found that the S/N ratio of the MMT measurement was nearly the same as in the case of the full aperture.

Example 5: Reconstruction of Actual Images by Speckle Holography

Speckle interferometry yields the high resolution autocorrelation of the object. It is also possible to reconstruct actual images from speckle interferograms. For that purpose one has to record speckle interferograms of the object one wants to investigate, *and simultaneously* speckle interferograms of an *unresolvable* star close to the object. The speckle interferograms of the unresolvable star (point source) are used as the deconvolution keys. It is necessary that the object and the point source are in the same "isoplanatic patch". The isoplanatic patch is the field in which the atmospheric point spread function is nearly space-invariant. We found under good seeing conditions the size of the isoplanatic patch to be as large as 22 arcseconds, which was at the limit of our instrument (article in press).

The technique of using as the deconvolution keys speckle interferograms of a neighbourhood point source is called speckle holography. Speckle holography was first proposed by Liu and Lohmann (*Opt. Commun.* **8,** 372) and by Bates and co-worker (*Astron. Astrophys.* **22,** 319). Recently, we have for the first time applied speckle holography to astronomical objects (*Appl. Opt.* **17,** 2660). Figure 6 shows an application of speckle holography. In this experiment we reconstructed a diffraction-limited image of Zeta Cancri A–B by using as the deconvolution keys the speckle interferograms produced by Zeta CNC C, which is 6 arcseconds apart from A–B.

The measurements reported here are only a small part of the measurements that were performed with the 1.5 m and 3.6 m telescopes. We also measured various spectroscopic binaries, six Hyades binaries, other interesting binaries, the diameter of Mira, the central object of 30 Doradus nebula and other interesting objects. We plan to report these measurements when the evaluation is completed.

Finally, we would like to thank A. W. Lohmann for initiating the speckle project and for many stimulating discussions. We would also like to thank the staff at La Silla, especially the night assistants, for their valuable cooperation. The development of the speckle interferometer was financed by the German Science Foundation (DFG).

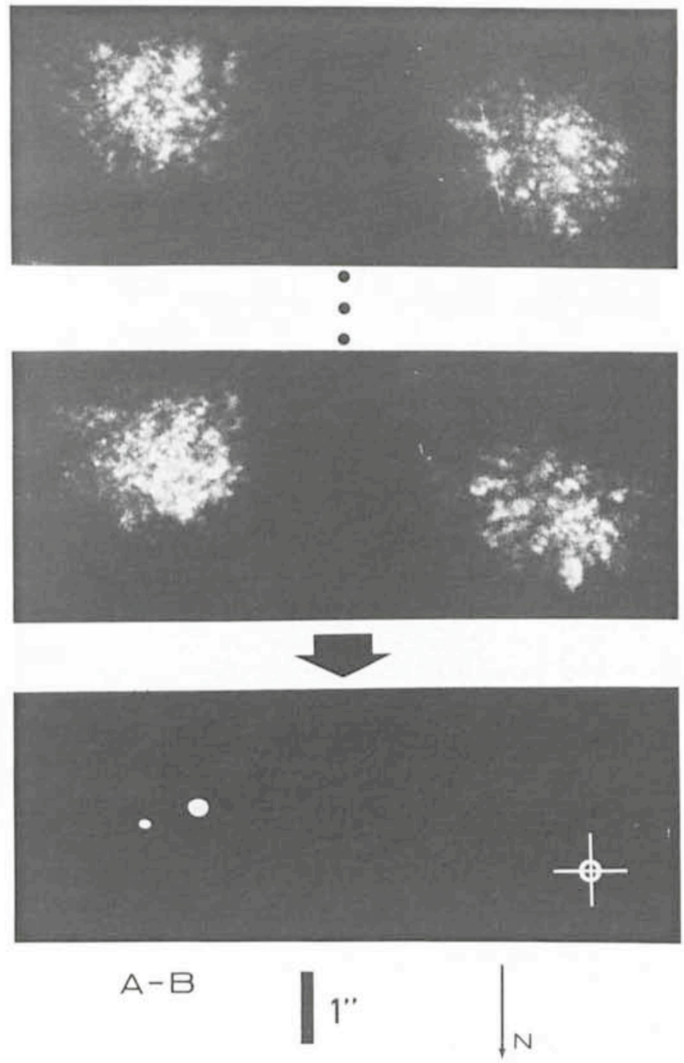


Fig. 6: *Speckle holography measurement of the binary star Zeta Cancri A–B. The diffraction-limited* image *of Zeta Cancri A–B (at the bottom left; separation = 0.″81) was reconstructed from 600 speckle interferograms. The cross at the bottom right has been drawn to indicate the position of Zeta CNC C. Two of the speckle interferograms are shown at the top. The speckle clouds on the left-hand side are produced by Zeta Cancri A–B. The speckle clouds on the right-hand side are due to Zeta Cancri C. The speckle clouds of Zeta Cancri C were used as the deconvolution keys. The speckle interferograms were recorded with the 1.5 m ESO telescope (the photograph in figure 6 is from the article "High resolution astrophotography: new isoplanicity measurements and speckle holography applications", G. Weigelt, submitted to* Optica Acta*).*

Photometric Observations of Minor Planets at ESO (1976–1979)

H. Debehogne, Royal Observatory, Brussels, Belgium

The study of the light variation of minor planets allows an estimate of their form and rotation (direction of axis and period). If it is furthermore possible to obtain a measure of their apparent magnitude over as long a time interval as possible, then the knowledge of the albedo and orbit gives the absolute magnitude and dimension. A table exists that connects the diameter and the magnitude/albedo; it has been compiled by the method of least squares applied to asteroids for which the diameters have been determined by other methods.

Minor planet photometry is in itself an important science and many astronomers work in this area only. However, many astrometrists and computers of orbits are overcome by their desire to improve their knowledge about minor planets and begin to do photometric observations. As indicated above, both astrometry and photometry are important for the study of these objects. The ESO observatory at La Silla offers the possibility to do both, by means of the 40 cm GPO astrograph (astrometry) and the ESO 50 cm telescope (photometry). Moreover, the GPO provides plates that facilitate the 50 cm observations.

There are two types of plates. The first type, which is later used for measurements of positions and improvements of the orbit, may also be used for quick (but less accurate) correction to the available ephemeris and therefore serves to facilitate the identification of the object in the 50 cm finder. The second type provides finding charts which increase the speed and reliability of the photometric observations. The two types of plates differ by the way they are made. The first may be referred to as "normal" for astrometric work; one makes three exposures (the exposure time is determined by the magnitude of the minor planet to be observed), separated by 6–10 minutes (to give a sufficient motion of the object) and slightly displaced, preferably in the δ-direction. This method, which has been used for many years, improves the accuracy of the measurements and makes the correct identification of the minor planet virtually fool-proof. Contrarily, the second type of plate consists of a single, 3–6 minute exposure which serves as finding chart for the 50 cm observations and does not give rise to any confusion because of multiple images as on the plates of the first type.

It is desirable to have a time interval between the GPO observations and those with the 50 cm. The photometric work requires a certain amount of preparation and it is important that the available observing time is well used and not wasted because of problems of identification, etc.

Observations at La Silla

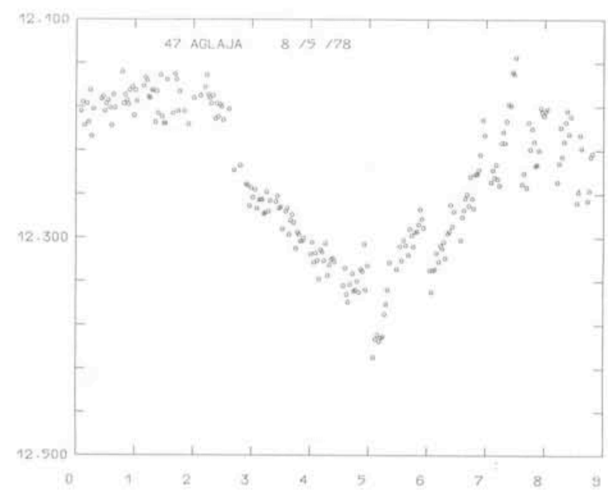
I have carried out photoelectric observations at La Silla, in 1976 with J. and A. Surdej (ESO), in 1978 together with V. Zappala (Turin) and in 1979 with L. and G. Houziaux, V. Zappala, E. van Dessel (Royal Obs., Brussels) and J. F. Caldeira (Valongo, Rio de Janeiro)—this year the variable carbon star V 348 Sgr was also on the programme.

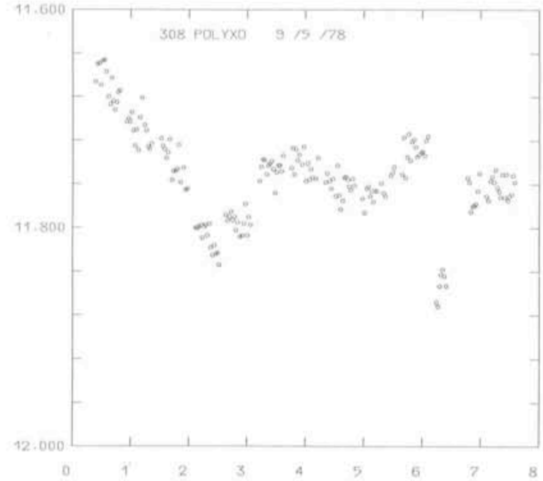
In 1976, the lightcurves of (59) ELPIS, (599) LUISA, (29) AMPHITRITE, (185) EUNIKE, (121) HERMIONE and (128) NEMESIS were observed and the corresponding periods of the first four determined as 13^h41^m, 9^h34^m, 5^h23^m and 10^h50^m, respectively. An interesting study has been carried out by J. and A. Surdej (cf. *Messenger* 13, page 4) which permits to draw conclusions about the form and rotation of asteroids from their observed lightcurves. In the case of (128) NEMESIS, our observations indicated a slow light change and therefore a slow rotation. This incited H. J. Schober (Graz) and F. Scaltriti and V. Zappala (Turin) to continue the observations of this object. A record period of 39 hours was finally found. For (121) HERMIONE a lower limit for the period was established at 9 hours and the period must be a fraction of 97.6 hours. (29) AMPHITRITE showed no less than three minima, a feature that has only been seen in six asteroids (H. J. Schober, 1978). So, all in all, the nine nights of observations in 1976 can be said to have been fruitful.

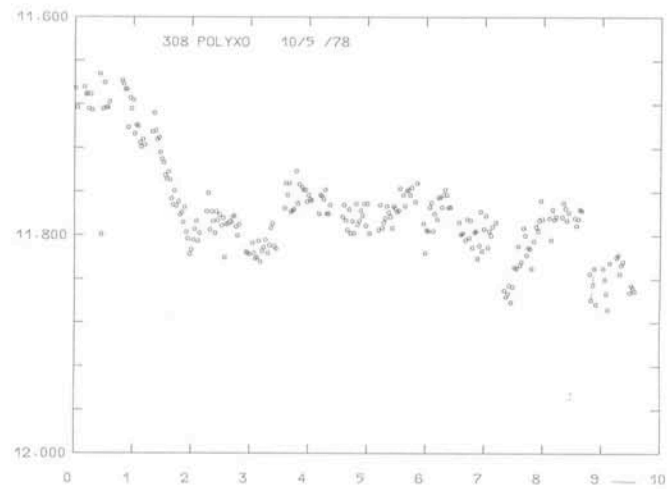
In 1978, observations were carried out during the first half of May. (47) AGLAJA was observed during two entire nights and the periods for (45) EUGENIA (three nights) and (308) POLYXO (three nights) were determined as 5.7 and 12 hours, respectively. This was done in collaboration with V. Zappala and H. van Diest. I feel, however, that the period of POLYXO is longer (32 hours), taking into consideration the observed gradients in the lightcurves and the high accuracy of the ESO 50 cm measurements, as well as the dispersion.

As a result of this experience, it was decided to observe two asteroids at the time this year (25. 4.-4. 5. 1979): (344) DESIDERATA and (110) LYDIA, and (139) JUEWA and (161) ATHOR. It is felt that this method is advantageous: a better assurance about the dispersion and about the reality of small differences in the brightness gradient. For instance small differences now force us to accept a longer period for (161) than believed before. A study is under way with Italian and Belgian colleagues.

The illustrations show observations of (47) AGLAJA and (308) POLYXO which were obtained in 1978. They were drawn by the UNIVAC computer in Uccle (H. van Diest).







Some Remarks about V 348 Sgr

A few words about our attempt to observe this star. It was not possible, but the explanation has now been found by examining the GPO plates. On a plate from April 22, 1979, its magnitude was 11.5. However, on a plate that was obtained four days later by C. F. Caldeira, it was no longer visible, i.e. it was fainter than 16^m! The period of this variable star is about 200 days and it is neither constant, nor regular, or even well known. It is therefore no wonder that it eluded us this time.

It is a pleasure to thank ESO, the night assistants and the La Silla Computer Centre for all help received.

New ESO Slide Sets

The first of the two new ESO slide sets announced on page 3 of *Messenger* No. 17 has just become available.

This slide set consists of 20 5 × 5 cm colour slides showing the ESO installations on La Silla. Buildings, telescopes and views of the site are included. A full description in several languages explains the slides.

The second slide set—containing 20 of the best black-and-white photographs obtained with the ESO 3.6 m telescope—will become available in late autumn this year.

Spectra of the Variable Star RY Sgr Near Minimum Light

M. Spite and F. Spite

Very interesting spectral observations were obtained by Drs. Monique and François Spite (Paris Observatory, Meudon) of the southern variable star RY Sgr, near a minimum. The observations were carried out with the Lallemand-Duchesne electronographic camera at the ESO 1.52 m telescope, and for the first time the O–O Swan band was detected in a R CrB star.

The variable stars of the R Cr B type are in a very interesting phase of stellar evolution, since they are supposed to be progenitors of type I *supernovae* (Wheeler, 1978). In their atmospheres, hydrogen is scarce or absent and the abundance of carbon and helium is large. They sometimes display small quasi-regular variations and deep minima at irregular intervals. This irregularity does not facilitate the observations of these stars during the minimum phase. Moreover, the stars become rather faint at minimum. The physical processes producing the deep minima are not yet understood. Clouds of carbon grains play a role, but when and where such clouds are formed are still unanswered questions, because the temperature of the photosphere seems too hot for a condensation of carbon into grains.

In order to make some progress in our understanding of the deep minima, spectra should be obtained, with good resolution, at critical phases. This is why we decided to observe, at the 1.52 m telescope, the star RY Sgr, the brightest star of this type after R Cr B, when a decay of its light was announced in 1977.

We had the opportunity to take advantage of the high sensitivity, high resolution and high photometric quality of the Lallemand-Duchesne electronographic camera, associated with the Echelec coudé spectrograph (Baranne, Duchesne, 1976) and we obtained two 60 Å/mm spectra covering the violet, blue and green regions. An untrailed photographic spectrum in the yellow range was obtained at the ESO coudé spectrograph.

Near minimum light, the spectra display the same main features as those observed at a preceding minimum (Alexander et al. 1972):

(1) narrow bright emission lines, called "chromospheric lines" after Payne-Gaposchkin (1963) who analysed the 1960 minimum of R Cr B itself;

(2) three broad bright emission lines in the violet (Ca II and He I λ3888);

(3) absorption lines.

The absorption lines show that the temperature of the photosphere is high, even during the minimum. This remark is backed up by a few measurements of the R–I colour index, obtained at the ESO 50 cm telescope: even neglecting the reddening by carbon clouds, the R–I index points to a rather high temperature.

Due to the good sensitivity of the electronic camera in the green region, the O–O Swan band is clearly visible: it is the first time that this band was ever observed in R Cr B type stars.

It is interesting to note that, for the moderately deep minimum of 1977, the main features of the spectrum

Spectrum of RY Sgr near minimum light in the blue-violet range, obtained with the Lallemand-Duchesne electronographic camera. In the underexposed (violet) part, the broad emission lines of Ca II (H and K lines) and of He I (λ 3888 line) may be recognized: they are evidences for violent motions of atoms.