The VLT will be able to observe the galaxies of the Coma and Perseus Clusters in the same detail as today's instruments observe the Virgo Cluster. In order to get a complete picture of elliptical galaxies, the photometric study has to be coupled with detailed dynamical analysis. The large scale of the telescope and sophisticated detectors covering the whole image of the galaxy will allow complete mapping of the velocity field and velocity dispersion, and thus provide a way to discriminate between different models. Triaxial models, for instance, do not require zero velocity gradient along the apparent minor axis, as in the oblate case.

All these observations require high spectral resolution. Since we already know the very peculiar behaviour of the luminosity profile and of the velocity dispersion in the nucleus of M 87 (Sargent et al., 1978) a proposal entitled: "A search for black holes in the nuclei of elliptical galaxies" seems to be a very appropriate one for the VLT, particularly if black holes continue to be fashionable as they are now.

Interesting cases to be studied are the elliptical-like galaxies which are rich in dust and gas, often radio sources, which Bertola and Galletta (1978) have recently proposed to possess a prolate configuration (i.e. extended in the direction of the poles). Unfortunately there is only one galaxy of this kind, namely NGC 5128, which is close enough to be studied in detail with present telescopes. In order to understand the way in which these galaxies formed and their correlation with other types of galaxies, it is of great interest to study both the dynamics of the gas and of the stellar component.

### Stars in Elliptical Galaxies

Finally, being always confined to elliptical galaxies, a "Study of the stellar population in the nuclei of elliptical galaxies" would be another programme requiring high spatial and spectral resolution. We are at the present moment collecting some evidence that the stellar content in the nuclear parts of ellipticals could differ drastically from the rest of the galaxy. Very recent observations (Bertola and Capaccioli, 1979) in the UV show that in the nucleus of the giant elliptical galaxy M 87 the energy distribution is increasing towards short wavelengths as a black body with a temperature of 30,000°K. The interesting fact is that the phenomenon is not just concerning the stellar-like, central source in M 87, but the whole innermost nuclear region, indicating a peculiar stellar population in the nucleus of M 87. Is this phenomenon characteristic of active galaxies only? Is star formation occurring in the nuclear regions of the ellipticals? This is an example of the questions that detailed spectrophotometric studies carried out with the VLT could answer.

There is of course the possibility, which is highly desirable, that at the time the VLT enters into operation, most of the problems envisaged in this article have already obtained a satisfactory explanation. But in the meantime, new and perhaps even more complicated problems will have arisen and the VLT will be a powerful tool for solving them.

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# The VLT and the Infrared

*J. Borgman*

*The use of the VLT will not be restricted to the visual region of the spectrum. One of the great advantages of the large size will be the greatly improved angular resolution in the infrared. Professor Jan Borgman of the Groningen University (of which he is Rector) has since long been active in infrared astronomy. He explains how the VLT can be used to study cool objects and possibly contribute actively to the search for life in the Milky Way.*

Larger telescopes have more light-gathering power and can do some jobs of smaller telescopes in less time. In the same observing time a 25-m dish will reach 3.5 magnitudes deeper than the 200-inch, as long as background saturation can be ignored. Such merits of large dishes are obvious; undoubtedly some time on the VLT will be given to programmes which have to push the limiting magnitude in order to reach more distant and/or fainter stars.

However, I would expect that the Observing Programmes Committee would favour proposals which really require the use of the VLT and which have contributed to the justification of the initial investment. In this class are some applications of the angular resolution capabilities of the VLT in the infrared, which can be favourably exploited with an infrared camera.

### Infrared Cameras

With available techniques an infrared camera picture has to be synthesized from observations with arrays of a modest number of discrete detectors. However, it is certain that the future will offer multiple element targets with high resolution capability. The VLT has diffraction-limited images of 0.2 arcseconds at the 10 $\mu$m diffraction limit in a field of 10 x 10 arcmin$^2$ (reasonably assuming that a fully corrected field of 15 arcmin diameter is available). We need $10^7$ picture elements in order to get diffraction-limited resolution over this field. Speckle interferometry techniques are needed to restore the picture at the resolution of the diffraction limit. An auxiliary instrument in combination with the necessary data management and storage power can safely be assumed to be available before the end of the 1980's.

Objects to be included in the observing list are those which are likely to be resolved at the available angular resolution. E.g., at the distance of the galactic centre an opaque nebula of 0.2 arcsecond diameter and at a temperature of 300°K represents a luminosity of $10^5$ $L_\odot$. This means that we might recognize the more massive stars in their early phases of evolution as far away as the galactic centre, without being bothered by interstellar extinction.

In the nearest galaxies, e.g. at a typical distance of 1 Mpc, the VLT can resolve opaque structures of $10^9$ $L_\odot$ at 300°K while observing at 10 μm. This resolvable luminosity can be reduced by a factor of 100 if a coherent array with a 250 m base line were installed rather than the 25-m single dish VLT.

### The Observations

After this introduction it is clear what I would do: take infrared pictures of the galactic centre, several H II regions with compact knots, and the nearest galaxies. These observations would be followed up by measurement of some infrared spectral features like the "ice" band at 3.1 μm and the "silicate" feature at 9.7 μm (or should we, following Hoyle and Wickramasinghe, speak of cellulose and chlorophyl?). Energy balance and radiation transfer models now being proposed for infrared sources require actual dimensions or new upper limits to the diameter in order to test or refine the models. It is likely that a ground-based VLT or an array of smaller telescopes is the only answer to this problem.

The question of life in the universe is going to become a spectacular and challenging topic in the next decades. A search for (precursors to) life, either in interstellar space, in cool circumstellar clouds, in warm interstellar clouds or on nearby giant planets could be supported by the VLT and its high resolution infrared camera and spectrometer. It is clear that such programmes require a joint approach with radio astronomical studies of molecular lines.

One final word about the actual observations: rather than being given 10 nights at the VLT I would hope that also the day time is available. A team of at least three astronomers or subteams is necessary to bring in the rich harvest that can be expected from using the VLT and the advanced auxiliary instruments during "my" run of 10 "nights" at the VLT.

**NEWS and NOTES**

# Joint IUE-ESO Observations of Binary X-ray Sources

In April 1978 a joint international observing programme of X-ray binaries started with IUE. The initiative to start this international collaboration dates back to 1975 when, on the invitation of R. J. Davis and A. K. Dupree of Harvard University, groups around the world decided to "pool" their observing time with IUE, in order to achieve an as complete coverage as possible of some of the most important X-ray binaries.

The sources involved in this cooperation are Cygnus X-1, Hercules X-1, Scorpius X-1 and Vela X-1. Other sources are studied by groups individually or in smaller collaboration. Four groups in the U.S. and three European groups (R. Wilson, A. Willis from University College London, E. van den Heuvel, H. Lamers and C. de Loore from the Universities of Amsterdam, Utrecht and Brussels, and A. Treves, E. Tanzi and M. Tarenghi from Laboratorio di Fisica Cosmica, Milano) take part in this collaboration.

Two weeks of observing time were allotted by the three space agencies involved (NASA, ESA, SRC) to this collaborative programme: one week from April 27–May 4 and another week from July 9–July 16, 1978. Most of the known X-ray binaries were observed during these periods. Thanks to a timely organizing effort of the observers, simultaneous observations of the objects were organized in X-rays and from the ground. For some sources observations were made from the X-ray to the infrared wavelength region.

For the X-ray observations the Leicester Sky Survey instrument aboard Ariel-5 and the UCL experiments aboard the Ariel-5 and Copernicus satellites were used. Also several groups have put as much effort as possible in obtaining simultaneous ground-based observations. During the 2 weeks of IUE observations, ESO allotted observing time to C. de Loore and M. Burger from Brussels. De Loore observed the brighter X-ray binaries with the coudé and the fainter ones with the Echelec spectrograph attached to the 1.5 m ESO telescope, whereas M. Burger used the 1 m telescope for photometric UBV and uvbyβ observations of the same sources. At the same time D. Morton and P. Murdin observed the sources with the Boksenberg image photon-counting system at the Anglo-Australian observatory in Australia. J. Menzies and P. Whitelock used the 74 inch and 40 inch telescopes at the Cape Town South African Astronomical Observatory also for spectroscopy and photometry in the visible wavelength region. Infrared observations were made

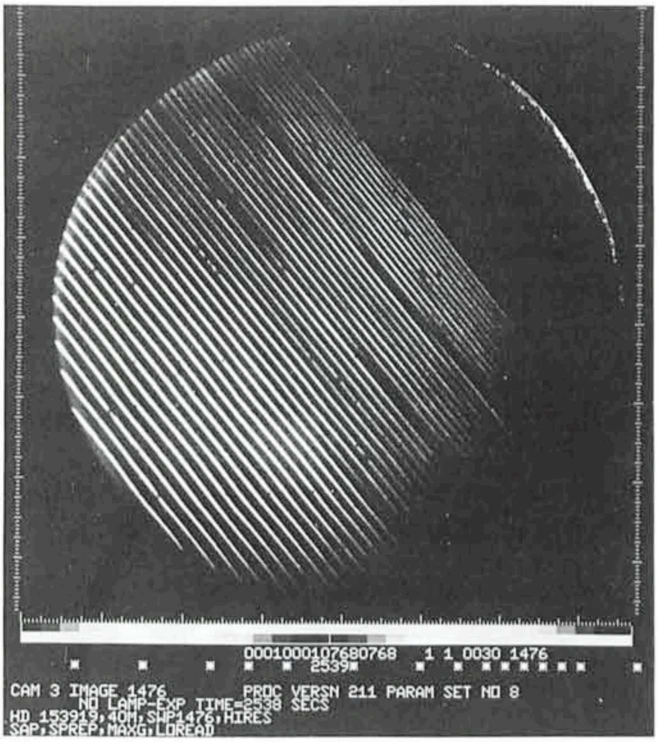


Fig. 1: *Photograph of the short wavelength, high dispersion IUE spectrum of the X-ray binary 4U1700-37/HD153919, obtained by G. Hammerschlag-Hensberge at the Villafranca ground station near Madrid. The broad P-Cygni profiles of UV resonance lines are indicative for a strong stellar wind.*