making it quite easy to pick out the trails of the asteroids among the round images of the stars. This has given for each of the observed fields almost 150 newly discovered asteroids. Figure 3 is a copy of a part of a plate taken during August 1979. The figure shows the trail of an ordinary main-belt asteroid, 1979 QU2, and that of a faster-moving object, probably an Amor asteroid (an asteroid with perihelion well inside the orbit of Mars).

Additional plates are taken for positions in order to derive orbital elements, and thus distances, and, from that, estimates of the diameters of the asteroids. The positions on some of the plates from 1979 were measured with the ESO Optronic machine, giving nearly 800 positions of some 140 newly discovered asteroids. Since this part of the programme still is in a preliminary phase, it is too early to draw any conclusions about the physical nature of the small asteroids.

Mapping the Southern Sky with the ESO 1 m Schmidt Telescope

H.-E. Schuster, ESO

To any astronomer, professional or amateur, the Palomar Observatory Sky Survey (shortly POSS) is a well-known and useful tool. The whole northern sky is photographed and prints from these photographs are available in the libraries of nearly all important observatories and astronomical institutes in the world.

Such a collection of photographs represents a sort of inventory of the universe, at least of the part accessible with our present instrumentation. In a simple way, this photographic inventory serves just to see what we have in the sky. What stars, clusters, nebulae, galaxies are there? Later, having done a selection, astronomers may concentrate on single objects or classes of objects for a deeper detailed investigation.

It is not necessary to explain here at long the importance and usefulness of the Palomar Sky Survey. In a certain sense it has become a "classic" already and has set a landmark and a high level in the field of sky mapping. Its only disadvantage, if one may say so, is the fact that it is limited to the northern hemisphere.

So, since the end of the fifties when the POSS had been finished and distributed to the astronomers, there has been the wish and the need to have a similar atlas of the southern sky.

One large obstacle to such an atlas was the fact that there was no adequate instrument available in the south for making the survey.

The instrument best fitted for such a photographic survey is a wide-angle camera with the following three important specifications:

(1) as already mentioned, it should have a wide field, otherwise it would be necessary take thousands of plates to cover a certain range of the sky, instead of only a few hundred;
(2) it should be powerful in "light-catching", in order to reach faint objects, or, roughly spoken, it should look into the sky as deep as possible;
(3) and the plate scale should be reasonably large as for extended objects, galaxies for instance, a fair resolution would help the user of the survey to try a first morphological classification of the objects.

The instrument of best choice is then, in consequence, a Schmidt camera.

There have been Schmidt cameras in operation in the south since long, but of smaller size and not as powerful as the Palomar Schmidt telescope. Once the northern atlas had been completed, one wished of course not only just a continuation to the south but a continuation which would be compatible. That means: the same field size, or nearly the same, the same limiting magnitude, or better if possible, and the same scaling in order to have comparable overlapping fields.

During the seventies, two large Schmidt telescopes came into operation; they had exactly the same scale as the Palomar Schmidt (1 mm = ~ 67 arcseconds) and fulfilled also the specifications of power and field size. These are the United Kingdom Schmidt telescope, based in Australia, and the ESO 1 m Schmidt telescope on La Silla. Both telescopes are now engaged in producing maps of the southern sky similar to the great example the Palomar Survey has set.

The laborious task has been distributed in such a way that both telescopes are busy with maps of different colours. ESO has taken the part of producing an atlas in the RED range, which is being realized on the fine grain KODAK IIIa-F emulsion behind a filter RG 630. In this way, a band-pass is defined from about 6300 to 6900 Å with the famous H-alpha line included. The exposure time for each plate is 2 hours, which is quite a task for a large-field camera aiming at the ideal condition to have good images all over the field of 5.5 x 5.5 degrees. The KODAK IIIa-F emulsion is a fine-grain emulsion, which results in high resolution, but the plates have to be pretreated before being used in the camera. This rather complicated and somewhat "tricky" process of sensibilization has to be applied; otherwise the response of the emulsion to light would be very low.

As a standard, at present, the plates are heated under 65° C in a gas flow of 2 liters per minute, in the following way: for 30 minutes in pure nitrogen gas and then another 2 hours in a mixture of 96 % nitrogen and 4 % hydrogen. This method is liable to variations depending on the original quality of the emulsion which varies with age and also intrinsically between factory delivery. So nearly permanent tests are necessary to have the emulsion under control.

The ESO RED atlas is under work at present, and about 5 to 6 years will be necessary to complete the 606 fields covering the sky from declination −17°5 down to the southern celestial pole.

It is a rather time consuming and sometimes difficult work to produce the necessary 606 master plates which are copied later for distribution.

Many parameters have to be obeyed carefully in order to get a good acceptable plate worth to be copied. Sensibilization may fail, intrinsic emulsion faults, i.e., scratches or holes in the emulsion, unproper development, breakage of the plate, guiding errors during the exposure are only some of the problems which may occur and disqualify a plate to be an original for copying.

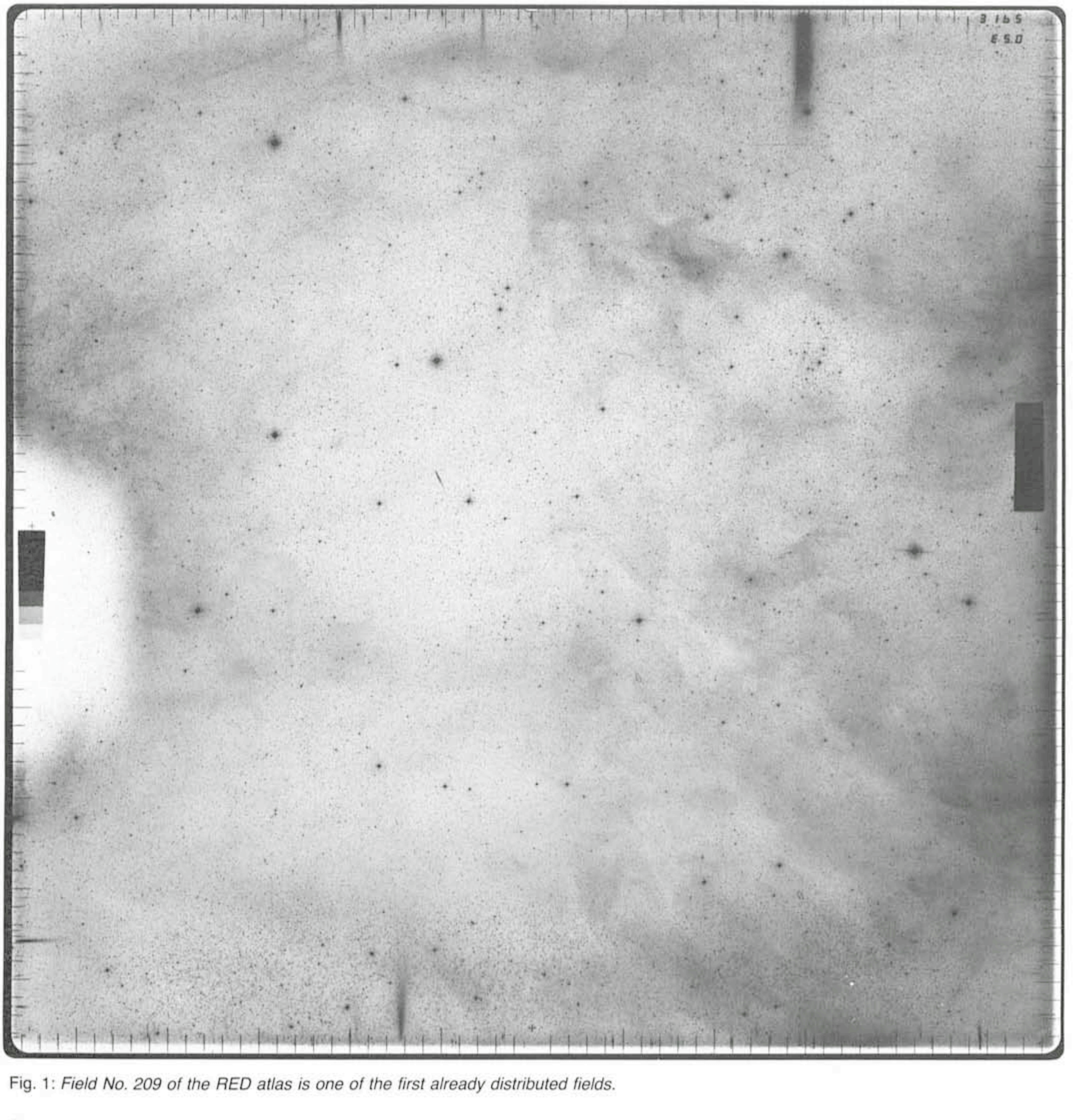

Fig. 1: *Field No. 209 of the RED atlas is one of the first already distributed fields.*

In addition, there are what we may call problems put by nature: moontime, clouds and bad seeing, which do not permit us to take atlas plates of high standards and cause delay in production.

To get a dozen good plates is nothing worth to be mentioned, but to have 606 plates of equally good quality in a reasonably limited time is something which can be fully appreciated only by somebody who has been busy himself in atlas and mapping projects, even if this may appear a little bit arrogant. And this refers only to the production of the master plates; another and certainly also troublesome task is the copying process, which is done in Europe – that is to obtain from one good original the necessary 20 or 50 or 100 equally good copies.

Fortunately, ESO could achieve a lot of valuable experience in atlas work before starting the above-mentioned RED atlas. Experience which resulted in improvements of the telescope and skills and "know-how" concerning plate handling and copying processes.

ESO had been busy for some years already in producing a BLUE atlas of the southern sky. This so-called Quick Blue Survey or QBS was completed about one and a half year ago and has been distributed to many observatories in ESO countries and others.

The same 606 fields are covered as now for the RED atlas; the emulsion of the plates used was KODAK IIa-O behind a filter GG385 giving a band-pass from about 3850 to 5000Å; the exposure time was one hour, and a limiting magnitude of 20.5 to 21 is reached. We hope to get deeper with the aforementioned RED atlas, possibly to the 22nd magnitude. To get the 606 good master plates for the finished BLUE atlas, altogether 1039 plates had to be taken, which leads to a ratio of 58%

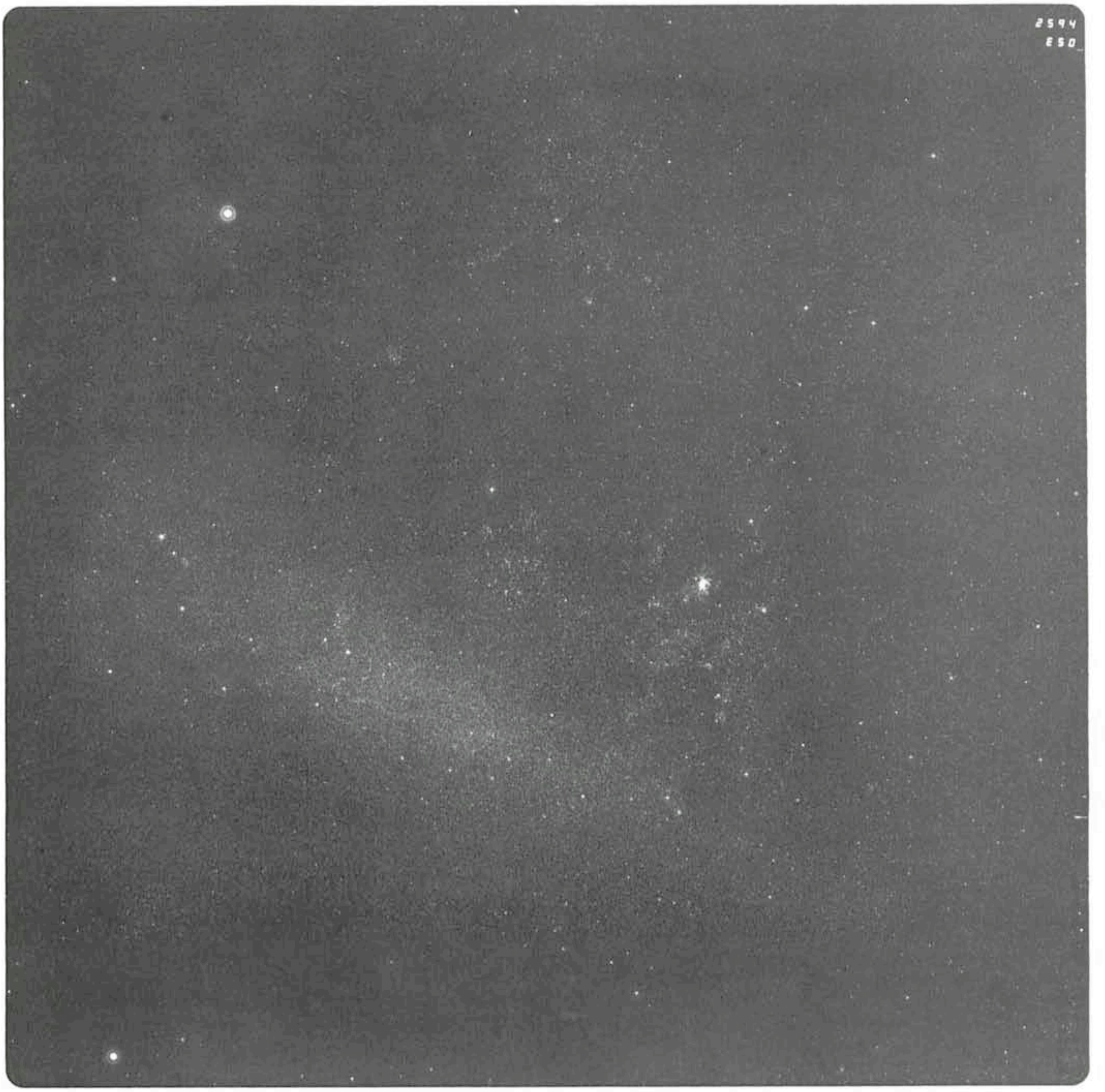

Fig. 2: *Infrared plate (IV N + RG 715) of the Large Magellanic Cloud.*

accepted plates to 42% rejected ones. It is interesting to note that this ratio is nearly exactly the same as the one of the Palomar group with the northern atlas.

Rejected plates are not completely useless; many of them have only a scratch or an unaesthetic patch, or a broken corner – details which do not allow them to be copied, but they are still useful and stored together with the master plates in the ESO files in the Garching archives.

The ESO Quick Blue Survey is now in full use and a direct follow-up work is also nearly finished. In collaboration with Uppsala Observatory, ESO has scanned the 606 southern sky fields, and any object larger than 1 mm (or about 67 arcsecs) is compiled in a catalogue, with the coordinates and a preliminary description. This catalogue, which contains several thousand objects, and the sky surveys done in Chile and Australia are the basis for future photometric and spectrographic programmes with the large telescopes now in operation in the south.

As said above, moontime does not permit us to take BLUE or RED atlas plates, the background would get to high. There exists, however, a combination of emulsion and filter which makes it possible to work even during full moon and to reach a colour band-pass which has become more and more of interest for astronomers. Using a KODAK IV-N emulsion with a filter RG715 the so-called near infrared is covered. The IV-N emulsion needs a careful wet sensibilization in a solution of silvernitrate, and then an immediate drying before use in the telescope. ESO has in its files in Garching a selected atlas along the band of the southern Milky Way. This IR atlas is not meant for distribution but available for use in Garching. On the other extreme of the spectrum, the ultraviolet has called more and more the attention of astronomers. Sporadically, there are informal talks about an atlas in the UV band. The same talks concern the possibility to have an atlas of objective prism spectra of the southern sky or at least of certain selected areas. But for the moment and for some time in the future the ESO RED atlas is the main task of the La Silla Schmidt.

Simultaneous Optical and Satellite Observations Provide New Understanding of a Famous Nova

H. Drechsel, J. Rahe

Remeis-Observatory Bamberg, and NASA-Goddard Space Flight Center, Greenbelt, MD, USA

A. Holm

Computer Sciences Corporation, Silver Spring, MD, 20910, USA

J. Krautter

Landessternwarte-Königstuhl, Heidelberg

Most stars in our Galaxy appear to be stable and shine with essentially the same intensity over millions of years. Novae (and supernovae), on the other hand, suffer suddenly a gigantic explosion. Their brightness increases in only a day or two by more than several 10,000 times, marking them often the brightest objects in the night sky, before they eventually fade in the course of several years to their former relatively insignificant pre-outburst brightness. These stars were called "novae" (which literally means "new stars"), long before it was realized that they are not new at all, but existed already as stars long before their outburst. Nova Aquilae (1918) is actually one of the very few objects which had been known to exist before it turned into a "nova".

Until now, more than 150 "normal" novae have been recorded in our Galaxy, and typically one or more can be observed in a year. Although many novae remain undetected, it is estimated that about 25 appear per year in our Galaxy.

In the outburst, a shell is ejected with typical velocities of about 2000 km/sec. In many cases, the expansion of this envelope could be followed in direct photographs. In the case of nova V 603 Aquilae (see Fig. 1), the envelope showed a radial velocity of about 1700 km/sec; it expanded by about 1″ per year.

It is now generally accepted that novae are in fact close binary systems, consisting of a very compact object, which is probably a white dwarf, and a large, cooler late-type secondary that fills its Lagrangian lobe. The hydrogen-rich material lost by the expanding cooler star flows through the inner Lagrangian point towards the white dwarf, forming a fast rotating ring of material around it.

To obtain a better understanding of a typical old nova, extended optical observations with the ESO 1.5 and 3.6 m telescopes as well as ultraviolet measurements with the IUE satellite were conducted.

Nova Aquilae (1918) was the brightest new star that appeared in the sky since Tycho's and Kepler's supernovae in 1572 and 1604, which reached a maximum brightness of -4^m and -3^m, respectively (Clark and Stephenson, 1977). It shone with a visual magnitude of $-1\overset{m}{.}1$, on June 10, 1918, and was the brightest nova discovered since the invention of the telescope. It is a spectacular example of a "fast" nova that went through a very sharp light maximum and showed a steep brightness decrease which was followed by pronounced post-maximum fluctuations (Payne-Gaposchkin, 1957). The fading nova was soon found to be surrounded by a small nebula (Barnard, 1919) which expanded at a uniform rate (Mustel and Boyarchuk, 1970), and which by now has essentially vanished (Williams, 1980).

The binary character of nova V 603 Aquilae was discovered by Kraft (1964) from an analysis of Palomar coudé spectrograms. The radial velocity curve had a period of $3^h\ 19\overset{m}{.}5$ and a rather small amplitude of v. sin i = 38 km s^{-1}, which indicates a low inclination of the system. Pronounced eclipses of the accretion disk around the white dwarf by the late main sequence star were therefore not expected.

Although, over the years, light fluctuations were reported by a number of authors, up to now, no photometric measurements