in which B, C and τ are amalgamations of astrometric, spectrographic, meteorological and optical variables and parameters. The index i refers to a particular part of the slit, determined by lines connecting the slit centre to the vertices. In the *A&A* paper, the solutions to B, C and τ are given.

In order to obtain $\chi_s(\lambda)$ one has to solve $S_{B,C,\sigma}(\tau)$,

$$S_{B,C,\sigma}(\tau) = \frac{1}{2\pi}\int_0^\tau \exp \left(\frac{-C^2}{2\sigma^2(B^2+1)\cos^2\tau}\right)d\tau$$

A serious complication in the numerical evaluation to $S_{B,C,\sigma}(\tau)$ is that the wavelength appears in τ.

Table 3 shows how MIDAS (release 90NOV) deals with such problems. First, the file TAU is created in 10,000 steps of 0°.036 each (10001 pixels), starting at 0°:0° $\leq$ TAU $\leq$ 360°. MIDAS treats the contents of a file (in this case the contents of the file TAU) as the input in its computations. As a consequence the file TAU itself, with its pixel values identical to the corresponding world-coordinates, can be considered as a variable. The result is shown in Figure 7 (referring to the left axis of this figure). In the second stage, MIDAS computes

$$\frac{1}{360}\exp\left(\frac{-C^2}{2\sigma^2(B^2+1)\cos^2\tau}\right),$$

named INTEGRAND. The result at

$$\frac{-C^2}{2\sigma^2(B^2+1)}$$

= 0.5 is also displayed in Figure 7 (referring to the right axis of this figure). In the third stage of Table 3 (the integration of INTEGRAND from 0° to 240°) MIDAS computes $S_{B,C,\sigma}(240°)$, named INTEGRAL, as the average of INTEGRAND in the interval 0° $\leq$ TAU $\leq$ 240 °, multiplied by the interval itself (thus the two hatched areas of Figure 7 cover identical surfaces). Note that $S_{B,C,\sigma}(\tau)$ uses radians whereas MIDAS computes in degrees.

Once the $\chi_s(\lambda)$s have been solved for the λs of Table 2, MIDAS produces $\chi_s(\lambda)$ for all λs by the interpolation-routine CONVERT/TABLE (see also Table 3). The results obtained using the above outlined procedure are displayed in Figure 8. From $\chi_s(\lambda)$, $a_s(\lambda)$ can then be obtained.

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A Coronagraph for COME-ON, the Adaptive Optics VLT Prototype

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Thanks to new adaptive optics systems, imaging resolution has reached the diffraction limit of large telescopes in the near-infrared. Numerous aspects of astronomy (spectroscopy, polarimetry,...) will benefit from this progress. Coronagraphic imaging belongs to this category. A coronagraph installed in an adaptive optics system will significantly increase the imaging contrast. In addition, adaptive optics yields stable images and this gives a high efficiency to the coronagraphic imaging. Up to now, an increase in spatial resolution meant a loss in coronagraphic efficiency, for the central star could almost never be exactly aligned with the occulting mask because of the seeing motion. For instance, the smallest mask used to observe the β Pictoris circumstellar disk had a diameter of 4.5 arcsec on the sky, corresponding to 30 AU. However, most of the essential and needed information lies inside this distance.

The coronagraph fitting the COME-ON adaptive optics system has been developed in 1990 in the Département de Recherche Spatiale, at the Observatoire de Paris (Meudon). It was originally designed to detect circumstellar environments around young stellar objects. The optical layout it simple; the coronagraph elements are inserted between the On-Off mirror and the infrared detector (see Fig. 1). The first lens L1 images the focal plane onto the mask M; the lens L2 then collimates the light onto the Lyot stop, which can be present or not; finally, the lens L3 reimages the focal plane onto the detector with the same aperture ratio as without the coronagraphic system. The optics is made of fluoride glass, to be transparent in the thermal bands. Masks of different size are aligned on a sliding thin plate in order to move quickly from one to another by translation. The masks and the Lyot stop are manufactured by a microphotolithography process. The Lyot stop is only used when the mask size is large compared with the FWHM of the point-spread function FWHM. The masks are movable in X and Y directions by a remote-control motorization. The centring accuracy is about one tenth of the pixel size on the sky. The size of the masks ranges from 95 to 460 microns, which corresponds respectively to 0.27 and 1.3 arcsec on the sky for F/20 aperture. Every element, except the lens L1, is fixed on a movable bench in order for commutation between the normal mode and the coronagraphic one to be fast and easy.

The first test was made in January 1991 at the 3.6-m ESO telescope at La Silla, Chile, during the adaptive optics runs. The vertical motion of the masks was not yet motorized and the centring via the On-Off mirror tilt was accurate to only half a pixel. Therefore, no reliable observations were obtained, but the concept was validated. The second test took place during the April-May 1991 COME-ON run. Although a parasitic reflection in the cryostat strongly limited the elementary integration time for faint stars, we succeeded in obtaining very good coronagraphic images of bright point-like stars (see Fig. 2), in particular Sirius. We did not find the suspected third companion, because the detector field was too small (3 arcsec) and we could only observe during a short period at the beginning of the night.

The main result is the confirmation of the contrast gain. In the case of diffraction-limited coronagraphic imaging, a mask which occults the Airy pattern up to the first dark ring stops 84 % of the light. If it stops the light up to the second dark ring, 91 % is obscured. It means that the rejection rate (total light to not occulted light ratio) of such a mask is 6.3 in the first case and 11.1 in the second one. With Sirius observed in the

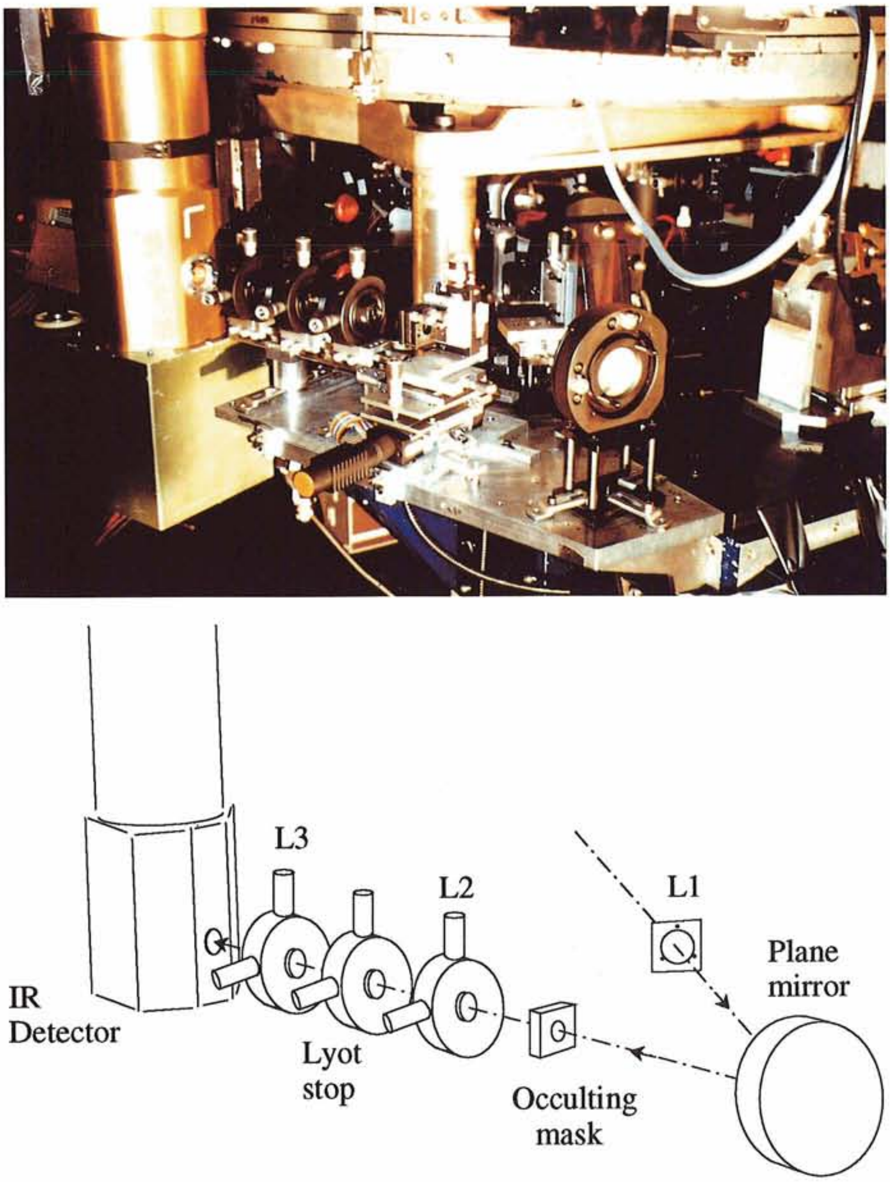

Figure 1: *The coronagraph installed at the focus of the VLT adaptive optics system COME-ON.*

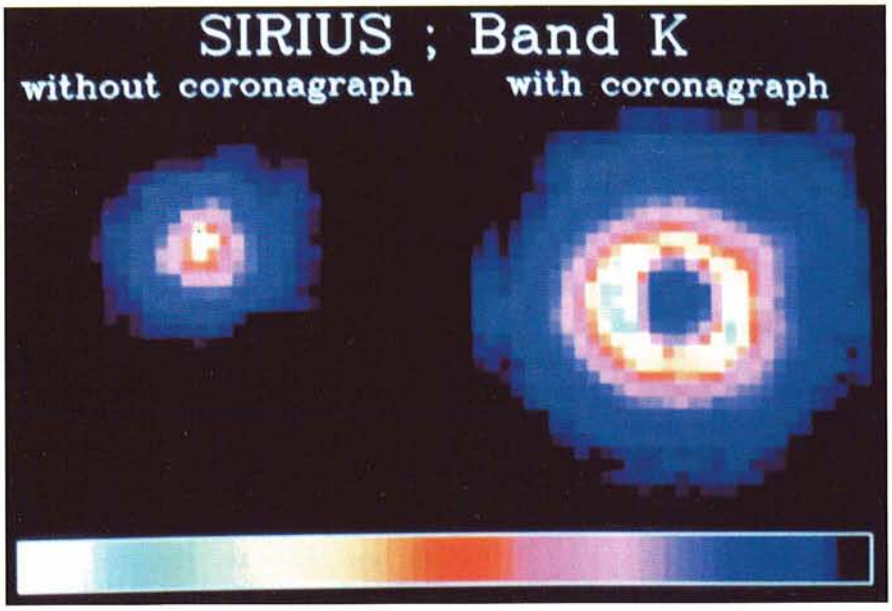

Figure 2: *Sirius images, without and with coronagraph in K band. The elementary integration time has been divided by 12 (192 ms vs 16 ms) between the two images. The pixel size is 0.101 arcsec.*

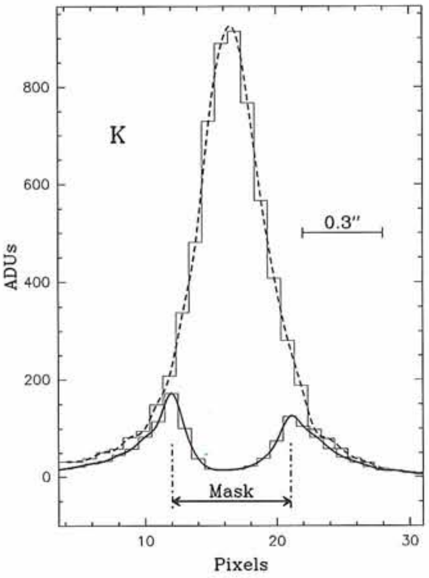

Figure 3: *Profile of a point-like star observed with and without coronagraph. The overlay between the two curves outside the mask is remarkable (the two profiles have been slightly displaced in order to increase the visibility of the figure).*

K band, we chose 16 ms as the elementary integration time to avoid detector saturation. With the coronagraph, we could reach 192 ms, i.e. 12 times longer. For another star, the gain in elementary integration time was 8.33. This demonstrates the ability of the coronagraph to increase the elementary integration time so that the signal-to-noise ratio goes as t rather than $\sqrt{t}$, as one is limited by detector read-out noise. Another point is the radial dependence of the intensity. Figure 3 shows that the radial profile of the point-spread function is not modified by the coronagraph beyond a distance equal to the sum of the mask radius and of the point-spread function half width at half maximum. If the star is not perfectly centred, the result is not changed but the maximum intensity is increased and, consequently, the elementary integration time is decreased.

These two runs allowed us to demonstrate the gain of coupling a coronagraph to an adaptive optics system. The expected and demonstrated gain is not only in resolution, but also in signal-to-noise ratio. An updated version of the coronagraph is undertaken to fit COME-ON+, the new adaptive optics system for the 3.6-metre telescope, to be put in operation at the end of 1993.

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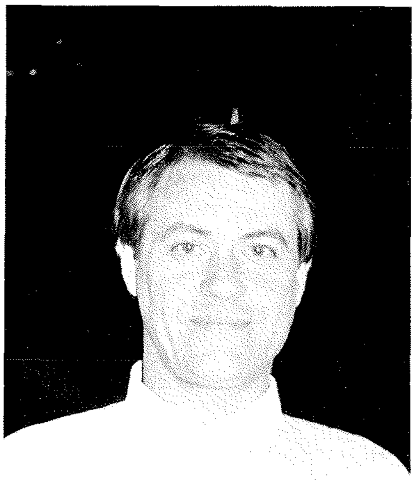
Jean-Luc Nieto (1950–1992)



Jean-Luc Nieto was born in Algiers in 1950, and came to France in 1962. He studied in Paris, obtained a Master's degree in mathematics, and in 1974, he received an engineering degree from the Ecole Centrale as well as a graduate degree (DEA) in astrophysics. He then worked on a doctoral thesis (doctorat de troisième cycle) under Jean-Claude Pecker.

In January 1977, Jean-Luc went to the University of Texas in Austin for a post-doctoral fellowship. He began to study galaxies with Gérard de Vaucouleurs. Two years later, he was hired at the Observatoire du Pic-du-Midi at Bagnères-de-Bigorre. In 1983, he moved to Toulouse, within the same observatory, where he obtained his PhD in 1984.

During the 15 years of his scientific career, Jean-Luc Nieto earned an international reputation in the area of high-resolution imaging with the purpose of understanding the nature and origin of extragalactic jets, and later of elliptical galaxies. Working tirelessly, he collaborated in many research projects – national as well as international – where his enthusiasm made him a driving force of many of them. All the big telescope domes – of ESO, CFHT – rang with his discoveries at one time or another. He played a leading role in the preparation and development of an ESO key programme to establish a physical classification of elliptical galaxies, bringing on active collaboration with the Observatories of Padua and Heidelberg.

His reputation earned many responsibilities: president of an IAU working group (1982–88), member of the French committee for telescope-time allocation (1982–83), lecturer at the National Aeronautics School since 1984, associate professor at the University of Padua in 1985, team supervisor at Observatoire Midi-Pyrénées since 1986. The French scientific community recognized the value of his work with the CNRS bronze medal in 1986.

Jean-Luc Nieto died on January 5, 1992. We will all remember his energy, his impulsiveness and his creativity, the passion with which he defended his scientific projects. His temerity and refusal to set limits did not always let us follow him, but we respected him for his bold and unique approach. After spending a year as visiting astronomer in Hawaii at the Canada-France-Hawaii telescope, he was preparing to work on exceptional images of central regions of elliptical galaxies obtained at CFHT and NTT. Mountaineering, one of his passions, took him away from us.

E. DAVOUST
(on behalf of French astronomers)

ESO at EXPO '92

A grand fiesta, lasting for 176 days and with more than 18 million participants, this is what the ancient Andalusian city of Seville is looking forward to as the final preparations for EXPO '92, the Universal Exhibition, now move into high gear.

On an area covering 215 hectares on the island of La Catuja, more than 100 pavilions have risen during the last 18 months. Most of them are national pavilions or represent geographical regions. Others are specifically devoted to the main theme of this Universal Exhibition: "The Age of Discovery".

Among the string of specialized pavilions is the "Present and the Future Pavilion", a 10,000 square metre building which will house exhibitions on robotics, energy, communications, artificial intelligence, etc. It will also be the home of an exhibition which has been put together by CERN, ESA, EMBL and ESO as well as by several Spanish research institutes. There will also be a planetarium, models of various ESA spacecraft, laboratory equipment from CERN including a big custom-built spark chamber, through which courageous visitors can walk and "see" the cosmic particles which pass through them.

ESO will show a huge, interactive model of its 16-m Very Large Telescope, together with short, specially-produced videos on different types of front-line astronomical programmes which will be undertaken with the VLT. Inside this pavilion there will also be many large colour photos from ESO on display, as well as an 11-m long photographic ESO-produced transparency of the Milky Way. And last, but not least, the outside entrance of the pavilion will be covered with a 400 square metre ESO colour photo (the largest astronomical enlargement ever made?) of a spiral galaxy. It is so large that it should be easy to see it from the city of Seville, across the river of Guadalquivir.

A universal exhibition like EXPO '92 has been described as one of the most comprehensive and ambitious cultural events of our time. It is a forum for demonstrating all facets of human endeavour. It brings together presentations of the latest advances in the arts, technology and sciences. As such it is a most fitting place to present the 16-m VLT project to the public at large.

. . . and in other places

On a smaller scale, ESO's own exhibition continues its travels on two continents. It closed in Santiago de Chile on January 23, 1992, when certain parts of it moved north to form a stand at the annual Penuelas Fair in La Serena, which opened on January 30 and closed on February 9.

On the day of the inauguration, the first visitor to the stand was the Minister of Agriculture, Mr. Figueroa, to be followed, a few days later, by the Minister of Mining and Energy, Mr. Hamilton. Further the Governor and deputies and senators for the IV Region of Chile, the