parameter, such as age/evolution, gas content (mass loss or accretion rate), etc., which is not easily separable from luminosity.

We are grateful to ESO for their support of unorthodox photometry in the far infrared and to the DFG-SFB project 131, Radioastronomy, for financial support.

Discovery and Rediscovery of Comets and Minor Planets with the ESO 1 m Schmidt Telescope

H.-E. Schuster, ESO – La Silla

After a successful night with the ESO Schmidt, having taken plates for the ESO Atlas or for the scheduled non-Atlas programmes, follows the indispensable check and quality control of the plates. Focus behaviour all over the large field, image quality, evenness of development, limiting magnitude, emulsion faults are some of the quality factors to be checked. This is done usually by visual inspection, the plate being put on a light table and inspected through a zoom microscope allowing a magnification of 10 to 40 times. The whole plate is scanned from corner to corner.

During this inspection, every now and then, just by pure chance, a comet or a minor planet is detected. As these objects have a noticeable differential movement against the field stars, they show up as long trails on the plates. The lengths of the trails depend on the "speed" of the objects and on the exposure time of the plate. Sometimes, trails of this kind call special attention because their fuzzy structure or even haziness on one edge indicate that the object may be a comet. From at least three different exposures a preliminary orbit can be calculated and a first ephemeris, and, what is important, the second and the third plates definitely confirm the reality of the object. And finally the repeated plates show if one has not been trapped on the first one (the detection plate) just by a reflection or an emulsion fault. In this stage it is normally also possible to decide whether the object is really "new" or if it is a known one just coming back in our neighbourhood.

In reality, the inspection of plates for comets and minor planets is not as easy as it may look here. There is first a certain effect of getting tired after having inspected some plates and there is also the danger of becoming less attentive and missing an object, especially as they are not always very spectacular. If the motion is slow and the exposure short, the trails may be very short and look like slightly elongated star images.

The aspect of a comet may be even more ambiguous. When far away from the sun, they do not show any noticeable activity or only a very low one. In consequence their trails may look like "normal" minor planet trails. Sometimes, a certain fuzziness promising a comet is faked only by seeing conditions or emulsion behaviour.

If one is sure about the reality of the object, a notice, normally by telex, is given to the IAU (International Astronomical Union) office in Cambridge (Mass.). From there the discovery is made known to other observers and institutes, for confirmation or for further studies of the new member of our solar system. As soon as a reliable set of coordinates has been established, people dedicated to such work will set up the orbital elements (a sort of passport for the object) and calculate an ephemeris for further observations. Of special interest are comets when their orbital and other parameters indicate that they may become bright and spectacular when passing near the earth in favourable observing conditions.

Special classes of minor planets not belonging to the large bulk of so-called main belt asteroids, are exciting for astronomers. Having orbits of high inclination with respect to the ecliptic plane, or being extremely "quick" (that means near the earth), they may cross the earth's orbit and are of high interest for specialized observers. In both cases, as well for comets as for special minor planets, it is very useful to detect them as early as possible, long before their close approach to the earth. Only then observations, and maybe even space missions, can be planned carefully and efficiently and a campaign can be started.

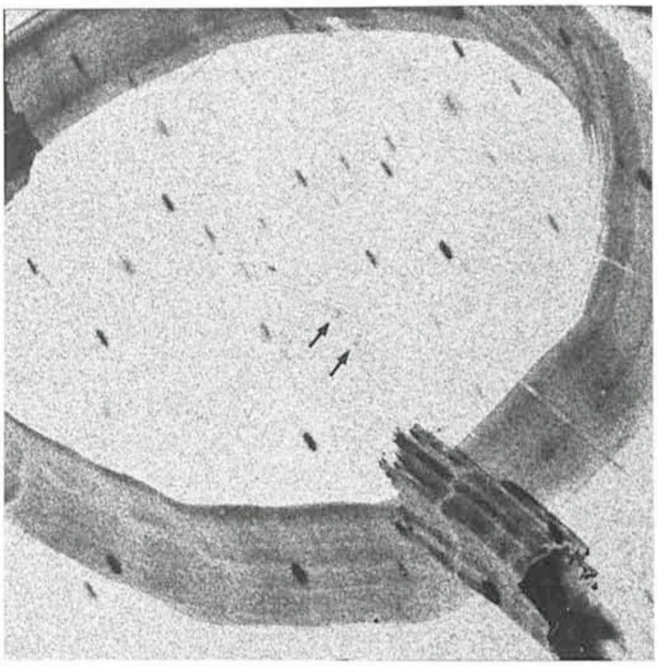

Fig. 1: *Recovery plate of comet P/Brooks, taken by H.-E. Schuster on 12 June 1980. Double exposure, 20 minutes each, on IIa-O emulsion, filter GG385. The arrows show the two images of the comet.*

The MESSENGER has frequently reported during the last years about comets and special minor planets detected on La Silla with the 1 m Schmidt telescope. Also reports on further studies and results have been given. So it is not intended to repeat these notes here.

What has to be stressed is the following: All the minor planets and comets found on La Silla with the Schmidt telescope are an accidental by-product of other programmes. No systematic long-time "hunting" has been done.

A more systematic and planned enterprise is the so-called recovery of known comets and minor planets. Here the time and the coordinates are known with some accuracy, when and where on the sky a periodic comet or a minor planet will show up again. It is of course not so spectacular and exciting to recover a known object than to detect a new one. But often, orbits and periods are not so well established and there are cases where an object has been lost. That may happen if during the first apparition (the detection event) only a few and maybe not very accurate observations were done. Sometimes the second apparition, when the object has finished its first revolution, is missed for bad weather. Consequently, the orbit is not very well known. During their travel through the solar system, periodic comets may pass near to one of the large planets. Then a drastic change of their orbital elements may take place. Such changes are ruled by pure celestial mechanics, but comets may also undergo other orbital changes not governed by Keplers laws. Such "non-gravitational" forces are not well understood yet.

So the return of a periodic comet and of some minor planets is still an exciting adventure, when such an object, after years, in case of periodic comets maybe up to 80 years and more, comes back to us after its long travel in deep space. That will happen soon with the famous comet HALLEY which after 76 years will visit us again.

And there is a certain tension of course: who will detect it first on its way back to us?

If one has some idea about the orbit, the recovery of these objects is not any more just "fishing" in the sky. One knows at least where to look, and when, what movement could be expected and what magnitude.

The ESO Schmidt telescope was very successful during the year 1980 in recovering comets and minor planets. 6 periodic comets were recovered (table 1) well before their perihelion (nearest approach to the sun) and one minor planet, the long lost HELLA, MP1370 (Schmadel, 1980, *Astronomische Nachrichten,* **301,** 251).

The recovery of the 6 comets was more or less a "routine", but the recovery of minor planet HELLA was something special. This object was observed for the first time in 1935 on a few exposures by Reinmuth in Heidelberg. From then on, for 45 years, the planet was not observed and finally listed as lost.

A careful study by Lutz Schmadel (also from Heidelberg) resulted in a search ephemeris telling us where to look for the object. Using Schmadel's computations, it was possible with the ESO Schmidt to recover minor planet HELLA after 45 years.

TABLE 1

List of periodic comets recovered at La Silla in 1980

P/Forbes	P/Borelly
P/Brooks 2	P/Kohoutek
P/Stephan Oterma	P/West-Kohoutek-Ikemma

Technically the work on the recovered comets and on HELLA has been made possible by a simpel, but powerful device integrated now to the Schmidt guiding system.

Normally, for regular plates, a guide star is put on the cross-wire of the television screen. When this is carefully done, all the stars on the plate will show up as distinct points, and a moving planet or comet will be seen as an elongated trail. One has to realize that doing this for the trailed comets or minor planets would be "wasting light". In this way, the objects we are looking for are moving over the plate and in a simple way one could say that faint objects do not stay long enough on any given spot to tell the emulsion "here I am". Only brighter moving objects can be detected, which mark a sufficiently strong trail. With the ESO Schmidt, for this kind of trailing, the detection limit is about 17th magnitude, depending of course also somewhat on the "speed" of the object. What is done now is the following: the electronic cross-wire on the TV screen is shifted according to the expected movement of the object under study, under computer control. Keeping the guide star on the cross, all stars on the plate will show up as elongated trails but the minor planet or comet under study will become a point. And the detection limit is pushed to the 19th, or even, under good conditions, to the 20th magnitude, depending a little bit on the quality of the precalculated parameters for the cross-movement. So, knowing more or less the movement of the returning object, one may redetect them when they are still faint.

The computer-controlled cross-wire, implemented some time ago to the Schmidt guiding system by the ESO engineers, has been proven to be a very useful and powerful tool in hunting for lost minor planets or recovering periodic comets. A similar system will also be integrated to the 3.6 m triplet guiding system.

For the year 1981 we have a list of candidates to be recovered with the ESO Schmidt telescope, and we hope to be as successful as last year.

H II Regions in Nearby Galaxies

M. Rosa, Landessternwarte Königstuhl, Heidelberg

1. Introduction

In the past decade the interest in emission nebulae in external galaxies has increased significantly. Although the titles of papers on extragalactic research often do not refer explicitely to the fact that the emission spectra of gaseous nebulae have been investigated, a closer look shows that a considerable fraction of that work is based on data obtained from the study of H II regions. In Section 2 I shall try to outline the importance of H II regions in extragalactic astronomy. Section 3 discusses the problems which are still open and form the background of my own work. Finally, some new results are presented and briefly discussed.

2. Previous Work

As soon as closer attention was given to the extragalactic nebulae, observers noted the bright diffuse patches in irregular galaxies and in the arms of spiral systems. As an example Figure 1 shows a blue photograph of the giant Sc galaxy M 101. Very large associations of young stars and H II regions can be seen in the outer parts of the spiral arms. Some of them have their own NGC numbers and their sizes of 10 to 20 arcseconds correspond to linear dimensions of 400 to 800 pc.

Apparently the first one to observe the spectrum of such a giant H II region in an external galaxy was H. Vogel of the Potsdam Observatory in 1890 (!) (cf. Scheiner, Spectralanalyse der Gestirne, p. 254, 1890). In the H II complex NGC 604 in the galaxy M 33 he detected the strong emission lines of Hydrogen and [O III] $\lambda\lambda$ 4960, 5007, thereby establishing the close relationship of this object with galactic H II regions. From that time on, H II regions were used as "wavelength standard sources" to determine the recession velocities of galaxies and the rotation curves of spiral systems. E. Hubble *(Astrophysical Journal,* **63,** 260, 1926) found that the relation between the