case does not seem to be directly linked with abundance determination in stars. Still, at the end of their life, the massive stars expelled processed material into the interstellar medium. Then, the atmosphere of stars which will be formed from the interstellar matter will contain the signature of the matter expelled by the stars. The analysis of stars of different age will give some hints for the understanding of these last stages and for the chemical evolution of the Galaxy. The differential study of dwarf stars relative to the sun gives very accurate results. Moreover, the study of halo dwarfs can give clues on the early evolution of the Galaxy. However, halo dwarfs are faint and the limiting magnitude of the instrument is crucial for such studies. At ESO, high resolution spectroscopy was possible only with the 1.4 m CAT + CES. The detector was a RETICON array of 1,870 photodiodes (15 μm × 700 μm). The limiting visual magnitude was about 7. It was, in principle, possible to obtain fainter stars by long exposures but the so-called "cosmic rays" made the choice hazardous. Multiple exposures of the same object could also be done but the time needed to obtain good spectra for a large sample of stars was quite long and prohibitive. Thus, this instrumentation was typically used for disk dwarfs. The resolving power was of the order of 100,000. Only the brightest halo dwarfs were then observable.

In January 1986, a new camera was installed at the CES. At the same time, a new CCD receptor was available. It is a double density RCA CCD (ESO CCD 8, 640 × 1,024 pixels, 15 μm square). Details on the technical and optical properties are given in No. 43 of the *Messenger* by Dekker et al. (1986). Allocation time has been allocated with this instrumentation for the period 36. The purpose of this paper is to show that halo dwarf stars can now be easily studied with the 1.4 m CAT of ESO. About ten times more halo dwarfs are now within the reach of the CAT.

Observations and Analysis

4 nights we allocated for the observation of halo dwarfs: it was the first regular run for visiting astronomers with this instrumentation (28 May to 1 June 1986). During the first night, the sky was cloudy. For the last three nights, we have been able to take spectra of 6 halo dwarfs, the magnitude of which were ranging from 8.1 to 9.07. For each star, we have obtained spectra in different regions of wavelength in order to derive the abundances of several light metals in the halo dwarfs. In this paper, we would like to present the analysis of the star HD 160617 (m_v = 8.74). For this star, we have obtained three spectra (table 1). A part of one of these spectra is shown in Fig. 1. The resolving power is about 50,000. Flat-field exposures were taken after each exposure, using the tungsten lamp. The reduction of the data was carried out with the reduction chain of programmes ASTERIX on the VAX computer of Paris Observatory at Meudon. The determination of the elemental abundance, based on the comparison of the line profiles with synthetic profiles, have been done following the same procedure as in François (1986a). For the main parameters of the atmosphere of HD 160617, we followed Perrin (1986) and adopted θ_{eff} = 0.86 log g = 3.5 and [Fe/H] = −1.60. We have also taken the microturbulent velocity v_t = 1 km/s as in Perrin (1986).

λ	Date	Exposure	S/N
6700	29/30 May 86	2 H 00	250
6160	30/31 May 86	2 H 00	250
4730	31 May/1 Jun 86	2 H 00	150

Table 1: *Spectrograms of HD 160617*

Results

Aluminium lines at λ 6696.032 and 6698.3 were not observable in this star because they were too faint (less than 2 mÅ). However, Sodium, Magnesium and Silicon abundances have been obtained. Results are presented in table 2. The ratios [Mg/Fe] and [Si/Fe] found in HD 160617 confirm the overabundance of α-elements (O, Mg, Si, Ca) in halo dwarf stars found with larger telescopes. The value of the [Na/Mg] ratio is in agreement with the ratio found by François (1986b) where a constant ratio in halo dwarfs was suggested.

Magnesium and Silicon are built mainly in massive stars and the overabundance of these elements in old stars which are halo stars seems to show that SNII (whose progenitors are massive stars) have mainly contributed to the enrichment of the halo (Matteucci et al. 1986, Cayrel 1986).

However, only few determinations of elemental abundances in halo dwarfs exist up to now, and new observations

[Fe/H]	= −2.00
[Mg/Fe]	= +0.50
[Na/Fe]	= −0.03
[Si/Fe]	= +0.35

Table 2: *Relative abundances*

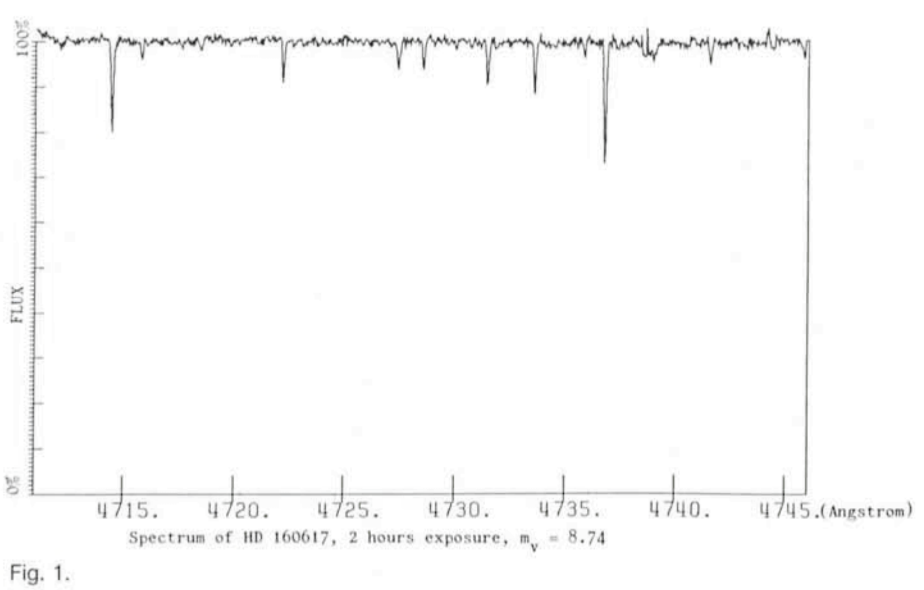


Fig. 1.

are important for understanding the chemical evolution of our Galaxy. The 1.4 m CAT + CES equipped with the short camera + CCD is now, as we have tried to show, suited for this study.

Acknowledgement

I would like to thank M. Spite for her help during the reductions of the data. I am grateful to F. Spite for useful comments on the manuscript.

References

Cayrel R.: 1986, *Astron. Astrophys.* (in press).
Dekker, H., Delabre, B., D'Odorico, S., Lindgren, H., Maaswinkel, F., Reiss, R.: 1986, *The Messenger* No. 43, p. 27.
François, P.: 1986a, *Astron. Astrophys.*, **160,** 264.
François, P.: 1986b, *Astron. Astrophys.*, **165,** 183.
Matteucci, F., Greggio, L.: 1986, *Astron. Astrophys.*, **154,** 279.
Perrin, M.-N.: 1986, *Astron. Astrophys.* **159,** 239.

Bierce and Astronomy

Ambrose Bierce, the famous American satirist, was born in 1842 and is believed to have died in 1913, during the revolution in Mexico. A man of many trades, he spent part of his life in San Francisco as a journalist. He apparently made the first entries to "The Devil's Dictionary" around 1876, but it was only after 1881 that regular instalments began to appear in the "Wasp" under Bierce's chief editorship.

Although Bierce apparently showed no particular animosity against astronomers, he did include some references in the "Dictionary". Here are some (slightly abbreviated) examples of his wit, written more than one century ago:

Astrology, n. The science of making the dupe see the stars. Astrology is by some held in high respect as the precursor of astronomy (. . .).

Comet, n. An excuse for being out late at night (. . .).

Dawn, n. The time when men of reason go to bed (. . .). The reason we find only robust persons doing this thing is that it has killed all the others who have tried it.

Electricity, n. The power that causes all natural phenomena not known to be caused by something else. It is the same thing as lightning and its famous attempt to strike Dr. Franklin is one of the most picturesque incidents in that great and good man's career. (. . .) The question of its economical application to some purposes is still unsettled, but experiment has already proved that it will propel a street car better than a gas jet and give more light than a horse.

Gravitation, n. The tendency of all bodies to approach one another with a strength proportioned to the quantity of matter they contain – the quantity of matter they contain being ascertained by the strength of their tendency to approach another. (. . .)

Morning, n. The end of night and dawn of dejection. The morning was discovered by a Chaldean astronomer, who, finding his observation of the stars unaccountedly interrupted, diligently sought the cause and found it. After several centuries of disputation, morning was generally accepted by the scientific as a reasonable cause of the interruption and a constantly recurrent natural phenomenon.

Newtonian, adj. Pertaining to a philosophy of the universe, invented by Newton, who discovered that an apple will fall to the ground, but was unable to say why. His successors and disciples have advanced so far as to be able to say when.

Observatory, n. A place where astronomers conjecture away the guesses of their predecessors.

Telescope, n. A device having a relation to the eye similar to that of the telephone to the ear, enabling distant objects to plague us with a multitude of needless details. Luckily it is unprovided with a bell summoning us to the sacrifice.

Zenith, n. A point in the heavens directly overhead to a standing man or a growing cabbage. A man in bed or a cabbage in the pot is not considered as having a zenith, though from this view of the matter there was once a considerable dissent among the learned, some holding that the posture of the body was immaterial (. . .).

List of ESO Preprints

September–November 1986

465. F. Murtagh and A. Heck: An Annotated Bibliographical Catalogue of Multivariate Statistical Methods and of their Astronomical Applications (Magnetic Tape). *Astronomy and Astrophysics Suppl.* September 1986.
466. D. Baade: Be Stars as Nonradial Pulsators. Invited review presented at IAU Coll. 92 "Physics of Be Stars", Boulder, 18–22 August 1986. September 1986.
467. C. Motch et al.: The Optical Light Curve of the Low Mass X-Ray Binary XB 1254-690. *Astrophysical Journal.* September 1986.
468. M. Rosa and J.S. Mathis: On the Chemical Homogeneity of the 30 Doradus H II Region and a Local Enrichment by Wolf-Rayet Stars. *Astrophysical Journal.* September 1986.
469. M. Heydari-Malayeri, V.S. Niemela and G. Testor: The LMC H II Regions N 11 C and E and their Stellar Contents. *Astronomy and Astrophysics.* September 1986.
470. A. Lauberts: UBVRI Photoelectric Photometry of 48 Southern Galaxies. *Astronomy and Astrophysics.* October 1986.
471. F. Murtagh and A. Lauberts: A Curve Matching Problem in Astronomy. *Pattern Recognition Letters.* October 1986.
472. T. Gehren and D. Ponz: Echelle Background Correction. *Astronomy and Astrophysics.* November 1986.
473. E. Giraud: Malmquist Bias, Type Effect and Dispersion in the Tully-Fisher Relation. *Astronomy and Astrophysics.* November 1986.
474. R. Gathier: Properties of Planetary Nebulae I. Nebular Parameters and Distance Scale. *Astronomy and Astrophysics.* November 1986.
475. M.H. Ulrich: Observations of Active Galactic Nuclei with IUE and Comparison with X-Ray Data. Review paper given at the NASA/ESA/SERC Conference held in London, 14–16 July 1986: "New Insights in Astrophysics: 8 Years of UV Astronomy with IUE". November 1986.

A Workshop organized by ESO on

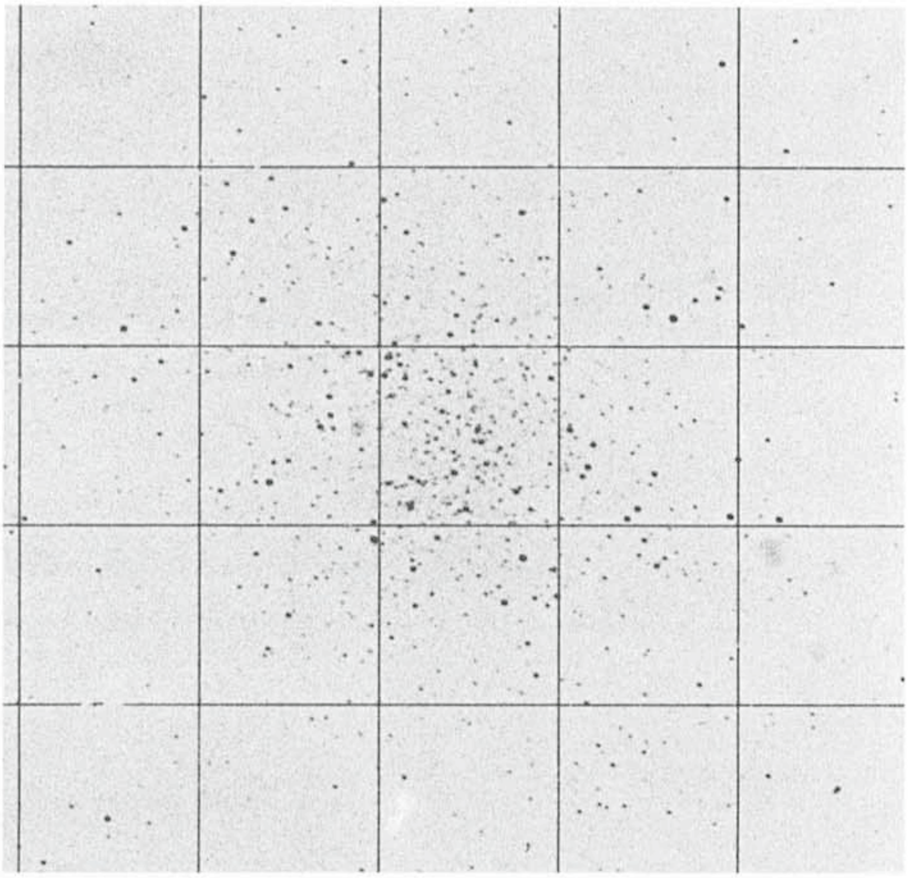
STELLAR EVOLUTION AND DYNAMICS IN THE OUTER HALO OF THE GALAXY

will be held at ESO, Garching, **April 7–9, 1987.**

Topics of this 3-day workshop will include observational and theoretical aspects concerning chemical evolution and dynamics of field stars, globular clusters and planetary nebulae in the halo of our Galaxy and in halo systems – Magellanic Clouds and Dwarf Spheroidals.

More information may be obtained from M. Azzopardi at ESO, Karl-Schwarzschild-Str. 2, D-8046 Garching bei München, FRG.

Messier 22: 73 Years Ago



This picture shows the globular cluster Messier 22 = NGC 6656, photographed (Plate no. 390; exposure 90 min) on August 26, 1913 with the f/17 40 cm astrograph at the Zo-Se station of the Shanghai observatory (P.R. China). The station is situated just south of Shanghai at a geographic latitude of +31°. Since this globular cluster lies in the southern Milky Way at R.A. = 18^h 33^m; Decl. = −23° 58′, the telescope was pointed close to the southern horizon. Messier 22 is the third nearest globular cluster at a distance of about 3 kpc.

This plate was brought to ESO-Garching by a visiting astronomer from Shanghai, Dr. Yao Bao-an, who is currently staying at ESO to work with ESO astronomers on it and other plates. Among other subjects, Dr. Bao is investigating the proper motions of stars in this cluster by comparing their positions on "old" plates with those on plates taken in 1986. For this, they scan the plates with the ESO PDS microphotometer and measure the displacements of the stellar images by use of the IHAP and MIDAS image processing software.

Plate no. 390 is a good example of how earlier observations can be extremely useful in modern astronomical research. Stars in the field which are not members of Messier 22 can be recognized as such by their different proper motions and a "cleaner" sample of cluster stars can be established. This in turn will lead to a better determination of the distance and also of the motion of the cluster in our Galaxy. The membership of some unusual stars is also an important question to be solved. The success of such measurements is entirely dependent on the existence of "old" and "new" plates from the same telescope. The Shanghai astrograph took the first plate in 1902 and was used for a long time by French astronomers. The roundness of the images, despite the position of the telescope and the long exposure, testifies to the skill of the observer, whose name unfortunately is not indicated on the plate.

In some years, the Shanghai astrograph will celebrate its hundredth anniversary. We wish this venerable instrument and the astronomers who now use it all the best for the future.

Who Has Photographs from Early ESO Days?

Next year, ESO will celebrate its 25th anniversary. On October 5, 1962, a convention was signed in Paris by the representatives of the original five member countries, Belgium, Federal Republic of Germany, France, the Netherlands and Sweden. Denmark joined in 1967, and Italy and Switzerland in 1981, bringing the number of ESO member states to the current eight.

In connection with the various activities which are being planned for 1987, we are now looking for "old" ESO pictures. Main themes of interest are: early ESO meetings, also before the formal founding of the organization; La Silla before and during early construction; early visitors (before 1970) to La Silla. There may of course also be other pictures of special interest to ESO.

In case you possess such pictures, we would be thankful for being informed about their approximate number and content. You are also very welcome to send them (by registered mail!) to the ESO Information and Photographic Service. We shall copy them and will return the originals to you as soon as possible.

New Minor Planet: (3496) ARIESO

The Minor planet (1977 RC) was discovered by H.-E. Schuster on a plate taken with the ESO Schmidt telescope on September 5, 1986. It has now been observed during three oppositions and was given the number (3496) by the IAU Minor Planet Bureau. The orbit is peculiar, of the so-called Pallas-type. It was found during the 1977 Pilot Survey for High-Inclination Minor Planets which was a joint project of Astronomisches Rechen-Institut (ARI) in Heidelberg, FRG, and ESO. It has been given the name ARIESO (combining the acronyms of the two institutions), after a proposal by the involved astronomers, L.D. Schmadel and J. Schubart (ARI), and H.-E. Schuster and R.M. West (ESO).

CCD Field Polarimetry with EFOSC

H. DEKKER and S. D'ODORICO

1. Field Polarimetry as the Sixth Observing Mode of EFOSC

This is a report on the installation of a Wollaston prism in EFOSC, the ESO Faint Object Spectrograph and Camera (1, 2). By inserting the prism in the parallel beam space of the instrument it is now possible to obtain for each object in the CCD field of view (3.′5 × 5.′6) two images characterized by perpendicular linear polarizations. The amount ϱ and the position angle Φ of the polarization can be derived from a cosine fitting to the relative intensity differences of the two images as measured at different orientations of the Wollaston. The change in the position angle of the polarization vector is achieved by the rotation of the adaptor flange on which EFOSC is mounted.

The analysis of the test data obtained in October 1986 indicates that 1% polarization can be easily measured for objects as faint as 20th magnitude. By averaging multiple frames of the same field and by taking special care in the flat-field procedure, it should be possible to improve both this limiting magnitude and the accuracy of the measurement.

The polarimetric observing mode of EFOSC can be used on the same night with any of the other observing modes of EFOSC: imaging, slit grism spectroscopy, multiple object spectroscopy, échelle spectroscopy and grism slitless spectroscopy.

2. The Wollaston Prism in EFOSC

We were motivated to introduce this observing option by the work of K. Meisenheimer and A.J. Röser of the Max-Planck-Institut für Astronomie in Heidelberg.

In November 1985 they used a double calcite plate (called a Savart plate) on EFOSC. The Savart plate was mounted below the aperture wheel in the diverging beam of the instrument and produced on the CCD double images of all objects in the field (3, 4). While successful in the detection of polarization in faint objects (4), the Savart plate could not be easily removed from the optical beam and required a change of focus either of the telescope or the EFOSC optics. At ESO we thus opted for the use of a Wollaston prism to be placed in the parallel beam space that performs the same function as the Savart plate, that is the splitting in two orthogonally polarized images.

A quartz Wollaston prism of 48 mm free diameter and an angle of 13.°44 was selected, antireflection-coated, and mounted on the grism wheel in a standard grism cell (Fig. 1). It produces a pair of images for each object in the field separated bey 10.4 arcsec on the CCD. The split images are usually aligned with the CCD columns; different orientations can be obtained by rotating the prism in its mounting.

The polarization standard HD 23512 (m_v = 8.1, P = 2.3%) was observed at intervals of 15° in position angle. The star was too bright for standard CCD observations so we had to defocus the telescope and use a narrow band filter. The accuracy of the photometric measurement on the two images is reduced as the outer isophotes overlap. Notwithstanding this limitation we derive a fine cosine curve from the sequence of measurements, which indicates that the instrument-induced polarization effects are smaller than 0.2% and the polarization angle shift smaller than 5°. As our measurements are carried out at a different wavelength than the standard (500 versus 600 nm) and are of limited photo-

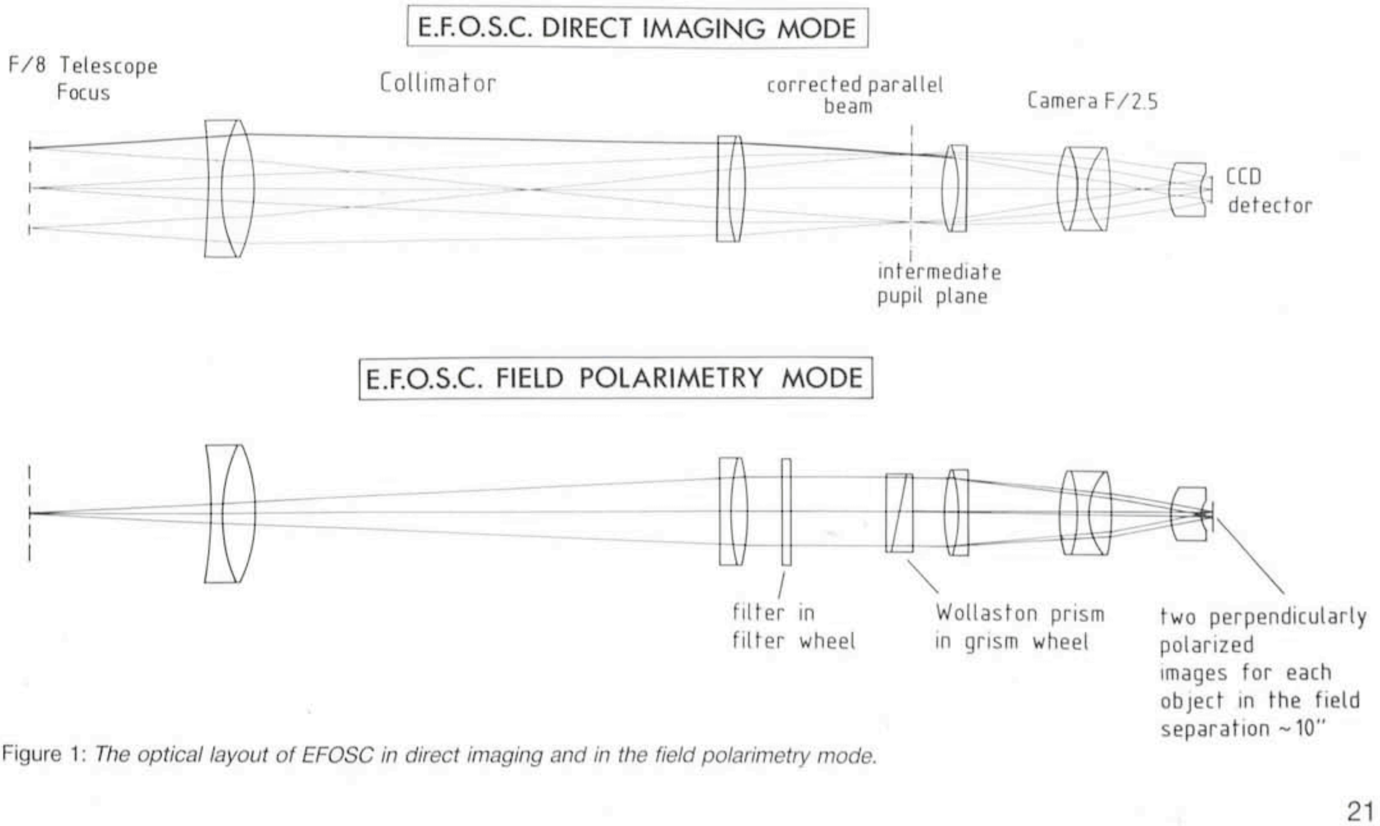


Figure 1: *The optical layout of EFOSC in direct imaging and in the field polarimetry mode.*

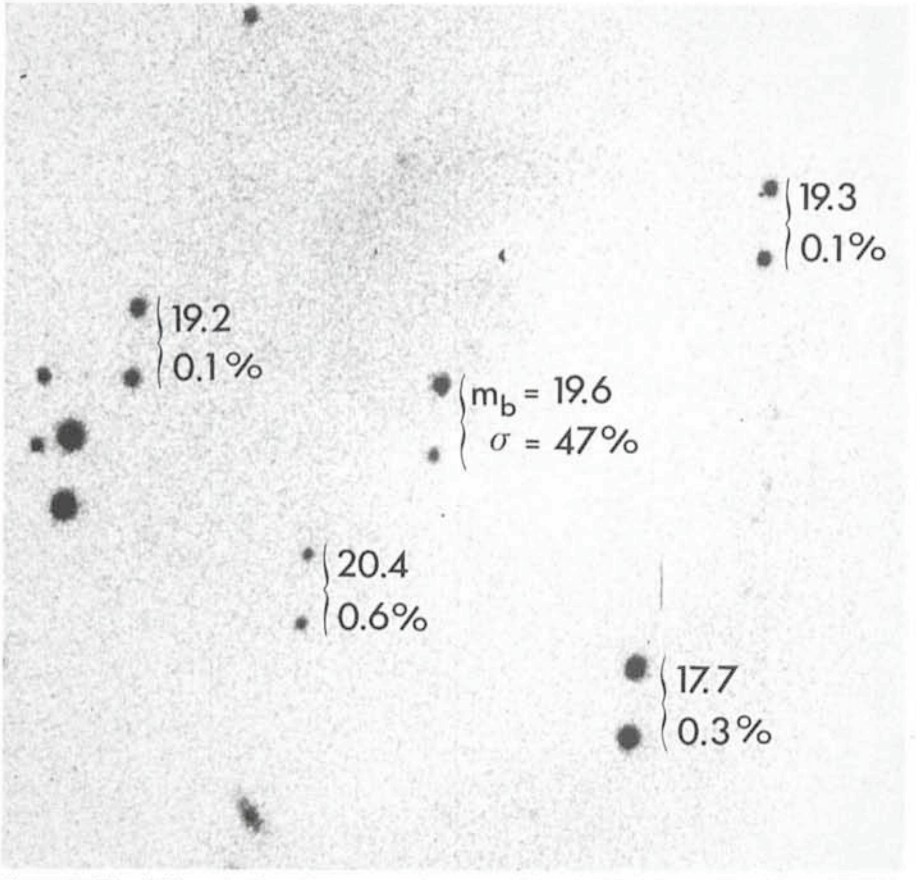


Figure 2: *The field centred on the western hotspot of the double lobe source Pictor A (0518-456) observed with the Wollaston prism in EFOSC. The position angle was 289°3, visual apparent magnitudes and the intensity difference $\sigma = 100\ (I_1 - I_2)/(I_1 + I_2)$ are indicated. The highly polarized object was discovered by Röser and Meisenheimer (4) and identified with the radio hotspot.*

metric accuracy as explained above, these values are likely to be upper limits.

The standard star measurements reveal however a systematic shift of ~0.6% for all the measurements, that is one of the two images is systematically brighter than the other one. More data will be needed to understand whether this effect, which is easily taken into account during data reduction, is peculiar to the standard star measurements or indicates a systematic instrumental effect like a slightly higher transmission for one of the two beams produced by the Wollaston.

3. The Observations of the Highly Polarized Object in a Radio Lobe of the Radio Galaxy Pictor A

A highly polarized object was identified by Röser and Meisenheimer (4) as the optical counterpart of the western radio hotspot of the double lobe source Pictor A (0518-456). They identified the object in an EFOSC observation through their Savart plate and a B filter, and measured a linear polarization of 29.6% with splitting in the N-S direction.

We repeated the observations with the Wollaston in the same B colour and at three different position angles. Figure 2 shows a part of a 20-min CCD frame including the object and listing the B magnitudes for the stars in the field and the relative intensity difference

$$\sigma = 100\ (I_1 - I_2)/(I_1 + I_2)$$

The magnitudes were derived from comparison with a standard field by Graham observed on the same night and should be accurate to 0.1 magnitude. A quarter of moon provided a relatively bright sky background which can limit the accuray of the photometry at faint magnitudes. The high resolution RCA (pixel = 15 μm = 0."34) was used. Images of stars have FWHM around 1 arcsec; the high-polarization object has a non stellar structure as found by Röser and Meisenheimer (4).

Our three polarization measurements give the following results: P.A. 174°3 σ = 25%, P.A. 244°3 σ = 19%, P.A. = 289°3 σ = 47.5% where the accuracy of the polarization is about 1% at 20th magnitude. This limit could be improved with multiple observations taken in dark time and an optimized data reduction technique as e.g. described in (5). The results confirm the exceptional nature of the object and the suggestion by Röser and Meisenheimer that the optical polarization could be higher than 50% at a position angle close to the one of the radio polarization. They also represent a most encouraging start for this new observing mode of EFOSC.

Acknowledgements

We would like to thank Dr. Röser for his advice on this project and S. Cristiani for his valuable support during the test observations.

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MIDAS Memo

ESO Image Processing Group

1. Application Developments

Several upgrades of commands have been made and will be released in the next MIDAS release 87JAN15. Major improvements were made on the Multivariate Analysis package which now includes many new methods and commands. In particular, it is now possible to do discriminant and correspondence analysis on tables. A new module was written in the Data Analysis part of MIDAS. It implements three methods to analyse Time Series Analysis with unequally spread data.

Collaboration with external sites is now starting to give some results. We have received a programme from IUE/VILSPA to read GO tapes from IUE-SIPS directly into MIDAS. The table editor has been upgraded by the SDAS group at STScI in Baltimore. We will distribute these programmes together with the standard MIDAS release.

2. FITS

Two major issues have been discussed in the FITS committees in the last years, namely: generalized FITS extensions with application to table and catalogues, and a longer physical block length of FITS tapes. Both the European FITS Committee and the AAS Working Group on Astronomical Software have during this year endorsed these proposals to be effective from January 1, 1987.

The proposal for generalized FITS extensions provides a design for future extension to the FITS tape format. It preserves compatibility with existing FITS tapes and software, including the "random groups" and other extensions of FITS, but its generalized design will permit a wide variety of new types of extensions in the future. A specific "Table" extension was also endorsed. This format provides a FITS standard to transmit tables and catalogues of astronomical data on tapes. A detailed description of the format can be found in Harten et al. 1985, *Mem. S.A. It.* Vol. **56**, p. 437.

In view of the increasing amount of digital data and the high tape densities available now, the original physical block length of FITS tapes (i.e. 2880 bytes) has become inefficient for transfer of large amounts of data. The long block proposal will allow FITS tapes to be blocked by a factor of up to 10 while the logical record length will remain 2880 bytes. If a FITS tape is written with long physical blocks according to this proposal, it MUST have the logical keyword "BLOCKED" equal to true in the first logical header record. This only indicates that the tape may be blocked. The detailed proposal can be obtained from the FITS committee.

The 87JAN15 release of the FITS read/write commands in MIDAS will support both table extensions and long blocks. However, it is recommended not to write long block FITS tapes during the first time since it will still take some time before most of the old FITS reading programmes from other institutes have been upgraded.

3. System

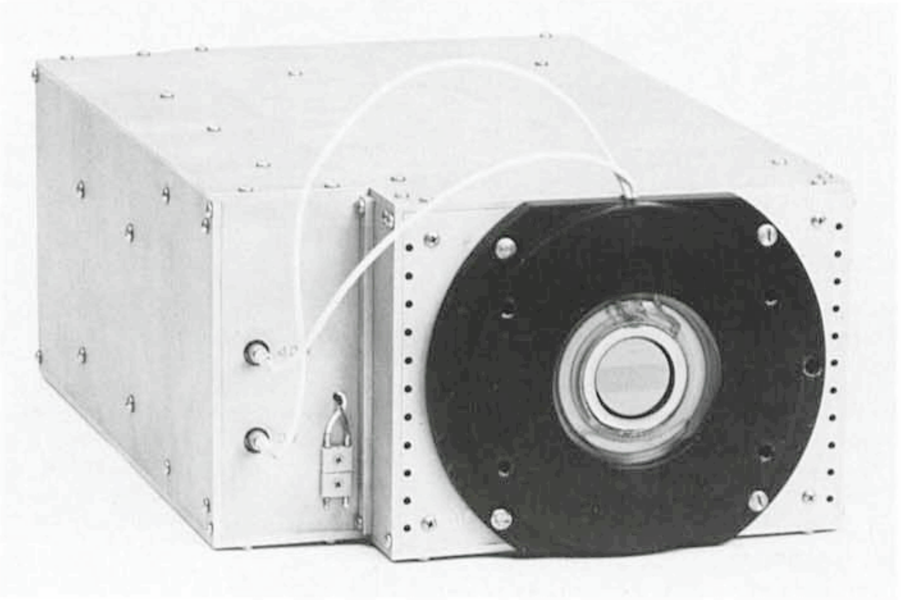
The MIDAS system has had two new improvements:

- It is now possible to have several MIDAS sessions working on the same disk directory in parallel.
- The user-mode options have been expanded to include the possibility of executing commands in a "prompt" mode, i.e. you are prompted for each parameter (also displaying the current default value) when executing a MIDAS command.

A "MAMA" for ESO

A photograph of the MAMA photon-counting detector system which was recently delivered to ESO. This detector, manufactured by Ball Aerospace Systems, has a bi-alkali photocathode and 1024 × 256 pixels. The head unit contains the detector tube and the front-end electronics. A second box (not shown) contains the event location and memory electronics. It will be tested in Garching in the coming months, and the first astronomical tests will take place at the Coudé Echelle Spectrograph in mid-1987.

M. Cullum



First Results with PISCO

O. STAHL, B. BUZZONI, G. KRAUS, H. SCHWARZ, ESO
K. METZ, M. ROTH, Universitätssternwarte München

1. Introduction

PISCO is the acronym for the new ESO polarimeter and stands for Polarimeter with Instrumental and Sky COmpensation. The design of the instrument has been developed by K. Metz and the main principles have been published in two articles in *Astronomy and Astrophysics* (Metz, 1984, 1986). The instrument has been built at the Universitätssternwarte München with the technical and financial support of ESO and is now offered to visiting astronomers at the 2.2 m telescope at La Silla. This article briefly describes the instrument and first results obtained during a test run in September 1986.

2. Optical Layout

The outline of the whole instrument is shown in Fig. 1. PISCO can be described as a two-channel polarimeter (see e.g. Serkowski, 1974, for polarimeter designs). In contrast to the usual design it uses, however, no Wollaston prism but a modified Foster prism to separate the ordinary and the extraordinary beam. This design has the advantage of a large (45°) and wavelength-independent beam separation.

The principal new feature of PISCO is the possibility to correct directly for the sky polarization and partly also for the instrumental polarization. The sky compensation is achieved by using two apertures and two phase plates with different orientation of the optical axes. The combined sky light is then unpolarized. However, the sky compensation mode is normally useful only for linear polarization measurements since the sky light exhibits an extremely low circular contribution. In addition, the sky compensation only works well if the sky intensity is not too large compared to the intensity of the object and if the sky

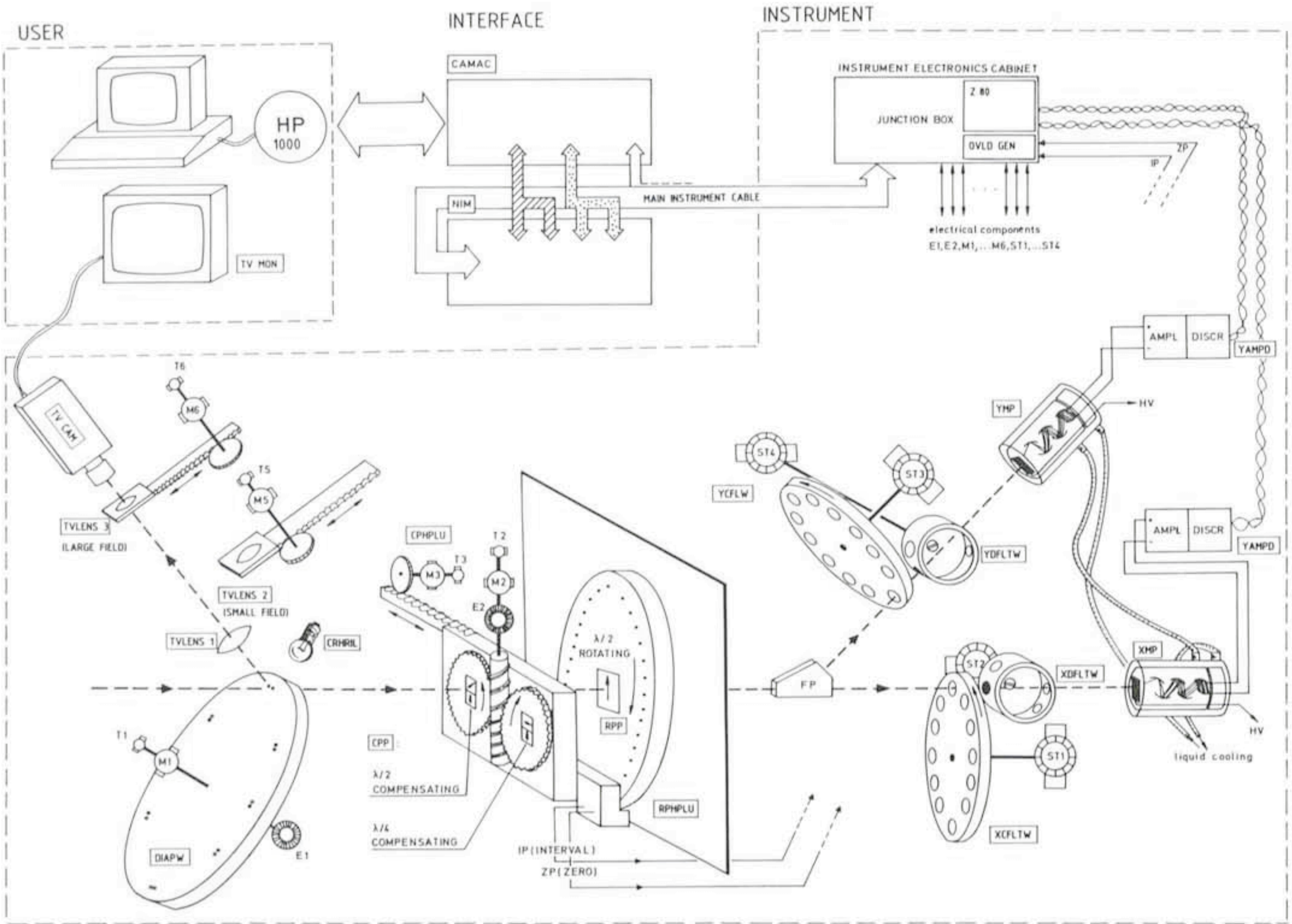


Figure 1: *Schematic drawing showing the most important parts of the instrument. The light enters the instrument through the diaphragm wheel DIAPW. Via the mirrored surface of this wheel, a TV camera views the observed field. Setting and guiding is done with the use of this camera. The compensating phase plate unit CPP corrects for the errors of the rotating half-wave plate RPP and automatically compensates for the sky polarization if a two-hole integration is selected. The Foster prism FP separates the ordinary and the extraordinary beam. The selection of the wavelength range is done via the colour filter wheels XCFLTW and YCFLTW separately for the X and Y channel. If the same filters are chosen for both channels, the instrument operates in the two-channel mode. The density filters XFDLTW and YDFLTW are inserted if very bright stars are observed. The photons are detected by the multipliers XMP and YMP. A Z80 micro-processor performs the integration of the counts in 2 × 32 channels. The user controls all functions of the instrument via the HP 1000 computer and a CAMAC interface.*

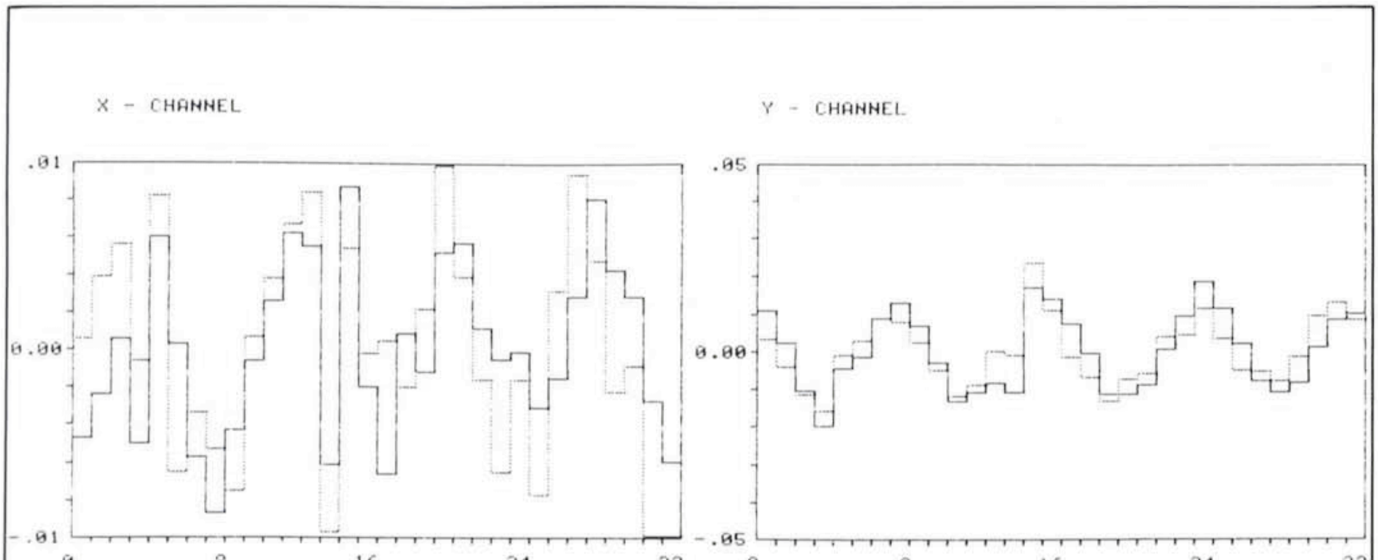


Figure 2: *Typical example for the on-line graphics display of the accumulated data counts. In this case two different filters have been used for the X and Y channel. For a polarized object the counts are modulated (as a function of the channel number, i.e. the angular position of the rotating half-wave plate) with a frequency of 4 times the rotation frequency. The degree of polarization is given by the degree of modulation.*

intensity is at least roughly constant. The instrumental polarization of the phase plate is compensated, if the whole compensating phase plate unit is rotated by 180°.

The signal modulation is effected by a rotating half-wave plate which rotates with 6 cycles sec^{-1} in our case. Each turn of this half-wave plate is divided into 32 equidistant sectors, corresponding to 32 counter channels.

The sinusoidal modulation of the count-rate with rotation describes the polarimetric signal which can be extracted by Fourier techniques. Typical signals look like the histograms of Fig. 2.

3. Detectors

PISCO is designed to work in the wavelength range 0.3 to 1.1 μm. Hamamatsu photomultipliers with a GaAs photocathode have been selected as detectors. They have a fairly high quantum efficiency over the whole wavelength range. The main disadvantage of these photomultipliers is that they have to be cooled in order to keep the dark current within acceptable limits. For PISCO, a Peltier cooling was originally planned. It was later decided to use a cooling system with liquid glycol because it could be realized much faster but it turned out that this cooling is not efficient enough to reach the desired temperature of −10°C or less. We measured a dark current of 100–200 counts/sec which limits the use of the instrument for fainter objects. A more efficient cooling could decrease the dark current by about a factor of ten with a corresponding gain in signal-to-noise ratio for faint stars and/or for narrow-band observations.

4. Instrument Control and Data Acquisition

The polarimeter PISCO offers a variety of options to the observer: She/he can observe linear or circular polarization, in two-channel mode (the same filters in the X and Y channel) or in one-channel mode (different filters in the X and Y channel, i.e. the polarimeter works like two independent one-channel polarimeters, with reduced seeing compensation, but two filters can be observed simultaneously) with or without sky compensation and with or without instrumental error compensation. The optimal choice will depend on the programme to be carried out and on the conditions during the observations. The observer has to know well the different possibilities to make optimum use of the observing time. However, once she/he knows what she/he wants to observe, the actual operation of the instrument is quite simple.

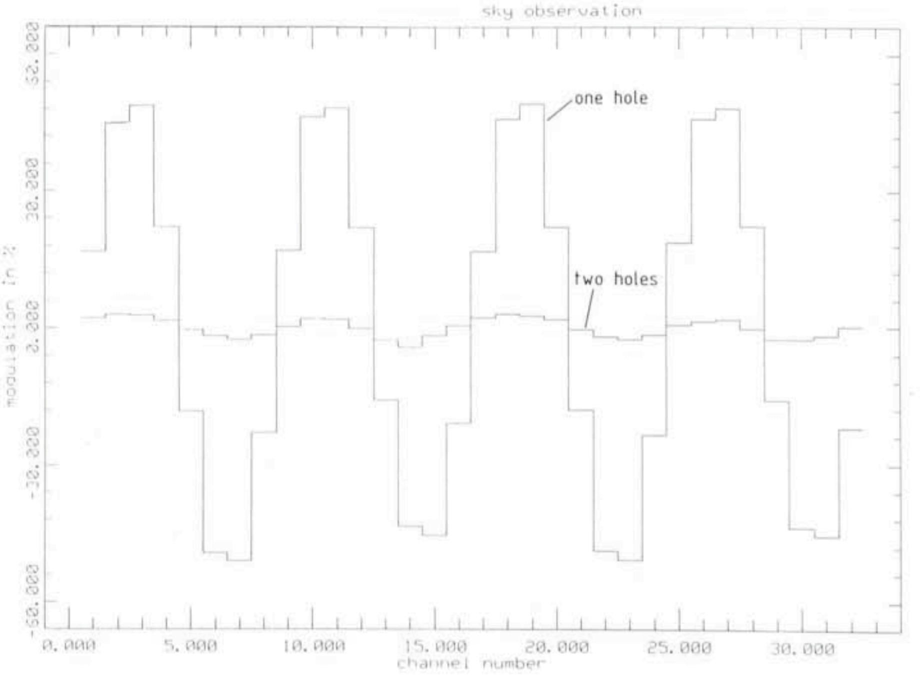


Figure 3: *Observed modulation of the count-rate as a function of the channel number with (two holes) and without (one hole) sky compensation. This measurement has been done observing a clear patch of moon-lit sky. The degree of modulation is a measure of the degree of polarization. It can be seen that the modulation is reduced by about a factor of twenty. Since the sky intensity is a factor of two larger if sky compensation is used, and the disturbing sky signal is given by sky intensity × sky polarization, the background signal is reduced by a factor of about ten.*

The whole instrument is remotely controlled from the control room via an HP terminal. Commands can be sent to the instrument via form-filling, softkey menus or typed commands, in a manner very similar to other ESO instruments. The accumulated counts in the 2 × 32 channels are displayed every 30 seconds on the graphics screen. In addition, an on-line data reduction is performed, so that the observer can immediately check the quality of her/his observations. All data are stored in IHAP files and can be transferred to magnetic tape in either IHAP or FITS format.

If a suitable guide star is visible on the reflecting diaphragm wheel which is viewed by the TV camera, the normal ESO autoguider system can be used. According to our experience, the field of view and the sensitivity of the instrument are such as to allow the use of the autoguider in almost all cases.

5. First Results

PISCO was tested at the 2.2 m telescope at La Silla in the five nights from September 15 to September 20, 1986 and immediately afterwards the first normal observing programme was performed.

Apart from initial problems with the optics, the instrument worked smoothly during the whole period. Since the test period was scheduled around full moon and the weather conditions were quite poor, there was ample opportunity to

Filter	U	B	V	R	I
Counts/sec	$1.2\ 10^4$	$8.0\ 10^4$	$1.4\ 10^5$	$1.3\ 10^5$	$6.5\ 10^4$
Limiting magnitude	11.4	13.5	14.1	14.0	13.2

Table 1: *Sensitivity of the instrument. We give in the Table the count-rate (in counts/sec) which can be expected for a star which has magnitude 10.0 in all filters, if the counts of the X and the Y channel are added (two-channel mode). These numbers have been computed from observations of standard stars. The corresponding limiting magnitude for a given integration time and a maximum photon noise error ε for the normalized Stokes parameters can then be calculated from the formula $\varepsilon(Q/I) = \varepsilon(U/I) = \sqrt{2N}$, where Q/I and U/I are the normalized Stokes parameters and N is the total number of photons counted (cf. Serkowski 1974). We give in the Table as an example the limiting magnitude for an integration time of 10 min and a photon noise error of 0.1%. It should be noted that the actual limiting magnitudes are somewhat brighter, since photon shot noise is not the only source of errors. Nevertheless, the numbers can serve as an orientation for planning observations.*

Filter	U	B	V	R	I
PKS 2005-489, Sept. 23	1.44 ± 1.04	1.70 ± 0.33	1.49 ± 0.29	1.77 ± 0.23	1.93 ± 0.26
PKS 2155-304, Sept. 23	2.86 ± 0.30	2.21 ± 0.17	1.95 ± 0.11	2.05 ± 0.09	1.78 ± 0.12
PKS 2005-489, Sept. 24	1.75 ± 1.36	1.34 ± 0.22	1.71 ± 0.26	1.56 ± 0.27	1.00 ± 0.35
PKS 2155-304, Sept. 24	5.91 ± 0.51	5.44 ± 0.33	4.97 ± 0.14	4.86 ± 0.18	4.13 ± 0.31

Table 2: *Observed degree of linear polarization in % in the UBVRI filters of two BL Lac objects. Both objects are of about 14th magnitude. The object PKS 2005-489 has only recently been classified as a BL Lac object (Wall et al. 1986). Our observations confirm this classification, although the degree of polarization is not very high for a BL Lac object. The listed results have been obtained in an integration time of about 10 minutes per filter. The results for PKS 2155-304 are also presented in Fig. 5.*

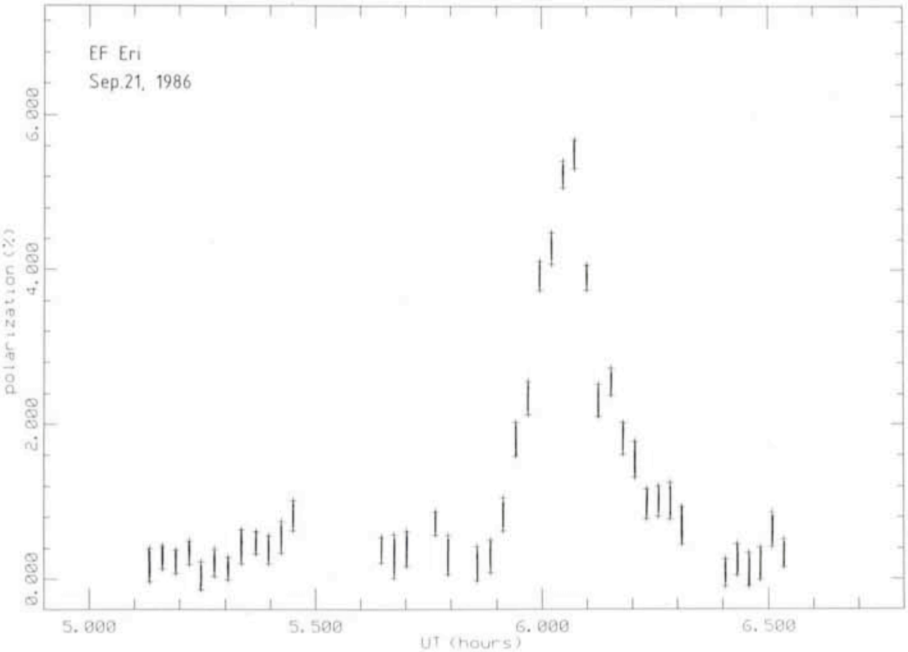


Figure 4: *The degree of linear polarization of the AM Her star EF Eri as a function of time. Note the pronounced peak of polarization at about 6 h UT. The observations have been done without filter in moonlight. The individual observations consist of 1 min integrations and have errors of typically 0.2 %. The sky intensity was slightly variable (due to clouds) and about 1/3 of the total signal (in two-hole mode). In spite of these very unfavourable conditions our results compare very well with the previous observations of Bailey et al. (1982) and Cropper (1985).*

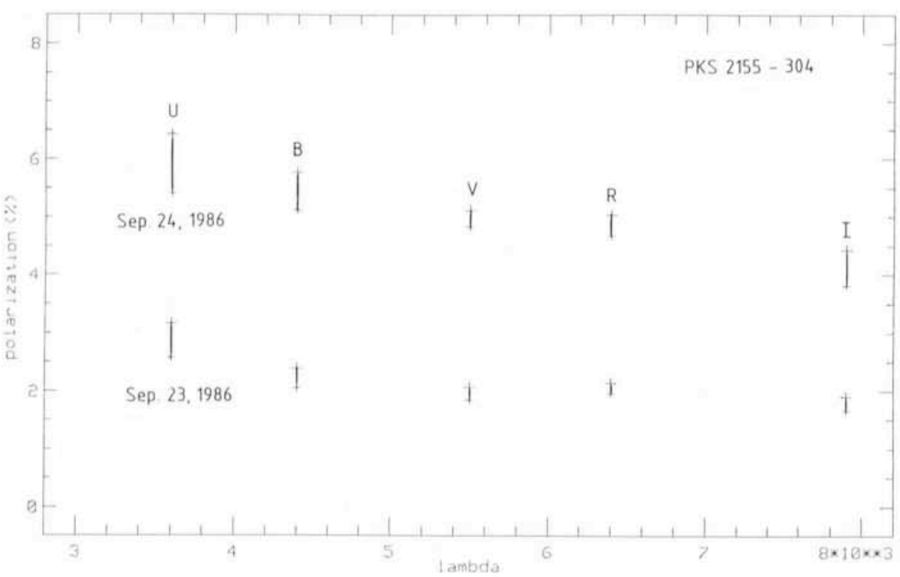


Figure 5: *Degree of linear polarization as a function of wavelength for PKS 2155-304. It is obvious that the polarization of the object is wavelength-dependent and strongly variable on the timescale of one day. This basically confirms the results of Griffiths et al. (1979) and Luna (1986).*

test the sky compensation of PISCO.

Fig. 3 shows the results of a test of the sky compensation observing just the moon-lit sky. In sky compensation mode, the polarization of the signal is not completely zero, but it is reduced by a factor of about 20. Since the intensity of the sky is twice as high when sky compensation is used, the modulation of the total signal introduced by the moonlight is reduced by a factor of ten—a very important gain compared to a normal polarimeter.

The sensitivity of the instrument has been measured by observing standard stars. The measured values are listed in Table 1 for the UBVRI filters. These measured values conform to the expectations.

In order to demonstrate the capabilities of the instrument, we give in the following a few results which have been obtained for fainter objects. In Fig. 4 we show the results obtained for the 15th magnitude AM Her star EF Eri, which shows a short peak of high polarization once during its orbital cycle. The reduction was done with the ESO image processing system MIDAS using a command procedure. The error bars have been derived directly from the data and should be realistic.

In Table 2, we list several observations of the BL Lac objects PKS 2005-489 and PKS 2155-304. The results for PKS 2155-304 are also given graphically in Fig. 5.

The first measures with PISCO have clearly been successful. The results, all of which have been obtained with rather bad photometric conditions, demonstrate that PISCO can indeed provide useful results even in rather poor weather. To measure the limiting performance of the instrument, dark and photometric nights will be needed.

Acknowledgements

We wish to thank all people from the Universitätssternwarte München and from ESO, both in Garching and on La Silla, who have contributed to the development of PISCO.

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NEW ESO CONFERENCE AND WORKSHOP PROCEEDINGS

In addition to the Proceedings of the Second Workshop on "ESO's Very Large Telescope" (see page 10: "VLT Documentation"), the following Conference and Workshop Proceedings have been published:

Second ESO-CERN Symposium on

"Cosmology, Astronomy and Fundamental Physics"

held at Garching from 17 to 21 June 1986

The price for this 326-p. volume, edited by G. Setti and L. Van Hove, is DM 35.– (including surface mail postage).

ESO-OHP Workshop on

"The Optimization of the Use of CCD Detectors in Astronomy"

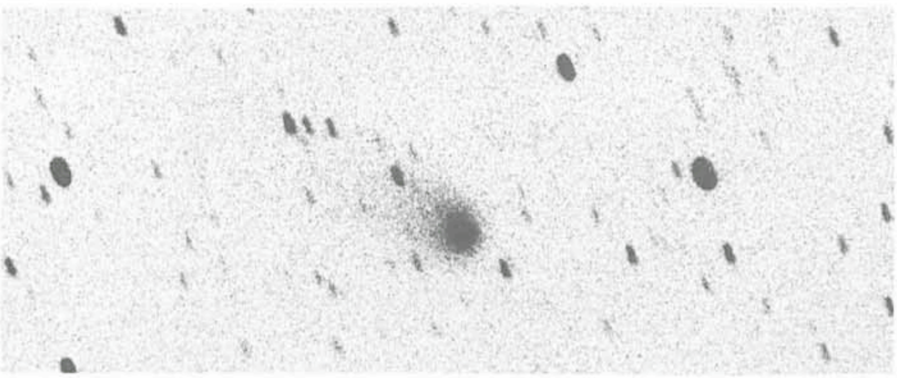
held at Observatoire de Haute-Provence from 17 to 19 June 1986

This 356-p. volume, edited by J.-P. Baluteau and S. D'Odorico, is available at DM 45.–.

All Proceedings have to be prepaid. Orders should be addressed to: ESO Information and Photographic Service, Karl-Schwarzschild-Str. 2, D-8046 Garching bei München (F.R.G.).

Comet Wilson (1986 l)

This picture of Comet Wilson was obtained with the ESO 1 m Schmidt telescope on November 6, 1986. The exposure lasted 15 minutes on red-sensitive 098-04 emulsion behind a RG630 filter. On this date, the magnitude of this new comet was around 11. A short, stubby tail extends towards northwest.



Observations of Comet Wilson from La Silla are being planned by several groups. When it is closest to the Earth towards the end of April 1987 (~ 95 million kilometres), it will be far down in the southern sky at declination – 78° and ideally placed for investigations from the ESO observatory. At this time it will not be visible from Europe.

Although this comet was rather bright when it was discovered, it has faded somewhat during the past weeks, and by early November 1986, it was more than 1 magnitude fainter than originally predicted. This effect is typical for new comets and is believed to result from initial sublimation of a thin layer of ices on the surface of the cometary nucleus. It is therefore difficult to predict its brightness, but a conservative estimate places it at around magnitude 4.5 in April 1987. It will therefore be an easy, visual object for southern observers. Nevertheless, comets are notoriously unpredictable, and it may well become brighter and more impressive than now foreseen.

ALGUNOS RESUMENES

El proyecto del VLT: estado actual

Durante los últimos meses el proyecto del Gran Telescopio ha dado un importante paso hacia su realización. Más de 80 científicos e ingenieros de los países miembros de la ESO (y otros) se reunieron en Venecia a fines de septiembre de 1986. Durante una semana dieron un detallado informe sobre esta ambiciosa empresa que tiene como meta la construcción del telescopio óptico más grande del mundo. Hubo un acuerdo unánime que el presente concepto está cerca de ser óptimo, que es técnicamente factible y que puede ser realizado dentro de aproximadamente 10 años, una vez que estén aprobados los fondos, y que permitira a astrónomos europeos realizar nuevas y espectaculares investigaciones del universo, sin paralelo en ninguna parte. Su conclusión se espera para el año 1997, pero parte del VLT podría ya funcionar en el año 1993.

Durante la reunión del 3 de octubre de 1986 el Comité Científico y Técnico de la ESO (STC) decidió recomendar que el proyecto del VLT fuera aprobado provisoriamente, en su estado actual, por el Consejo de la ESO. Se espera que el proyecto definitivo y detallado se presente al Consejo en junio de 1987 y que se llegue a una decisión final, incluyendo el financiamiento por los países miembros, hacia fines de 1987.

Fotografía de gran campo de la Vía Láctea

En la ESO recientemente se ha tomado una nueva fotografía panorámica de la Vía Láctea. Esta fotografía panorámica difiere en algunos aspectos de las imágenes tomadas anteriormente de la Vía Láctea. Sin usar un filtro y con una emulsión sensible a la luz visible, la impresión general de la fotografía panorámica es similar a la impresión que se obtiene cuando se observa la Vía Láctea en el cielo nocturno.

La completa fotografía panorámica

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 eight countries: Belgium, Denmark, France, the Federal Republic of Germany, Italy, the Netherlands, Sweden and Switzerland. It operates the La Silla observatory in the Atacama desert, 600 km north of Santiago de Chile, at 2,400 m altitude, where thirteen telescopes with apertures up to 3.6 m are presently in operation. A 3.5-m New Technology Telescope (NTT) is being constructed and also a 15-m radio telescope (SEST). A giant telescope (VLT = Very Large Telescope), consisting of four 8-m telescopes (equivalent aperture = 16 m) is being planned for the 1990's. Six hundred scientists make proposals each year for the use of the telescopes at La Silla. The ESO Headquarters are located in Garching, near Munich, FRG. It is the scientific-technical and administrative centre of ESO, where technical development programmes are carried out to provide the La Silla observatory with the newest instruments. There are also extensive facilities which enable the scientists to analyze their data. In Europe ESO employs about 150 international Staff members, Fellows and Associates; at La Silla about 40 and, in addition, 150 local Staff members.

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está siendo reproducida para ser usada en un libro titulado "Exploring the Southern Sky" que será publicado pronto. Aparecerá en una hoja plegada en cuatro, con un largo total de aproximadamente 120 cm. Más adelante también será publicada una traducción del libro al español.

La parte norte de la Vía Láctea fue fotografiada desde el Observatorio Roque de los Muchachos en la Isla La Palma, usando el reflector de 60 cm de la Real Academia Sueca como instrumento rastreador portando una pequeña cámara. Tanto la parte sur como también el centro fueron fotografiados desde La Silla en marzo de 1985. Se usó el GPO de 40 cm.

Una de las placas que se usaron para la fotografía panorámica se encuentra reproducida en las páginas 14 y 15. Muestra el pandeo central de la Vía Láctea con sus millares de estrellas. Por supuesto, la parte central de la galaxia se encuentra oculta detrás de las extensas nubes de polvo en el disco galáctico. En la página 16 aparece otra vista panorámica.

¿Quién tiene fotografías de los primeros tiempos de la ESO?

El próximo anõ la ESO celebrará su 25° aniversario. El día 5 de octubre de 1962 los representantes de los originalmente cinco países miembros, Bélgica, la República Federal Alemana, Francia, los Países Bajos y Suecia, firmaron una Convención en Paris. Dinamarca se adhirió en el año 1967, e Italia y Suiza en 1981, totalizando así el presente número de 8 países miembros.

En conexión con las distintas actividades que se están planeando para 1987 estamos ahora buscando "viejas" fotografías de la ESO. Los principales temas de interés son: las primeras reuniones de la ESO, también aquellas que tuvieron lugar antes de la fundación oficial; La Silla antes y durante las primeras construcciones; los primeros visitantes (antes de 1970) en La Silla. Podrán haber también otras fotografias de especial interés para la ESO.

Si Ud. posee tales fotografías agradeceríamos informarnos sobre la cantidad y tema. O sírvase enviarlas (por correo certificado) al Servicio de Información y Fotografía de la ESO. Las fotografías serán copiadas, y los originales serán devueltos lo más pronto posible.

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