weather conditions would not meet the requirements of the main programmes (e.g. poor seeing, high cirrus, etc.). Most of these projects could not be executed, for the reasons mentioned above. However, science grade data were obtained for the following programmes:

• FORS1 Broad-band imaging of Antlia, the dwarf irregular galaxy recently discovered in the Local Group.

• ISAAC Spectroscopy of the Highly-magnified Galaxy MS1512–cB58 at z = 2.72.

The FORS1/ISAAC SV data were released through the ESO web site on May 10, 1999 and are accessible at http://http.hq.eso.org/science/sv/

Few more data taken by the Commissioning Team are yet to be fully reduced and evaluated, and will be released as soon as possible.

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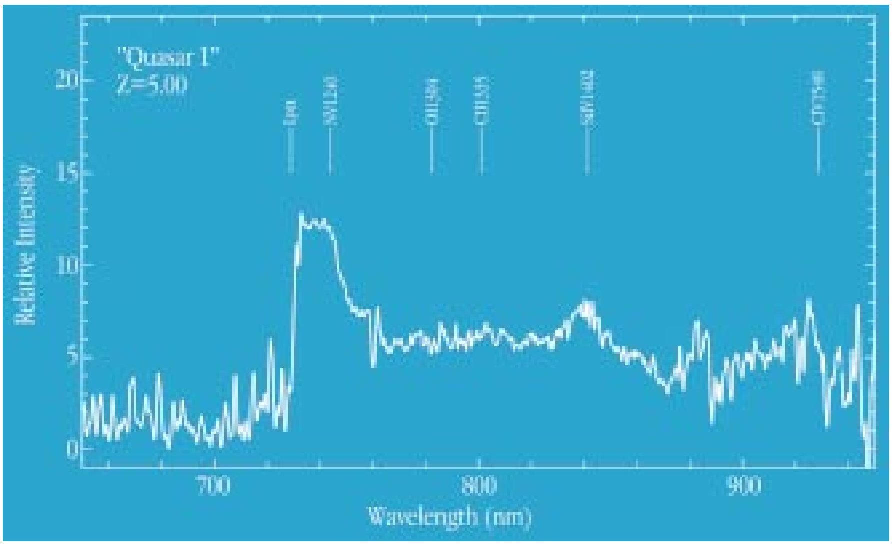

Figure 2: FORS1 Spectrum of "Quasar 1", discovered by X. Fan et al. within the Sloan Digital Sky Survey Collaboration. The redshift is no less than 5.0.

UT2/Kueyen: a Stellar Astronomer’s Dream Comes True

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Stellar astrophysics is today a mature science. Many of the fundamental questions have received reasonably satisfactory answers, leaving more subtle, harder and harder problems yet to be solved. A typical example of success is offered by the quantitative knowledge of stellar evolution. We have now a fairly complete understanding on how stars of all masses evolve, from the main sequence all the way to the white dwarf stage or supernova explosion. Perhaps it is not too exaggerated to say that just details remain here and there to be worked out. On the other hand, an example of a hard, still unsolved problem is star formation. Many beautiful images of star-forming regions have been obtained, and still the physics of star formation defies our understanding: predicting from first principles the initial mass function and the star-formation rate has so far proved to be beyond our grasp. Star formation is indeed a very complex physical process, dominated by hydrodynamical/magnetohydrodynamical phenomena that can hardly be formulated by simple algorithms, and that even the biggest computers cannot properly handle. Hence, progress in this field has been slow, and is likely to remain slow for a while. In general, still poorly understood are all those phenomena in which hydrodynamics (especially if chaotic) plays a prominent role, such as convection, mixing, mass loss, common envelope phases, etc. It is important to realise that most often the limit to our understanding does not come from insufficient observations, but rather from the intrinsic complexity of the involved physical processes (not unlike the case of many problems in solar physics). This is to say that even the VLT will not accelerate much the progress in some areas of stellar astronomy. Therefore, while the VLT is entering its fully operational life, it is worth addressing the question of its role vis-à-vis stellar astronomy.

As is well known, the ESO astronomical community has a very strong tradition in stellar astrophysics, with a majority of astronomers in virtually all member states being dedicated to stellar studies. Yet, for the first VLT Observing Period (P63), only 19% of the requested (and allocated) time was for stellar proposals. About 72% of the time was requested for extragalactic astronomy proposals, and the rest was shared by Interstellar Medium and Solar System projects. Nearly the same proportions are also maintained in P64. Does this signal a low interest of the stellar community towards the VLT? At a time when observational cosmology is experiencing its most rapid progress, and a brand new branch of astronomy – exoplanets – is exploding, what space is left to stellar astronomy?

The minority role played by stellar astronomy in P63 and P64 should not be over-interpreted. Indeed, the instrumentation offered at UT1/Antu for these two periods was very attractive for extragalactic studies, but FORS1 and ISAAC could satisfy the needs of only a fraction of the stellar community. By good fortune, UT1/Antu is just the first telescope of the VLT quartet, and the situation is likely to change dramatically already with UT2/Kueyen, which is now being commissioned. Indeed, with this second VLT unit the dreams of many stellar astronomers are about to come true.

UT2/Kueyen will be a spectacular, unique machine for high spectral resolution studies. Figure 1 shows the instrumental complement of this telescope. The Cassegrain focus will feed FORS2, capable of a resolution ($R = \lambda/\Delta\lambda$) up to ~ 4000, and multiplex up to ~ 100.

The high-resolution echelle spectrograph – UVES – will occupy one of the two Nasmyth platforms, and will reach $R \simeq$ 120,000. Both these instruments will be offered to the users in P65, starting April 1, 2000, and the deadline for the submission of proposals is October 1, 1999. Finally, at the other Nasmyth platform the fibre positioner (OzPoz) will be installed in the summer of 2001, along with the medium-high-resolution spectrograph GIRAFFE.

With the installation of OzPoz and GIRAFFE, the high multiplex machine called FLAMES will take shape. FLAMES is OzPoz+GIRAFFE+UVES, plus the software to orchestrate them. In the MEDUSA mode, OzPoz will send 132 fibres to GIRAFFE, capable of getting the spectra of as many objects with R = 7000 or R = 15,000. OzPoz could also dispatch 8 fibres to the other Nasmyth platform, and feed UVES promoting this spectrograph to high multiplex at $R \simeq 40,000$. It will also be possible to use GIRAFFE and UVES simultaneously, observing the eight brightest objects in a given programme with UVES at higher resolution, while gathering lower-resolution spectra of over 100 fainter objects with GIRAFFE. More extensive information on UT2/Kueyen instrumentation can be accessed on http://http.hq.eso.org/instruments/.

While it is easy to imagine several extragalactic applications for each of these

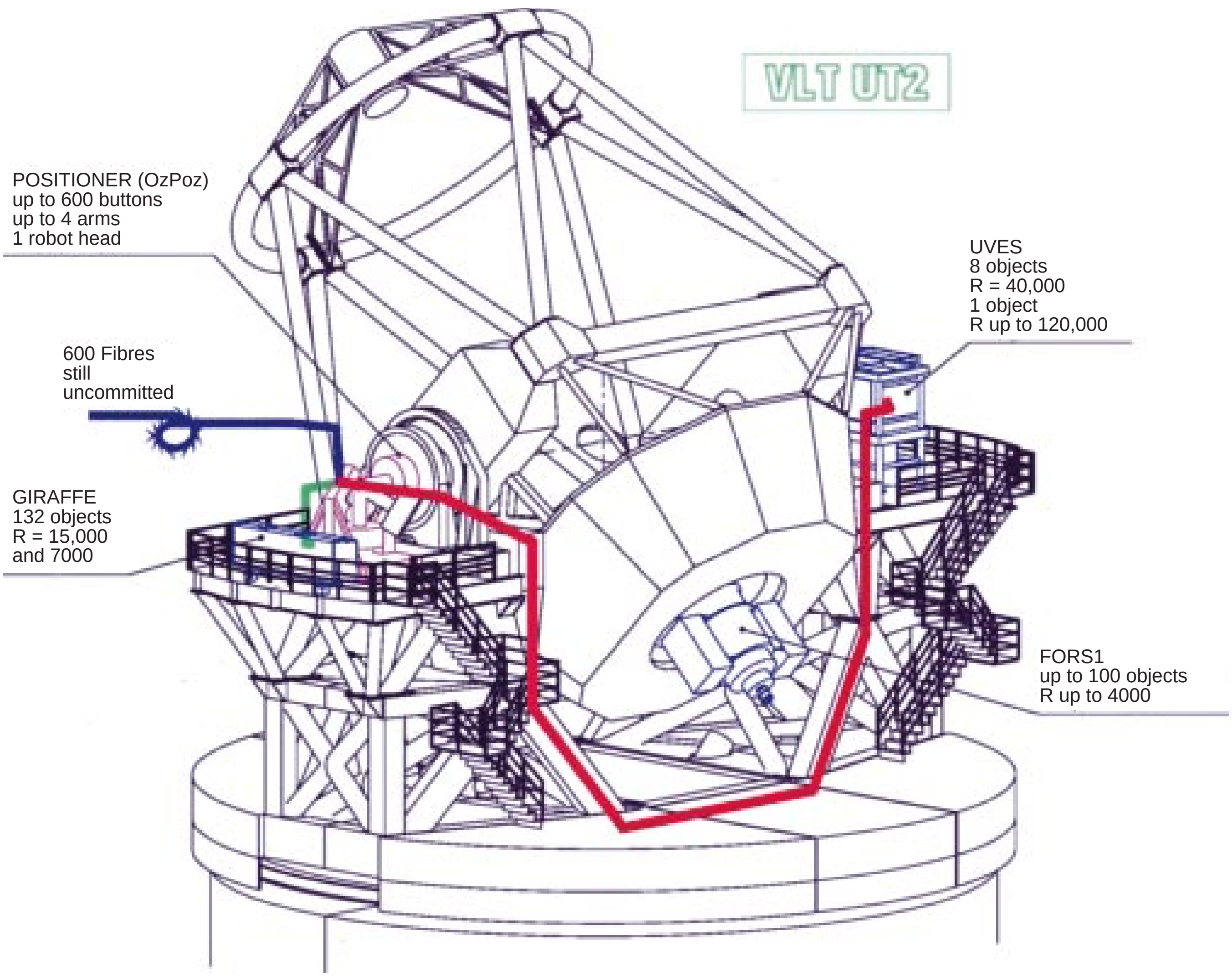

Figure 1: A schematic view of the instrumentation attached to UT2/Kueyen. The fibre Positioner (OzPoz) can feed either the medium/high-resolution spectrograph GIRAFFE, or UVES, or both at the same time. For each instrument the spectral resolution and multiplex are indicated. With minor upgrade, the Positioner could locate on the focal plate up to 600 fibre buttons, a multiplex capability that still remains to be exploited.

instruments, it is stellar astronomy which is likely to make use of the great advantage of such an instrumental complement. This is especially the case of stellar population studies, since within few years it will be possible to obtain high-resolution spectra for thousands and thousands of stars in, e.g., the Galactic bulge, open and globular clusters, the Magellanic Clouds, and the dwarf spheroidal galaxies, thus obtaining unique, extensive information on the detailed chemical abundances and kinematics of so many stars.

The determination of the elemental abundances of iron, the α-elements, as well as the s- and r-process elements, will allow us to gather a very detailed picture of the chemical evolution of the Galactic spheroid and disk, as well as of the dwarf satellites of the Galaxy, thus shedding fresh light on the formation and evolution of the Milky Way galaxy. The abundance of cosmologically interesting elements such as lithium could be determined for thousands of stars in just one observing run, along with other relevant information such as rotational velocity, chromospheric activity, etc. In its integral field unit mode (ARGUS) GIRAFFE could take high-resolution spectra of all objects in a very crowded field, such as the central regions of globular clusters, thus helping identifying the optical counterparts of low-mass X-ray binaries, or studying the dynamics of collapsed cores. Of course, these are just some of the major stellar population studies that will become possible with FLAMES, many others will certainly be invented by the creativity of the users.

Accurate co-ordinates for the programme stars will be necessary in order to precisely position the fibres when FLAMES will be used in the MEDUSA mode, or to feed UVES. FLAMES does not have an imager of its own, and therefore astrometry will have to be obtained from images taken at other telescopes. The Wide Field Imager at the 2.2-m telescope (WFI@2.2) will be ideal for this purpose. With its $34' \times 33'$ field of view it will perfectly match the OzPoz field of view (25′ diameter). It is expected that the most efficient use of FLAMES will need ~ 400 stellar fields per year with high astrometric accuracy. About half of them are expected to be provided by individual preparatory programmes, addressing very specific scientific goals and producing their own target lists. However, one expects that a major fraction of the projects will concentrate on a relatively small number of fields. The Working Group for Public Surveys in its meeting of March 22–23, 1999, has recommended ESO to take shallow (8-min) *UVI* exposures with WFI@2.2 for ~ 200 among the most obvious fields in the Galactic bulge, LMC and SMC, as well as in dwarf spheroidals, open clusters, and nearby globular clusters. The corresponding proposal for such a public survey to be conducted over the next four observing periods has been submitted to the OPC in response to the P64 call for proposals. Other widely used fields could be added in the future in response to requests from the community of the users. In this way, the survey will provide public backbone data, while users with very specific interests could apply for obtaining complementary data.

Though others may have a different taste, I dare to say that the identification of the progenitors of Type Ia supernovae is the single most important unsolved problem in stellar astrophysics (perhaps second only to the origin of gamma-ray bursters). Suffice to think of the role of Type Ia supernovae in the chemical evolution of galaxies and clusters of galaxies, or in providing a tool to measure the variation with cosmological time in the rate of universal expansion. For over 15 years two scenarios have been considered without being able to decide among them. In common to both is the basic mechanism: the thermonuclear explosion of a white dwarf (WD) accreting material until a critical mass is reached. But the two options diverge on the nature of the mass donor: a giant star filling its Roche lobe in the single degenerate (SD) scenario, another WD spiralling in due to gravitational wave radiation in the double degenerate (DD) scenario. Searches for DD systems have been only partly successful, being painfully slow at 4-m-class telescopes. The VLT now offers a chance to thoroughly address this problem, by checking a great number of WDs for radial velocity changes due to orbital motion. Unfortunately, the surface density of WDs is too low for exploiting the high multiplex of FLAMES (just 2 or 3 per square degree down to magnitude 20). However, WDs are all over the sky, and a snapshot survey with UVES will be ideal for filling in gaps in the night schedule when UT2/Kueyen will be used in Service Mode. At the high resolution of UVES, DD systems could be easily identified with just two short exposure spectra, with further observations allowing to determine the period. In five years, with a few minutes per WD, of order of 1000 WDs could be checked for binarity by investing just a few percent of the fraction of the UVES time that will be operated in service mode. Besides possibly finding a number of SNIa precursors, such a survey would provide unique information on the endpoints of interacting binary-star evolution, as well as a unique database of WD spectra.

Some among the stellar astronomers may have had the perception of the access to VLT data being overwhelmingly difficult. Actually, quite the opposite is going to be true: the flow of stellar data from the VLT is likely to be so high that a major fraction may not be promptly processed and exploited for shortage of astronomers who can do it. For example, it is estimated that with FLAMES absorbing some 80 nights/year for stellar studies, about 400,000 high-resolution spectra will be obtained during the first five years of operation[1]. Like all VLT data, all these spectra will become publicly available one year after the observations, allowing others than the proposing group of astronomers to refine (or even anticipate!) the scientific analysis. This will be especially interesting in the case of stellar high-spectral-resolution studies, in which the scientific result is at least as dependent on the actual modelling as it is on the quality of the original data. Rather than being a threat for stellar astronomers, the VLT offers to this component of the ESO community a great deal of opportunities. Deadline for applications for Period 65 is October 1, 1999.

[1] For comparison, note that high-resolution spectra are presently available for just a dozen stars in the Galactic bulge.

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VLT Instrumentation Renewal

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I. The Rationale

At the time of this writing, ESO, with a major contribution from its community, is embarked on the so-called first-generation VLT instrumentation plan, with eleven different instruments for as many foci of the VLT, plus four instruments for the VLTI. The first two instruments (ISAAC and FORS1) have just been put in operation, with two others (UVES and FORS2) planned to join them in about 9 months. Succeeding in this ambitious endeavour is our present first and utmost priority.

When this major effort is completed around 2003–2004, we will then be faced with the prospect of almost immediately restarting new instrumentation, as the first instruments installed will be well in the midst of their likely 10–12 years useful life.

Peering just a little bit into a crystal ball, one can see indeed at least three different rationales which will likely push towards a substantial renewal of the presently planned first instrumentation complement of the VLT, namely:

• shifts in emphasis between major astronomical fields to be addressed with the VLT, as well as within these fields,

(Continued on page 18)

Centrefold

Satellite image showing the proposed location of ALMA, the Atacama Large Millimetre Array (see article on page 7 in this issue of The Messenger). Also indicated are the town of San Pedro de Atacama, the prominent volcano Licancabour, and the Laguna Verde.

This image is a composite of three exposures in spectral bands at 1.6 μm (rendered red), 1.0 μm (green) and 0.5 μm (blue). The horizontal resolution of the false-colour image is about 30 metres. North is at the top of the photo.

The image was produced in 1998 at Cornell University (USA), by Jennifer Yu, Jeremy Darling and Riccardo Giovanelli, using the Thematic Mapper data base maintained at the Geology Department laboratory directed by Bryan Isacks, and is reproduced here with their kind permission.