darkening, certain bright coronas, star spots, stellar rotation, oblateness. According to the few results of speckle interferometry at Palomar, cool stars appear to be accurately spherical. There must be exceptions, particularly among the fast-rotating hot stars. Features resembling Saturn's rings are expected around Be stars, but these were not resolved at Palomar. Are there dots or channels on Betelgeuse, Antarès and Aldebaran? Are Mira stars changing their size or shape as they pulsate? How about observing the pulsations of Cepheids?

Close binaries provide inexhaustible supplies of spectacular observations. How much atmosphere is there between Algol A and B? Accurate stellar masses can be obtained in many cases from observed orbits and radial velocities.

A major gain of information arises from the fact that spectra will become sharper. This is a consequence of improved spatial resolution: In conventional spectrographs the mixing of spectral features produced by different regions of the star widens the observed line profiles. The kind of highly informative spectral and spatial data heretofore obtained on the sun, including spectroheliograms showing detailed atmospheric motions, will also be obtained on the 30 or 100 largest stars. This means nightmares for model-atmosphere experts, and headaches for their computers!

Quasars, Pulsars and X-ray Binaries

Active optics cannot cancel atmospheric effects at stellar magnitudes fainter than 10 or 12, but some less appealing interferometric methods still remain applicable down to $m_v = 15$ or more. These methods can answer some critical questions in cosmology. A speckle-interferometer measurement of 3C 273 suggests a source smaller than 0".020. Something mysterious happens there, and we do not even know how small the source really is. The bright nuclei of many galaxies also deserve a closer look.

Optical pulsars, particularly the Crab object, are of course worth a look even though neutron-star models predict non-resolvable dimensions for the central object. Indeed, nebulosity near the object might exist and exhibit patterns resembling a searchlight beam in clouds.

Among the X-ray emitting binaries which are believed to incorporate a black hole, certain orbital dimensions can be resolved with the instrument. For the detection of circumstellar planets by direct-imaging means, a single space telescope of 2.5-metre size is more likely to succeed than a large ground-based array. This is because the problem is one of scattered light, not resolution. An additional limitation has to do with faint objects of complicated morphology, such as globular clusters or stars in galaxy images: owing to some basic noise effects in interferometry, these objects are also relevant to space telescopes and arrays.

References

1. A. Labeyrie, *Ann. Rev. Astron. Astrophys.* (1978).
2. J. W. Hardy, *Optical Telescopes of the Future,* Proceedings of ESO Conference, p. 455.

Instrumentation Schedule

Following the proposal of the Users Committee, we shall start with this edition of the *Messenger* to publish regularly our time schedule for the major instruments which are being developed at ESO in Geneva. These instruments are constructed for use on the 3.6 m telescope. The target dates indicate the date of "first light". This means that the instruments will have passed at that date the test procedures in Geneva and on La Silla as far as optical-mechanical and electronical tests are concerned. "First light" is the date of the first trial on the sky. It should be understood that it will take half a year more before the instrument goes into regular use.

It can be assumed as a normal rule that the instruments have a half-year assembly and test period in Geneva followed by a three-month period for shipment and installation before the target date. The detail design gets frozen already one year and a half before the target date.

In order to learn more about these instruments, questions and proposals may be addressed to the astronomer or to the engineer indicated in brackets. For some of the instruments, a description can also be found in the *Messenger* as indicated.

Triplet Adaptor (M. Tarenghi, M. Ziebell). Target date: May 1979. The components are:
- two 3-lens correctors for prime focus
- an adaptor with tv for acquisition and guiding
- a remote-controlled shutter and changer for 4 filters
- a remote-controlled changer for 8 plates (3 magazines); plate size is 240 x 240 mm.

More details will be published in the next *Messenger.*

4 cm Mc Mullan Camera (W. Richter). Target date: October 1979.
- Electronographic camera as developed by Mc Mullan. Can be used behind triplet adaptor in prime focus.

Coudé Echelle Scanner (CES) (D. Enard, J. Melnick). Target date: end 1979.
- Instrument to record very high resolution digital spectra (up to 100,000) on a 1876-channel-DIGICON detector. Double-pass scanning mode permitting calibrations on bright objects with very clean instrumental profile.

For more details see *Messenger* No. 11.

Infrared Top-End (R. Grip, P. Salinari). Target date: start 1980.
- Wobbling secondary mirror with f/35 in Cassegrain focus, new telescope top-ring which puts radiating material away from light beam.

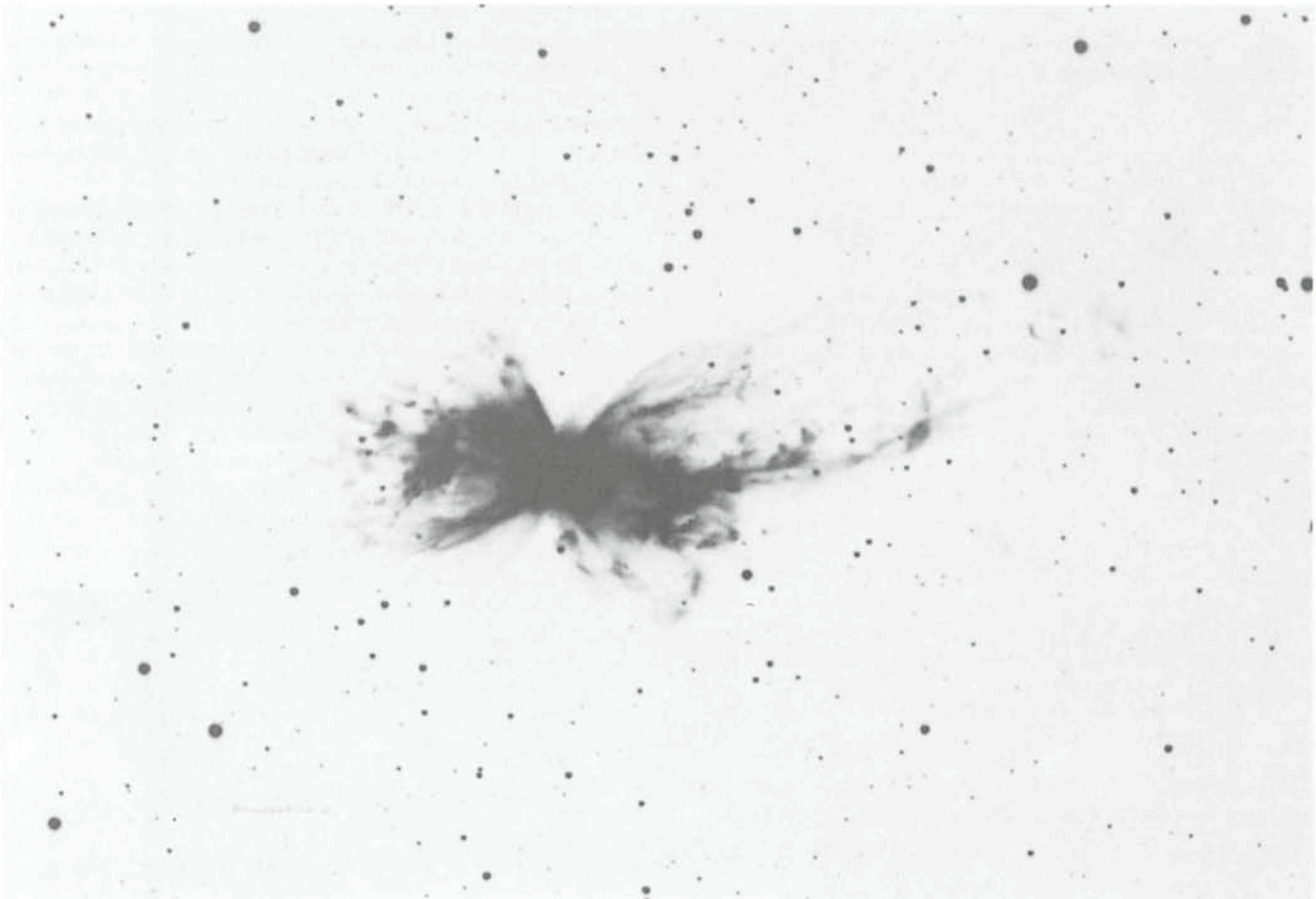
For more details see *Messenger* No. 13.

Coudé Auxiliary Telescope (CAT) (T. Andersen, M. Dennefeld). Target date: mid 1980.
- 1.5 m spectroscopic telescope feeding CES of the 3.6 m telescope. Three-mirror alt-alt telescope with f/120 (f/32 after focal reducer). Dall-Kirkham optics with spherical secondary. Direct drive servos without gear.

For more details see *Messenger* No. 10.

Cassegrain Echelle Spectrograph (CASPEC) (M. le Luyer, M. Ulrich). Target date: end 1980.
- Instrument with resolution of 15,000, 30,000 and 60,000 with an SEC-Vidicon detector. Data-reduction process not yet defined in detail.

W. Richter



Planetary nebula NGC 6302, photographed in red light with the 3.6 m telescope (IIIa-F + RG 630, 20 min; observer: S. Laustsen).

Planetary Nebulae and Comets

L. Kohoutek

Dr. Luboš Kohoutek from the Hamburg Observatory, FRG, is well known, both for his devotion to planetary nebulae and his many comet discoveries. Not quite unexpectedly, he decided to divide his ten nights on the VLT between these two types of objects, expecting to learn more about the processes that lead to the formation of planetary nebulae and the true nature of comet nuclei.

Although the greatest amount of progress at the VLT will probably be made in extragalactic astronomy, the galactic research should not fall into oblivion. Particularly the study of both the early and the late stages of stellar evolution requires special effort, because our knowledge of this fundamental topic has still many gaps.

The theory describing the evolution of red giants in the mass range of 1 to 3 $M_\odot$ into hot white dwarfs through the planetary-nebula stage is generally accepted. Nevertheless, there are many unanswered or only partially answered questions concerning planetary nebulae (PN), mainly: What are the progenitors of PN? What is the physical mechanism responsible for the ejection of PN? Are multiple shells of PN a typical or only an exceptional behaviour? Which role does dust play in PN? Is the distinction of PN in objects belonging to the galactic Population I and II significant and if yes, how is the evolution of these two different groups of planetaries? Why do central stars exhibit a large variety of spectra? Do all stars with low mass become PN?

In my opinion the VLT could contribute very substantially to the solution of these problems, assuming that this telescope would reach a limiting magnitude of about 27 mag, and that it would be equipped with advanced auxiliary instrumentation. Spectrophotometry with non-photographic recording systems, panoramic photodetectors that digitally record line intensities over the whole nebula and multicolour photoelectric photometry in the visual as well as in the infrared region would be the most promising.

The following programmes may be proposed for the ten nights at the VLT:

(1) Protoplanetary nebulae. Detailed investigation of some candidates with the aim of obtaining the basic physical parameters of the exciting stars (temperature, luminosi-