

## The 4th ESO/OHP Summer School:

TWO WEEKS IN PROVENCE; STARS, COMETS, GOOD FOOD AND WARM HOSPITALITY

M. VÉRON, *Observatoire de Haute-Provence, France, and*

E.J. WAMPLER, *ESO-Garching*

### 1. Introduction

The fourth biennial ESO/OHP Summer School was held at the Observatoire de Haute-Provence from July 18 to July 29. This Summer School gives 18 selected astronomy graduate students practical experience in observing techniques, data reduction and the software systems that are in use in the ESO member states. Afternoon lectures by experts on the various tools used by modern observers introduced the students to the sweep of techniques used in ground-based astronomy. And the enthusiasm of the summer school students moved even

their stodgy teachers. Relaxation during breaks came from the swimming pool, pastis and after dinner pétanque (boules) competitions. As usual, the student attendees were highly convivial and this led to warm relationships developing among the students and between the students and the School staff.

The Observatoire de Haute-Provence, located in a particularly lovely region of southern France, is one of the very few places in Europe where the summer climate and modern astronomical facilities combine to insure the success of a summer school devoted to teaching observing techniques to astronomy graduate

students. The OHP summer school thus helps to fill a gap in the formal education of promising young European observers.

### 2. Practical Work

The curriculum of the 1994 Summer School followed the general pattern that proved to be useful in the three earlier ESO/OHP Summer Schools (cf. *The Messenger* No. 53, p. 11, No. 61, p. 8 and No. 69, p. 17). The 18 students were divided into groups of three, and six tutors (Denis Gillet, Sergio Ilovaisky, and Philippe Prugniel from OHP, Agnes Lèbre from Montpellier, Pascale Jablonka from



Figure 1: At the break during Ray Wilson's talk, the group posed for an official photograph. From the left: first row: R. Wilson, M. Véron, A. Fishburn, b. Milvang-Jensen, M. Chadid, S. Ruphy, V. Doublier, P. Jablonka, A. Gemmo. First step: S. Leon, S. Och, M. Serote-Roos. Second Step: V. Hill, I. Rentzsch-Holm, N. Troelsgaard-Jensen, T. Preibisch, L. Vanzì, L. Lucy. Back group: F. Courbin, J. Wampler, M. Gray, M. Federspiel, G. Rauw, P. Véron, M. Nauta and R. Noordhoek.





Figure 2: Cool water was a welcome treat at break time during the afternoon talks.

Meudon and Alessandra Gemmo from Garching) each assisted one student group with a short, pre-planned observing programme.

D. Gillet led V. Doublier, N. Troelsgaard-Jensen and L. Vanzi in a study of the  $\beta$  Cephei star BW Vul to attempt to distinguish between Stark broadening introduced by the passage of the compression wave and shock emission during the line-doubling phase. They used the AURELIE spectrograph to measure variations in the  $H\beta$  line. Their imaging project was to see if the small migrating bump reported on the light curve of XX Cygni is real or if it is an artifact of the interpretation of previous observations.

A. Gemmo helped F. Courbin, M. Nauta and I. Rentzsch-Holm observe poorly-known Cataclysmic Variable stars (CV stars). The spectroscopic part of the programme was aimed at obtaining low-resolution spectra with the 1.93-metre telescope of those CV stars with good coordinates but with little or no spectral information. The photometry programme with the 1.2-metre telescope was directed to finding the physical parameters, in particular the period, of the programme CV stars.

S. Illovaisky led M. Federspiel, G. Rauw and S. Ruphy in a search for an optical counterpart for ROSAT X-ray sources. They used the 1.2-metre telescope to obtain images of the X-ray fields to try and identify candidate objects. Low-resolution spectra were then taken of the candidates with CARELEC. The resulting data were searched for peculiar spectral features in an attempt to identify likely X-ray candidates.

P. Jablonka guided V. Hill, R. Noordhoek and T. Preibisch in an observational comparison of high-and-low metallicity globular clusters. Long-slit spectra with the 1.93-metre telescope were used to obtain the integrated metallicity of two globular clusters (M 13 and M 56). With the 1.2-metre telescope, images taken through the  $B$  and  $V$  filters were used to obtain colour-magnitude diagrams of the two clusters.

A. Lèbre worked with S. Leon, B. Milvang-Jensen and S. Och to investigate the stages of stellar evolution: RV Tauri stars and planetary nebulae. AURELIE was used to obtain spectra for studying the shock-induced profile changes in the  $H\alpha$  and the sodium doublet lines. The 1.2-metre telescope was used to image planetary nebulae with narrow-band filters that isolated the lines of  $H\alpha$ , and  $[S II] \lambda\lambda 6717, 31$ . Particular attention was paid to Sh 2-71 in order to sort out the peculiar morphology of this object.

P. Prugniel helped M. Gray, M. Serote-Roos and V. Shcherbakov with observations of Comet Shoemaker-Levy 9. Imaging observations were obtained at the 1.2-metre telescope and spectra with a resolution of about  $1 \text{ \AA}$  were obtained using the 1.93-metre telescope. Because the impacts turned out to be so spectacular, the findings of this group were watched with interest by the other groups.

As a special bonus for the 1994 Summer School, the students were able to use the guiding telescope attached to the 90/60-cm Schmidt telescope to visually observe the impact spots made on the

planet Jupiter by comet Shoemaker-Levy 9. Certainly such an unusual event occurring at the time of the summer school will make the school particularly memorable to all of the participants.

Readers of this article will note that the observing programmes for the students could produce interesting scientific results. Of course, the main aim of the Summer School was to teach the students how to observe using modern equipment, but the potential of obtaining publishable results motivated the students to work extra hard on their programmes. In fact, despite a few early evening clouds during the Summer School, all the students were able to successfully finish their projects.

### 3. Afternoon Talks

Following the tradition of previous Summer Schools, eight afternoons were devoted to talks by experienced astronomers about various aspects of instrumentation and data reduction.

The first speaker was Ray Wilson, who talked about modern telescope design and the contributions to telescope design by Karl Schwarzschild. Following his discussion of the optical design of large telescopes, Ray described the current situation with respect to manufacture and test technology. He concluded with a plea for more attention to be paid to the maintenance of telescopes and their optics.

Roser Pello and Joseph Wampler described spectroscopy and the design of spectrographs. The first concentrated on low-resolution spectroscopy, while the second described high-resolution spectrographs and, in particular, echelle spectrographs. Techniques for the extraction of the spectra from two-dimensional CCD frames were also described.

Leon Lucy gave an introduction to the principles of image restoration; describing Maximum Likelihood and Maximum Entropy. Following this, he discussed procedures that yield high photometric accuracy and considerations that are important when the observing programme requirements are influenced by the ability of modern reduction techniques to remove instrument signatures from the data.

Sergio Illovaisky described imaging and photometry using CCDs. Sergio pointed out the various artifacts that the detector may have. He particularly stressed the importance of flat fields for removing these artifacts. He emphasized the need for careful determination of the linearity of the CCD detector. And standard star observations are needed for accurate photometry. Overall, Sergio emphasized the need for a deep understanding of the possible sources of er-

ror in the photometry in order to obtain reliable results.

Michel Dennefeld continued the discussion of detectors with a clear presentation of the techniques for storage and transfer of charge in CCD detectors. He described the photoelectric effect and contrasted it with the photoconductive effect. He again emphasized the problem of flat-fielding CCD detectors and described the various ways that the detector produces interference fringes. He finished his talk with a description of the special problems of obtaining detectors for large telescopes.

Jason Spyromilio gave a lively description of the techniques and special problems that face the infrared astronomer. In addition to tricky detectors, the designer of infrared telescopes and instrumentation must face a situation in which any warm piece of equipment glows at nearly the same temperature as the astronomical source. He illustrated his talk with many interesting astronomical images, including a spectacular IR image of Jupiter showing some of the impact sites of comet Shoemaker-Levy 9 on the planet.

The last talk was a lecture by Roger Ferlet on dark matter in the Universe. He emphasized the importance of dark matter in setting the conditions of the early Universe and the evidence for dark matter in the rotation curves of galaxies. Roger then turned to the search for brown dwarfs and the discovery of micro-lensing by three different groups. He finished by noting that the micro-lensing programmes will, as a by-product, give us a huge sample of variable stars.

Overall, the afternoon talks gave a

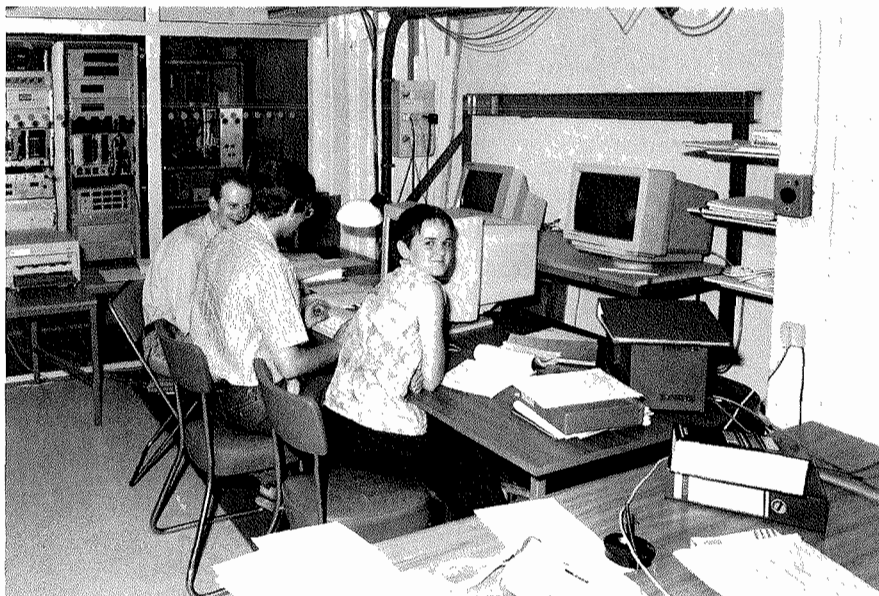


Figure 3: G. Rauw, M. Federspiel and S. Ruphy in the 1.93-metre telescope control room looking for X-ray stars.

valuable theoretical underpinning to the night-time observing and the subsequent data reduction. The talks were enlivened by many not-to-be-forgotten experiences, from Jason's table pounding with a bamboo cane to Philippe's not-so-innocent tough questions. We are still not sure who won Jason's contest for the person who asked the most questions.

#### 4. Memories

Among the memories that all of the participants will carry home with them are the social occasions that we had together. We particularly wish to thank De-

nis Gillet for taking us on a Sunday outing to the gorges at Oppedette and then on to the old village of Simiane. The gorges, the old towns and the scents of the Provençal countryside where the lavender harvests were underway, gave the visitors to Haute-Provence a real treat.

Also not to be forgotten was the Observatory swimming pool, the many late-night discussions, and the good fellowship at meal times, where Philippe told us certified true stories about famous astronomers, where Vanessa showed us her capacity for pastis, Bo his capacity for lettuce, and where Alessandra entertained us with her Italian jokes.