some confidence that the tricky process of star/galaxy separation works well. Visual checks of our method suggest that the automatic star/galaxy separation yields errors smaller than 10% at reasonably high galactic latitudes.

An automized comparison of the data from the R-plates with those from the J-plates has the advantage that the classification of all objects can be checked. Although the quality of the procedures is not tested by the comparison, the reliability with which the procedures work on the same object at different brightness levels and on plates taken under different observing conditions will become apparent. Another test is the comparison between automatically determined morphological types of galaxies on R- and J-plates. Its outcome will be more difficult to interpret because of additional physical effects. It will be interesting to see whether a colour dependence of morphological classification can be quantified.

The Stage and the Plot

Dwelling on basic details, such as removing artifacts and struggling with photographic magnitudes, while results from the red survey are still in the making, reminds us of showing a stage in daytime.

Nothing looks glamorous and the actors are still rehearsing. We hope, however, that the scenery promises to become a worthy background for a great production. The plot will be presented in the version offered by the ESO/SERC Atlas which, together with powerful measuring machines and computers, has opened new possibilities for staging the drama of the universe.

The topics and papers given below are acknowledgements to our coworkers who are not mentioned as coauthors.

Amplifier: Budell, R. 1992, in *Astronomical Photography 1990*, ed. J.L. Heudier, Université de Nice-Sophia-Antipolis, P. 23.

Astrometry: Tucholke, H.-J., Schuecker, P. 1992, *PASP* **104**, 704; Tucholke, H.-J., Hiesgen, M. 1991, in IAU Symp. 148, *The Magellanic Clouds*, eds. R. Haynes, D. Milne, Kluwer, Dordrecht, p. 491; Winkelkoetter, H. 1992, Diploma Thesis Münster.

Colour-magnitude diagrams: Ritzmann, B.-M. 1992, Diploma Thesis Münster.

Fluctuation analysis: Schuecker, P., Ott, H.-A. 1991, *ApJ* **378**, L1.

Hubble Constant: Duemmler, R. 1992, *A&A* **261**, 1.

Morphological classification: Spiekermann, G. 1992, *AJ* **103**, 2102.

Photometry: Cunow B. 1992, *MNRAS* **258**, 251; 1993a, b, *A&A*, in press.

Quasars: Meijer, J. 1991, Diploma Thesis Münster; Nolze, W. 1993, Diploma Thesis Münster.

Redshifts: Schuecker, P. 1993, *ApJS* **84**, 39.

Software and Hardware: Teuber, D. 1989, in *Reviews in Modern Astronomy 2*, ed. G. Klare, Springer, Berlin, p. 229.

Star/galaxy separation: Horstmann, H. 1992, Doctoral Thesis Münster.

First Technical Run of the COME-ON-PLUS at the ESO 3.6-m Telescope

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From December 6 to 15, 1992, the new VLT adaptive optics prototype system, the so-called Come-On-Plus system, was tested at the 3.6-metre telescope (Fig. 1). This system [1, 2, 3] is an upgraded version of the previous prototype, Come-On [4].

The main characteristics are its 52-actuator deformable mirror, the photon counting wavefront sensor using an Electron Bombarded CCD and the modal control [1, 2, 3]. During this run two visible wavefront sensors were used, one for visible magnitudes up to 9.5 and one for visible magnitudes up to 16. The imaging channel was equipped for this run with a 32×32 InSb infrared camera from the DESPA/Observatoire de Paris working in J, H, K, L, M bands. The scale was 50 milliarcsec/pixel which provides a field of view of 1.6 arcsec.

Long and short exposure images in the J, H and K bands were obtained with

Figure 1.

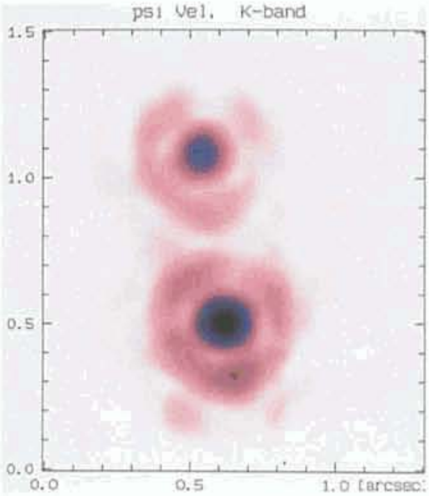

Figure 2.

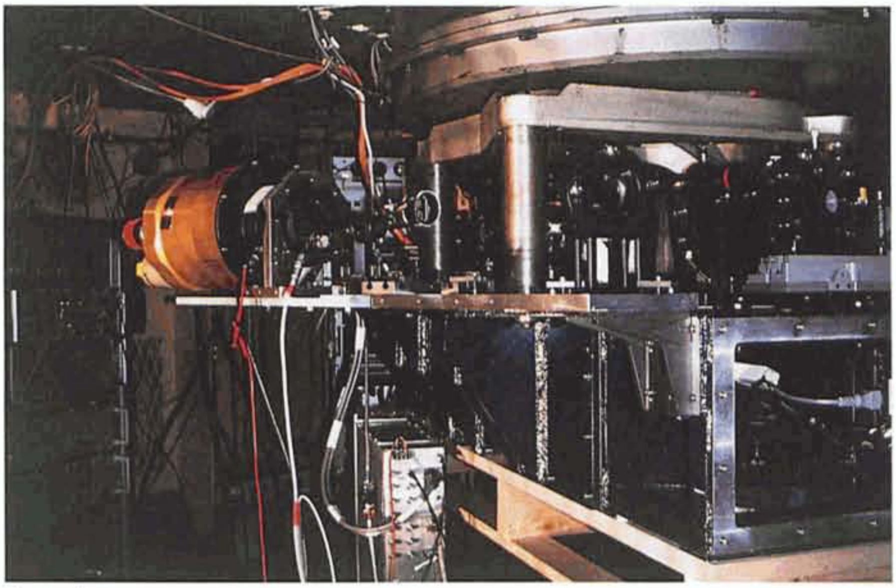

Figure 3.

a high correction efficiency using the "high flux wavefront sensor" (Fig. 2). Isoplanatic patch measurements were performed with star separation up to 20 arcsec still showing a good correction for the off-axis star in the K band. With this wavefront sensor a 30 Hz open loop bandwidth at 0 dB was reached.

Using the photon counting wavefront sensor, long exposure images in the K and L bands were recorded. The powerful capability of the modal control was used to optimize the correction depending on the star magnitude, the seeing condition, the average wind speed of the turbulent layers and consequently to minimize the noise propagation on the different modes. The system bandwidth (modal gain) was adjusted versus the signal-to-noise ratio. For instance, only tilts, defocus and astigmatisms were corrected with a 14th magnitude star (spectral type M). For magnitude 16 (spectral type M) only the tip-tilt was corrected allowing us to reduce the FWHM by a factor of 2.

At the end of this technical run a 512×512 cooled CCD camera was implemented in order to evaluate the partial correction capability of the system in the I band (Fig. 3). The scale was 20 milliarcsec/pixel with a field of view of 10 arcsec.

For the wavefront sensing, stars of visible magnitude between 4 and 6 were used and long exposure images were recorded. Double stars with separations of 0.33, 0.55, 0.8 and 2.6 arcsec were observed (Fig. 4). An average of 0.2 to 0.3 arcsec FWHM was obtained in the I band during this test under poor seeing conditions (seeing >1arcsec and average wind speed >10 m/s).

A detailed analysis of the results collected during this technical run is now under way and will provide important information for the second technical run foreseen in April. People interested in the detailed results are kindly invited to attend the next ESO Conference on Adaptive Optics in August.

Acknowledgements

The authors would like to thank many colleagues from ONERA, Observatoire

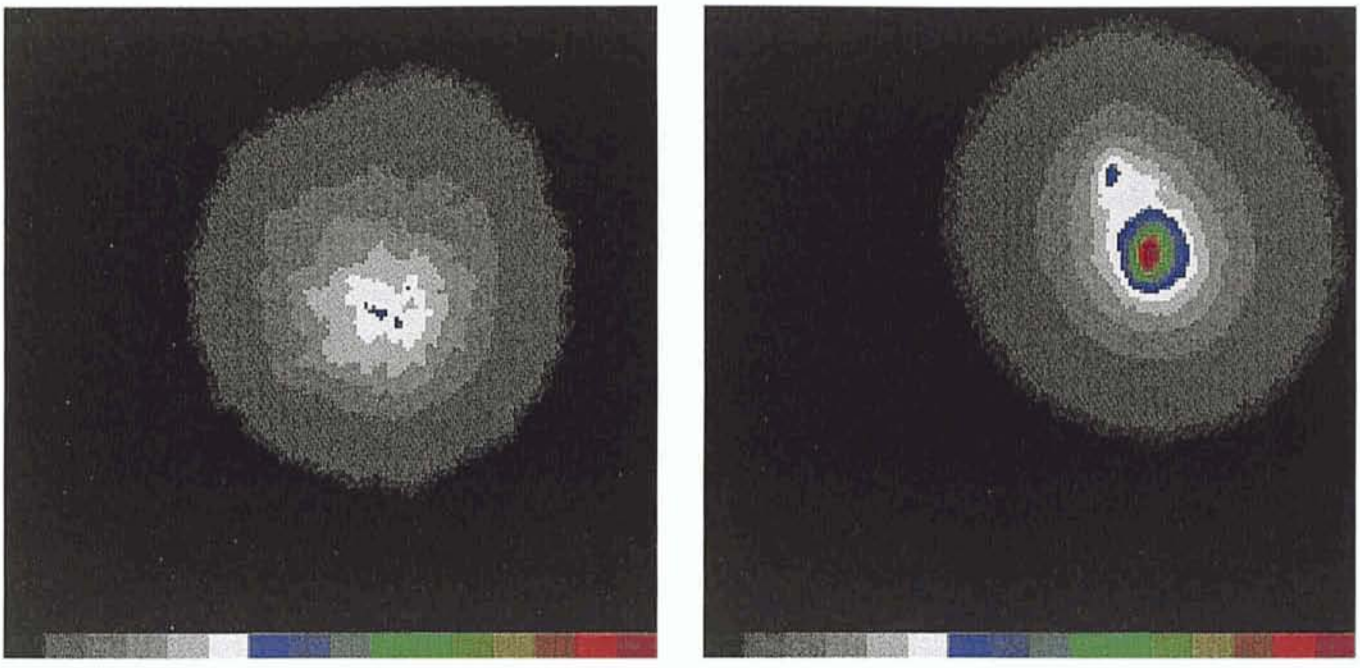

Figure 4: *Double star with separation of 0.3 arcsec observed in the I band, uncorrected (left) and corrected (right).*

de Paris, Laserdot, LEP and ESO-La Silla who have contributed to the design, construction and test of this instrument. In particular, we are thankful to Sen Wang and Pierre Gigan of the Observatoire de Paris for the optical and electronic integration performed during this run.

References

[1] Hubin et al. (1992): New adaptive optics prototype system for the ESO 3.6-m telescope: Come-On-Plus, 1992, *SPIE* 1780.

[2] Rousset et al. (1992): "The COME-ON-PLUS project: an adaptive optics system for a 4 m class telescope" ESO Conference Proc. No. 42, 403.

[3] Gendron et al. (1991): The Come-On-Plus project: an upgrade of the Come-On Adaptive Optics prototype system, *SPIE* 1542.

[4] Rigaut et al. (1991): "Adaptive optics on a 3.6-m telescope: results and performance", *Astron. Astrophys.* **250**, 280.

ADONIS – a User Friendly Adaptive Optics System for the 3.6-m Telescope

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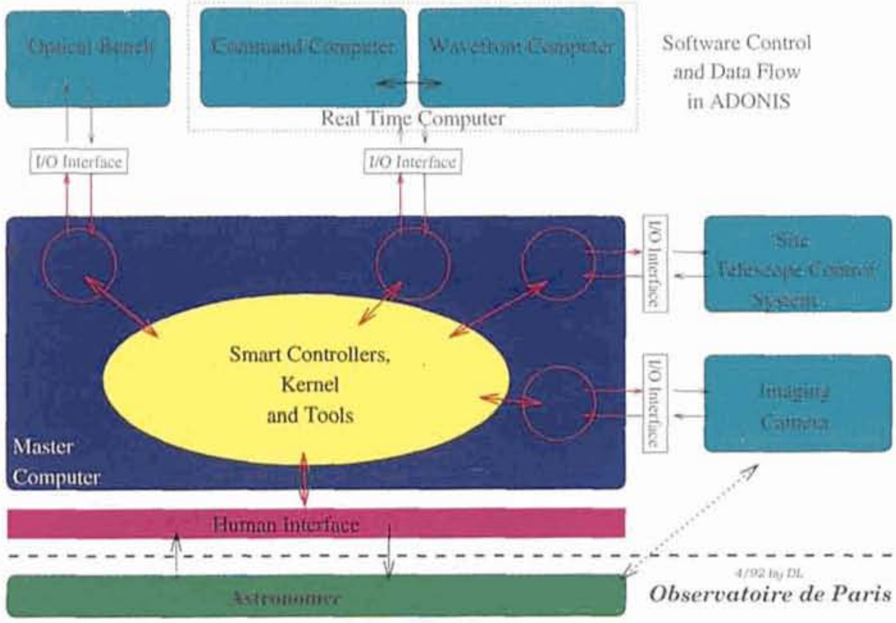
Last November a contract was signed between ESO and the Observatoire de Paris for the "design, development, manufacturing and installation at the ESO 3.6-m telescope at La Silla-Chile of the COME-ON+ upgraded to a user-friendly instrument called ADONIS". ADONIS stands for ADaptive Optics Near Infrared System.

This represents the third phase in the development of the VLT adaptive optics prototype. The very first version, COME-ON, constructed by the consortium ESO – Observatoire de Paris – ONERA – Laserdot, has already achieved routinely diffraction limited images in the near infrared on the ESO 3.6-m telescope (Rousset et al. 1990, *Astron. Astrophys.* **230**, L29; Rigaut et al. 1991, *Astron. Astrophys.* **250**, 280).

During five observing runs in 1990–1991 COME-ON obtained significant astrophysical results such as the determination of the rotation axis of the asteroid Ceres (Saint-Pé et al. *Icarus*, submitted), the first direct images of a disk-like structure around the young star Z CMa (Malbet et al., *The Messenger* No. **66** and *Astron. Astrophys.*, in press) and the images of Eta Car, showing a very complex structure (*Physics Today*, April 92).

A first upgrade of COME-ON, called COME-ON+, was recently tested on the 3.6-m telescope. The efficiency and performances of the instrument have increased significantly (see the report on page 50). However, COME-ON+ remains a prototype, its operation procedures are complex and a qualified team is required to operate the whole system in an efficient way.

In fact, several parameters have to be optimized (number of corrected modes, band-pass, choice of wavefront sensor) according to astronomical requirements (wavelength of observation, magnitude of object) and external inputs such as atmospheric turbulence (amplitude and temporal spectrum), magnitude, spectral type and angular distance of the reference star. This has led to the necessity of implementing an automated system which will do the settings and optimization much better and with greater regularity, thus helping the observer to take the basic operation decisions in an efficient way with respect to the more efficient use of telescope time.



To perform this, a smart software control system will be generated, with interfaces (data acquisition or direct control) with all subsystems such as optomechanical bench, real-time computer, infrared camera, telescope control system, site sensors (seeing, meteo), databases and user interface (see figure).

In addition, a dedicated 128×128 infrared imaging camera, covering the 1–5-μm region, will be installed to take full advantage of this powerful adaptive optics system. Two interchangeable scales (0.035"/pixel and 0.1"/pixel) are selectable to match the diffraction patterns respectively in J (1.2 μm) and L (3.6) bands.

ADONIS will also offer the possibility to accommodate many different imaging devices, for instance the Nicmos camera of the MPI/MPE Garching which will already be used on COME-ON-PLUS in April 1993. Moreover, the possibility for visiting observers to bring along special equipment will be possible by the definition of a simple and open interface on the output F/45 beam. An ADONIS interface manual will be published for this purpose.

ADONIS should progressively become available to the community during the period 1993–1995. In addition to the scientific use at La Silla, ADONIS will