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

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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 × 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 × 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

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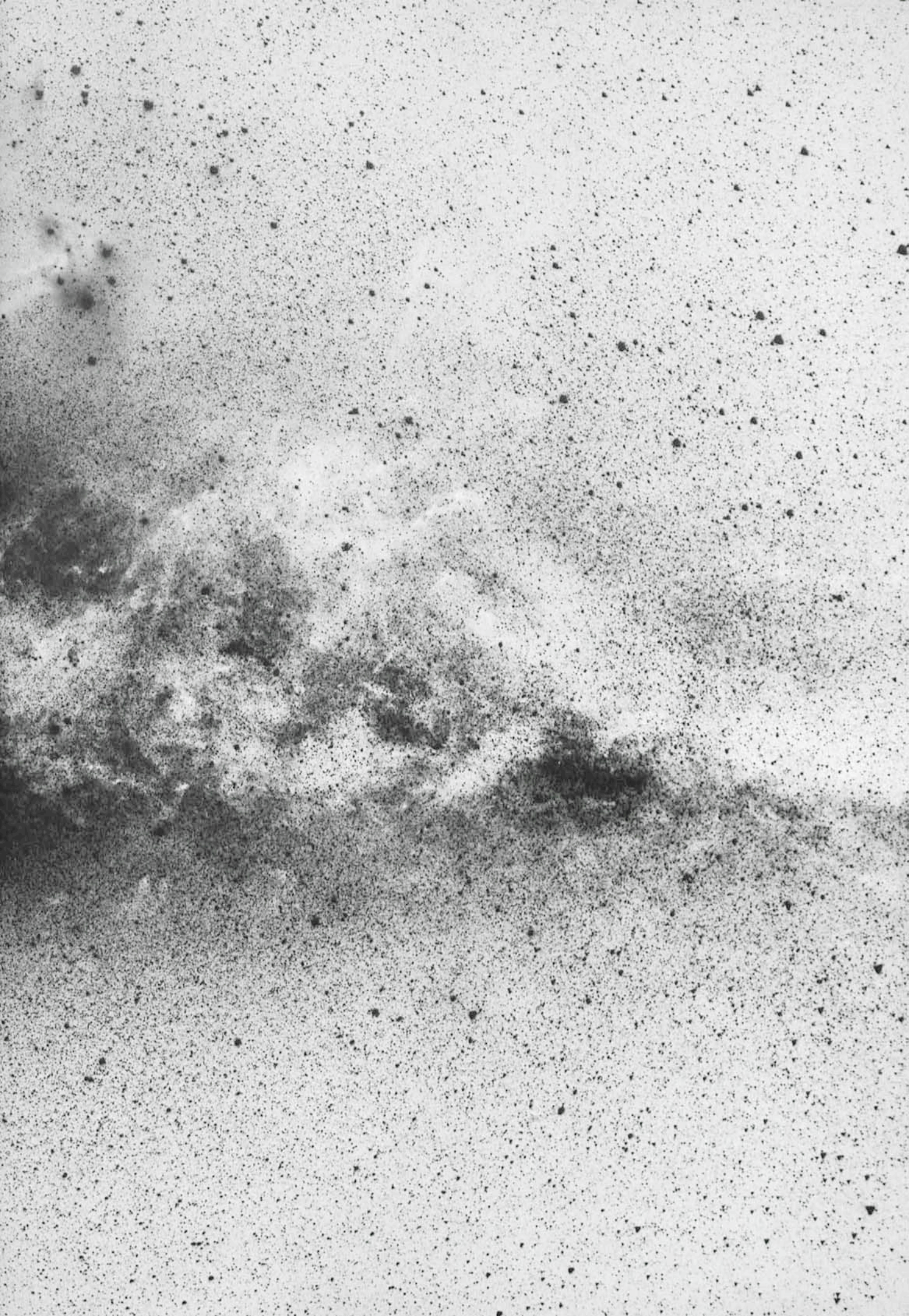
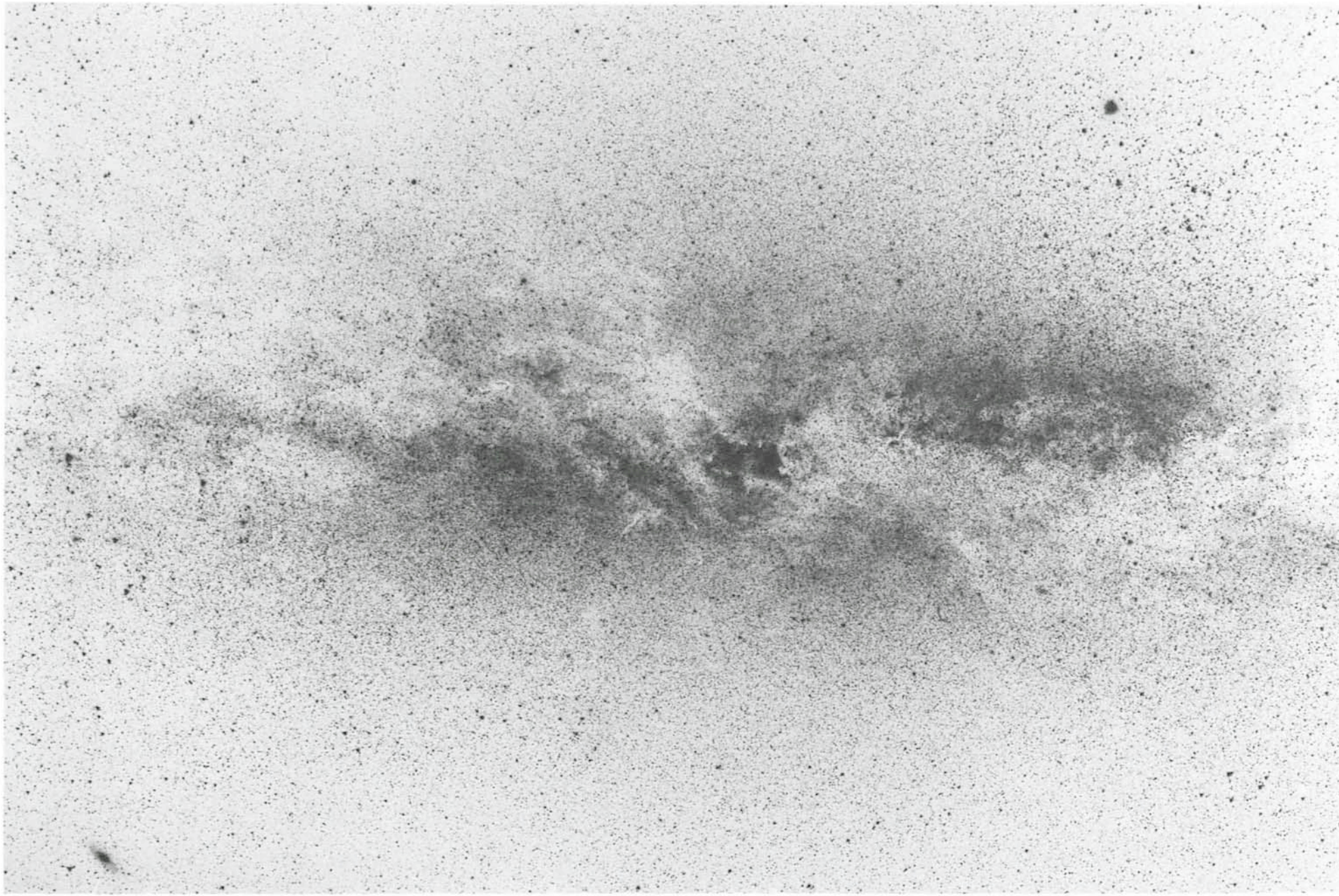
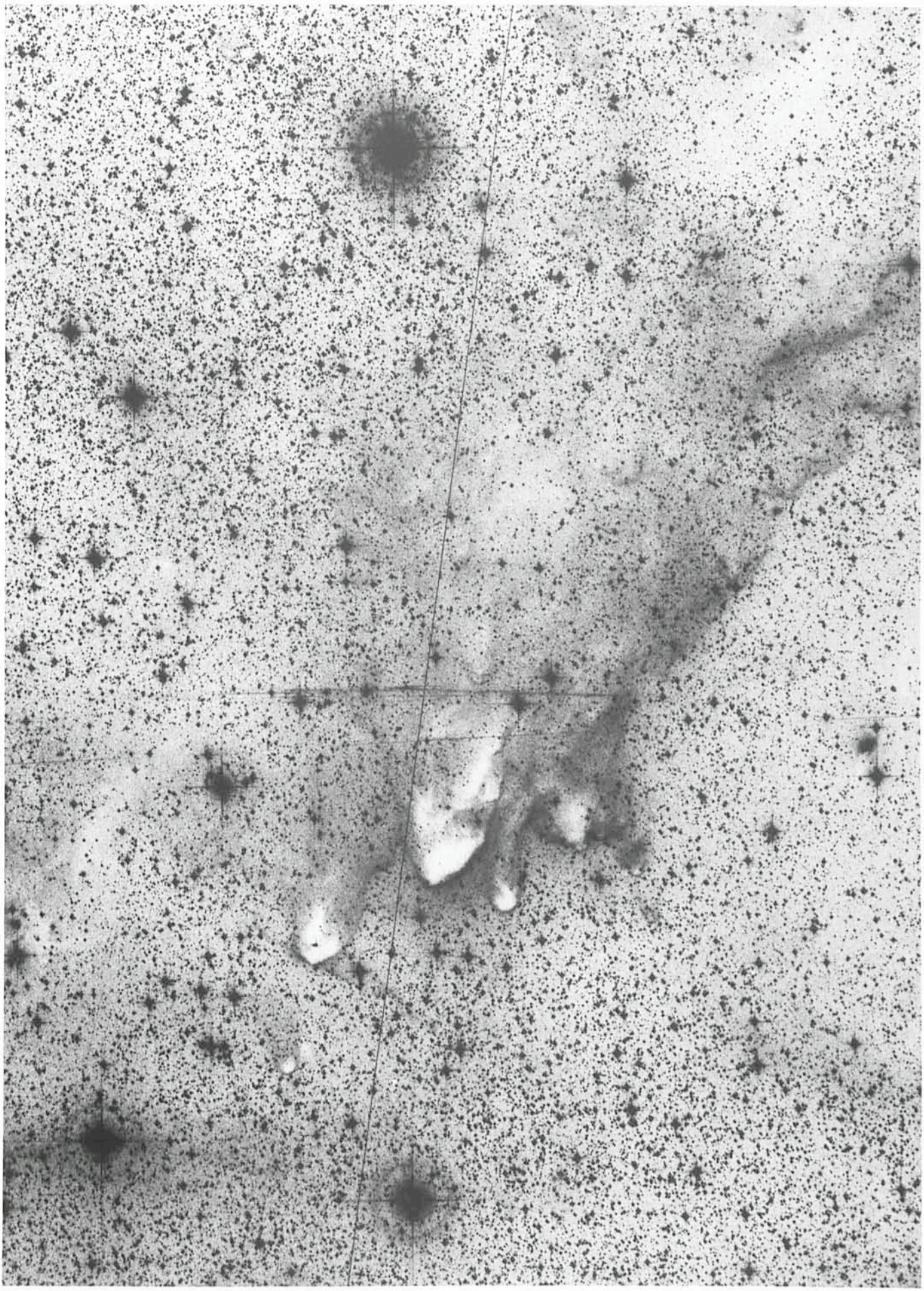
One of the plates used for the panorama is reproduced on the following two pages. It shows the central bulge of the Milky Way with its myriad of stars. The central part of the galaxy is of course hidden behind the extended dust clouds in the galactic disk. The field shown here covers approximately 70 × 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.