

Individual stars in NGC 55, a large galaxy in the nearby Sculptor group of galaxies. The plate was obtained in the prime focus of the 3.6 m telescope in December 1976, by Dr. S. Laustsen. IIIa-J + GG 385, 60 min.

Stars in Other Galaxies and Protoplanets

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Will the VLT find planets around other stars where there could be life? Dr. Immo Appenzeller from Landessternwarte Heidelberg-Königstuhl would like to try. He would also like to observe individual stars in other galaxies and to determine element abundances outside the Milky Way. Is the chemical composition the same everywhere in the Universe?

Having been informed that 10 nights on the just completed VLT have been allotted to my observing programme, my first reaction would probably be to call VLT headquarters to ask whether perhaps a decimal point was omitted between the one and the zero in the number of nights. After all, past experience allows to derive a rather well-defined relation between the number of nights allotted to a given observing programme and the cost of the instrument used. If we extrapolate this relation (based on the allocation schedules of the major ground-based or satellite-based optical telescopes presently available to European astronomers) to 2×10^9 SF (the conventional estimate of the cost of a VLT) we obtain with good approximation 1.0 night per application. Of course, extrapolations can be wrong. Nevertheless, while I regard it as fairly realistic to assume that a VLT will be brought into operation sometime before the end of this century, it appears considerably less realistic to expect that any European astronomer will ever get a block of ten nights at this valuable instrument.



Assuming now that a sizable amount of observing time on the VLT has indeed been put to my disposal and assuming furthermore that at the time when the VLT has become operational I am still interested in the same topics which I am working on right now (which, considering the time scale on which I changed my main fields of interest in the past, will almost certainly *not* be the case) I would use the observing time in the following way:

Protoplanets

About 30 per cent of the available time would be used to obtain high angular resolution images either by speckle interferometry and image reconstruction or perhaps by some other advanced method (e.g. "active optics") which is able to eliminate the distorting effects of the earth's atmosphere. The objects to be observed would be low-mass protostars or very young solar-type stars. The motivation for these observations follows from the following considerations: In my opinion, one of the most important astronomical problems to be solved in the near future is the question if, where, and what kind of life exists (or may exist) outside our own tiny planet Earth and outside our solar system. As noted by many authors, an obvious first step in this direction would be to look for other planetary systems and to study their physical

parameters and conditions. Since such life-supporting planets of distant stars are expected to be relatively faint objects seen very close to much brighter stars, their direct investigation will be very difficult even with the VLT. On the other hand, according to present theories, planetary systems may be much more conspicuous objects ("proto-planetary discs") during their formation. The closest region in our Galaxy where ongoing star formation has been observed is about 100 pc away. Thus, in order to observe features of the size of the earth's orbit, an angular resolution of about 0".01 is needed. A VLT could not only provide (in principle at least) the required angular resolution but also (and this is even more important) a sufficient amount of photons to allow the use of methods like speckle interferometry on such relatively faint objects.

Stars in Other Galaxies

Having finished the part of my observing programme described above, I would still have 70 per cent of the allotted time left. I would use this larger part of my observing run entirely for medium or high dispersion spectroscopy of stars in nearby extragalactic systems. (Of course, I am also very much interested in spectroscopy of various types of galactic objects. However, for all my pet galactic objects there exists a sufficiently bright specimen which can be observed at any required spectral resolution with existing telescopes if up-to-date detectors and effective spectrographs are used.) The extragalactic part of my VLT observing programme would have the objective to determine the physical parameters (i.e. effective temperature, radius, mass, chemical composition, etc.) of some of the stars which make up these nearby galaxies. Thanks to high dispersion spectro-

scopic work on galactic stars and thanks to the refinement of our methods to analyse stellar spectra, the physical properties of the normal galactic stars are by now relatively well known. In extragalactic systems only a few bright stars in the Magellanic Clouds have ever been observed spectroscopically in some detail. For all other galaxies we simply *assume* that their stars basically have the same properties as those in our own Galaxy. On the other hand, nonstellar objects (like H II regions and globular clusters) that are bright enough to have been studied in extragalactic systems in many cases show significant differences when compared to their galactic counterparts. Therefore, I would not at all be surprised to find in extragalactic systems stars with (e.g.) higher mass or higher metal content than observed anywhere in the Galaxy. Since the nearby galaxies play an important role in establishing our extragalactic distance scale, such results may have profound effects on our knowledge of the large-scale structure of the Universe. Some work in this direction (e.g. in the local group of galaxies) can probably be done with our existing optical telescopes if modern detectors are used. However, in order to do even medium resolution spectroscopy of single stars in such important nearby galaxies as M 101 nothing less than a ground-based VLT will suffice.

Of course, there are many other interesting but at present "impossible" astronomical problems that could be tackled with a VLT. The questions described above are only those which I would attack first with this instrument. Having written these lines, my biggest question now is whether the observing programme outlined above will remain (science-) fiction or whether I shall indeed sometime have a chance to push the buttons and bang my head in the dark at the VLT!

A New Bipolar Nebula in Centaurus

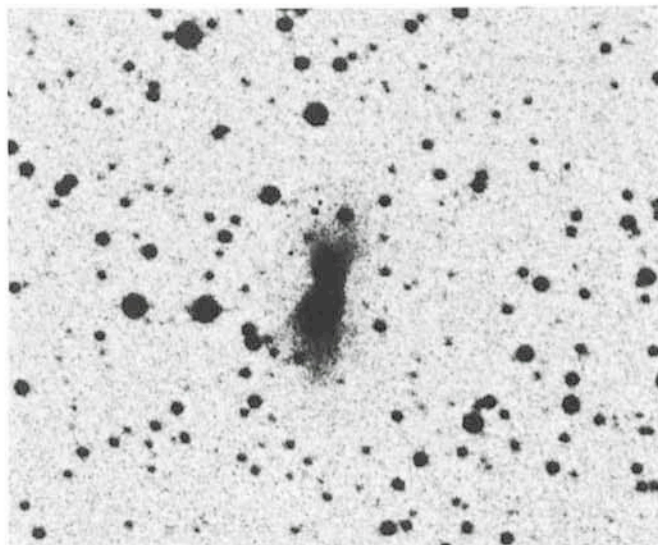
Looking through large Schmidt plates can be a rewarding, but sometimes also a somewhat frustrating business. Depending on the colour of the plate and on the exposure time, otherwise normal objects (galaxies, nebulae) may reveal features that make their classification difficult. A direct Schmidt plate says nothing about the spectrum of the objects, except when it is compared with other plates in other colours.

Thus, there are many objects on the one-colour ESO (B) Atlas which have to be described as just "peculiar", until their spectrum has been observed. One of these was found during the ESO/Uppsala survey of this atlas and also independently by two astronomers at the South African Astronomical Observatory, Drs. G. Wegner and I.S. Glass. It was designated as 172-?07 by the ESO and Uppsala astronomers who frankly did not know whether it was a galaxy or a nebula in the Milky Way.

Some light has been thrown on the nature of 172-?07 by the South African astronomers who recently obtained spectra of the object with the 1.88 m reflector at Sutherland. They find that only absorption lines are visible and that the spectral energy distribution corresponds to about spectral type F0. However, infrared observations with the same telescope reveal a clear IR excess, i.e. the object is brighter in the infrared than one would expect from the visual magnitude.

Wegner and Glass speculate whether 172-?07 is a pre-main sequence object, in which an envelope of dust shrouds

a star that is contracting out of this dust. But most objects of this class show emission lines and it is therefore clear that the mystery about 172-?07 has not yet been solved.



ESO 172-?07, a bipolar nebula in Centaurus, photographed with the ESO Schmidt telescope on Ila-O emulsion, through a GG 385 filter. Exposure time 60 min.