More High-Quality Observations Of Stellar Spectra

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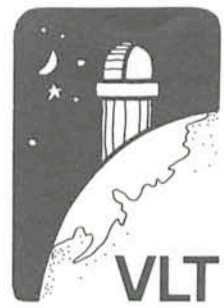

With its large light-gathering power, the VLT will permit spectra of even rather faint objects to be obtained with short exposure times. It will therefore become possible to observe rapid changes in, for instance, the emission lines in nova spectra and to learn about the physical conditions of a nova outburst. Professor Léo Houziaux of the Astrophysical Institute in Liège, Belgium, expects to observe spectrally variable stars with the VLT and also to do very accurate spectrophotometry of a number of brighter stars.

Looking at the increase of observing time devoted to extragalactic astronomy with existing large telescopes, it is very likely that most of the nights with a VLT will be awarded to programmes concerned with the structure and evolution of galaxies, quasars or BL Lacertae objects. This trend is quite justified as most of the exciting features in contemporary astronomy arise from the study of such objects.

The main advantage of the VLT will be its high light gathering power. It should be remembered, however, that the limiting magnitude for such an instrument is much depending on its focal length and on the quality of seeing. On the other hand, we do not have at present much experience on the optical image quality of multi-mirror systems. It is clear that the brightness of the "dark" sky will be more and more disturbing as the diameter of the telescope increases. Therefore the wavelength ranges for most favourable observing conditions should be carefully studied, and the remaining part of the spectrum should be left for instruments on board of satellites or space stations. Certainly the use of a VLT has to be considered in correlation with other ground-based or space instruments.

Variable Emission-Line Objects

If I were granted ten nights at the VLT, what would I observe? In fact, I think this is a fairly unrealistic question, since I can see no way of being granted such a long observing run by any institution without having submitted for quite some time a detailed proposal! If the instrument would be available now, I would write an application for making spectrographic observations of short time-scale variable objects. High time and spectral resolution observations of novae and other variable emission-line objects would be very valuable. We know that the light variability of novae exhibits short periods, but we do not have at present numerous series of correlated spectral observations. We suspect that the shell around a nova develops in a short time and we should try to measure its acceleration during this early phase. How is this acceleration connected with the overall luminosity variations? When do the various shell absorption lines arise? How does the line structure change with the position angle of the spectrograph slit? What happens to the line profiles during the transition phase? Numerous observations of Nova Aquilae 1918 have shown that there is considerable asymmetry in the distribution of emitting material. The VLT should permit short exposures to be made, revealing at the early phases these asymmetries as well as anisotropies in the velocity field. Speckle interferometry techniques might be most useful for such purposes. On the other hand, it should be possible with the VLT to continue the observations until the object has become quite faint and reached its minimum brightness.

In summary it can be said that careful observations of a nova outburst with a VLT would bring us important information on the development of the shells especially at the early stages and hence clarify the understanding of the nova phenomenon. Along the same lines, I would be curious in obtaining spectra of intrinsic variables for which the spectrum is known at present only at maximum of light. Spectrograms of such stars at intermediate phases and at minimum of light may reveal what makes these objects fade out rather suddenly (emission of stellar material, increase in the opacity of the atmosphere?) For such an investigation, one would hope that much attention be given to the appropriate instrumentation which might reveal itself as important as the light gathering power of the telescope. But it is most unlikely that I could spend all the dark hours each night on a nova or on a peculiar variable star.

Accurate Spectrophotometry of Bright Stars

So I would like to use a part of the night for observing with great accuracy the profiles of certain lines even in moderately bright stars. A high signal-to-noise ratio may be reached even with photographic plates if a sufficient number of spectra is secured. An accuracy of 1 per cent in intensity seems to be a reasonable goal to achieve. Therefore, one would hope that adequate auxiliary instrumentation will be provided with the VLT and that all the characteristics of such an instrumentation will be available to the observer well in advance of his observing run. Appropriate data handling and reduction will be important items and should also be available to the guest astronomer. If the VLT were available for describing the spectra of a fair number of brighter stars with an accuracy of 1 per cent over the spectral range 3000 Å to 9000 Å it would help a great deal in solving current problems in the field of stellar photospheres and external atmospheres.