sities in opaque dust clouds. The Palomar Sky Survey and the Whiteoak extension cover the sky north of declination –46°. When I worked on this task during the summer of 1976, the ESO (B) "quick blue" survey of the southern sky was near completion and enabled me to extend the search to more southernly areas. Most of the ESO plates were available at the Uppsala Observatory, where the ESO/Uppsala galaxy survey was well under way, and I checked many of the remaining plates during a short visit to ESO/Geneva. At this time, only a small area around the celestial south pole was not yet covered by the ESO survey, which meant that I was able to examine about 99 per cent of the whole sky.

In all, I found 160 bright nebulosities in 80 different dark clouds and cloud regions with a Lynds opacity class of at least 4. Most of these bright objects are reflection nebulae, but the catalogue also contains quite a few Herbig-Haro objects (stars being born by contraction in interstellar dust) and emission nebulae that are clearly embedded in or otherwise physically connected to a dark cloud.

Since most of these regions are relatively nearby and at least to some extent optically resolved, it should in general not be too difficult to get an idea of their structure. Moreover, since many of them are seen well away from the galactic equator (galactic latitudes in excess of 15° are quite common), confusion with more distant galactic infrared or radio sources should not be a major problem.

The part of the sky south of declination –46° contains few spectacular regions with bright nebulae in cloud complexes of the kind that can be found farther north (like the Orion and Taurus clouds). However, there are certainly some southern regions that deserve further study, like the one centred at $\alpha = 11^h08^m$, $\delta = -77°$ (1950.0); see the figure.

My future plans include a search for very red and/or reddened objects around a number of nebulosities in the catalogue by means of near-infrared photography. I also expect to map in different formaldehyde lines a few regions with particularly simple geometries.

The catalogue has been published in *Astron. & Astrophys. Suppl. Series* **29,** 65 (1977).

Accurate Spectrophotometry of Early-type Spectrum Variable Stars

A Danish astronomer, Dr. Holger Pedersen from the Astronomical Institute of the Århus University, has recently used a novel instrument, ELIS, to measure the intensity (equivalent width) of the He I 4026 line in early-type stars. The accuracy is impressive and Dr. Pedersen has found several new spectrum variable stars. The observations were carried out at the ESO and CARSO observatories and are here summarized by Dr. Pedersen:

The spectrum line variations of the Ap and Bp stars have so far mostly been studied by ordinary photographic spectroscopy. With photoelectric spectroscopy it is now possible to get better equivalent-width data for individual spectral lines ("area" of a spectral line). During three observing sessions on La Silla I have used the Danish Echelle Line Intensity Spectrometer (called ELIS, see Fig. 1) to observe the strength of the He I 4026 line. The candidates for the first two sessions were B-type He-strong and He-weak stars while still hotter CNO stars were observed during the last run.

The Photometer

The measured quantity R is the ratio of flux through a 9 Å wide slit centred on the spectral line and a 2 x 7.5 Å wide, double continuum slit. The precise relation between the index and the equivalent width of He I λ 4026 has yet to be established. A provisional relation from the definition of the index is

$$W = 9 - 15\,R$$

but this function does not take into account scattered light, the instrumental profile or a possible dependence on the rotational velocity of the star.

The bandpasses are defined by two out of twelve exit slots mounted on a wheel which may be rotated by computer command. The wheel itself may be displaced along the direction of dispersion to correct for radial velocities, slit offsets and bending. By means of observations of spectral lamps the wavelength zeropoint is kept constant to an accuracy of about $\Delta\lambda/\lambda = 10^{-5}$. A small fraction of the light which passes through the entrance slit and the order separating interference filter is directed to a reference photomultiplier instead of the grating. Measuring the ratio of the signals from these two channels, a very efficient correction for scintillation and variable cloud cover is obtained.

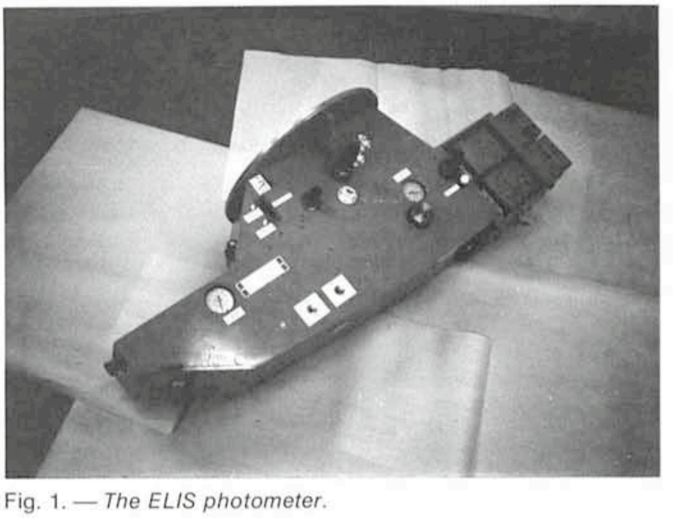

Fig. 1. — *The ELIS photometer.*

Optically ELIS is identical to the prototype used by Dr. P. E. Nissen and described by him in *Messenger* No. 9. The present instrument, however, is computer-controlled so that only a few operations must be done manually. ELIS has also been used successfully as a medium-resolution scanner but its main advantage is in the field of absorption-line measurements. The design of a fully-automated echelle photometer with several optical and mechanical improvements is presently being studied. With such an instrument one can measure in quick succession the strength of several spectral lines and thereby obtain more data for the analysis of the spectrum variable Ap and Bp stars.

The Observations

During the first observing run seven out of 26 stars were found to be spectrum variables. One of the most interesting

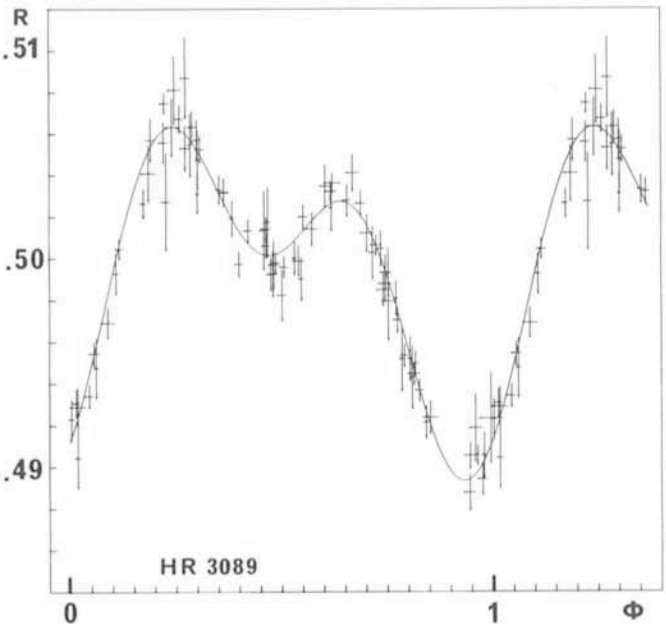

Fig. 2. — *The He I λ 4026 variability of the He-strong star HR 3089. The total range of the index, ΔR = 0.017 corresponds to an equivalent-width change of 225 mÅ. The average mean error is ΔR = 0.00094 or 14 mÅ. A five-term trigonometric function is fitted to the data which are folded modulo 1.33016 day.*

among these is the He-strong star HR 3089 for which a period of 1.33 day was found. A total of 82 observations of this star were collected during January, February, October and December 1976, with the Danish 50 cm at La Silla, the ESO 1 m and the CARSO 1 m telescope at Las Campanas. They are shown phase-resolved in Fig. 2 together with a five-term trigonometric function which fits the observations nearly as well as predicted by photon statistics.

At the end of my second visit to La Silla, Dr. Hardorp from Stony Brook, USA, encouraged me to make some measurements of the fast-rotating Ap star, CU Vir. Since the programme for the next observing run was already fixed, only a few hours could be spent on this star but the results nevertheless show a gain compared to conventional equivalent-width determinations. Each of the observations is the result of only 100 seconds integration time on the line band and 100 seconds on the continuum bands. Among other things, the phase-resolved data in Fig. 3 show that the index curve is asymmetric and possibly even has a secondary minimum.

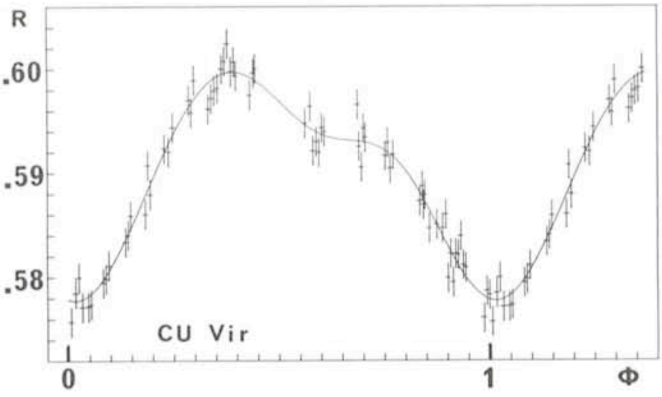

Fig. 3. — *The He I λ 4026 variability of the Ap star CU Vir. Since the observations were taken under nearly equal conditions, the individual mean errors have been replaced by the average mean error, ΔR = 0.00137. The curve is a seven-term trigonometric polynomium with a period of 0.52067688 day. Note the much smaller He line strength in this star as compared to HR 3089.*

At present, a graduate student, Mr. B. Prinds, is analysing the results for several of the He-weak and He-strong stars in order to find the surface distributions of Helium equivalent width. He "moves around" with imaginary circular spots of enriched He content and tries to make the computed index curve fit the observations when the star rotates. The number of free parameters, however, is so large, that a lot of very different but reasonable solutions seem to exist. This situation can only be changed when high-quality line profiles become available.

Optical Radiation Found in the Radio Lobes of Double Radio Galaxies

Philippe Crane and William C. Saslaw

Pushing the largest telescopes to their faintest limits is certainly not easy, but often extremely rewarding. The discovery of optical objects associated with powerful double radio sources (for which only the central galaxy was known before) will undoubtedly have a great impact on the study of the physics of radio galaxies. Two of the codiscoverers, Dr. Philippe C. Crane of the ESO Scientific Group in Geneva (formerly Princeton University) and Dr. William C. Saslaw, Institute of Astronomy, Cambridge, U.K., and University of Virginia, Charlottesville, USA, here review the new, fascinating discoveries—for the first time outside the professional journals.

When radio galaxies were first discovered in the 1950s, their most surprising property was that the radio and optical emission often came from different places. The most dramatic examples have a giant elliptical galaxy in the centre and two giant lobes of radio radiation on either side. A hundred kiloparsecs (1 pc = 3.26 light-years) is a typical distance between the galaxy and a radio lobe, although some sources spread over several megaparsecs. The radio lobes radiate about 10^{40}–10^{45} erg s^{-1}, and often surpass the optical radiation of the central galaxy in intensity. For comparison, the Sun radiates 3.8×10^{33} erg s^{-1}.

At first these radio sources were thought to be colliding galaxies. Now many more sources are known than can be produced by random collisions. Most astronomers believe that the central galaxy has emitted vast clouds of relativistic particles, or continuous beams of particles, or compact massive objects which generate the relativistic electrons in the radio lobes. To help constraining these theories, we