widths of the strongest lines, not contaminated by water-vapour lines. The comparison of our equivalent widths with those of the Moore et al. (1966) solar atlas, paying attention to add all the possible contributions, has shown an agreement within ±0.004 Å, and without systematic trends. Such a small difference can be easily accounted for considering the uncertainty in the drawing of the continuum and the accuracy of the measurements in our spectrum that has a S/N of ≈200.

The level of the scattered light measured in the interorder region stays fairly low all over the CCD and in the red it remains below 2% of the nearby order intensity.

The spectral resolution measured from the arc image is slightly varying from one order to the other likely due to non-perfect focusing over the entire wavelength range. The best resolution is found in order 28 where the average FWHM of the arc lines is 0.48 Å giving a resolving power of ≈ 12,000. This is what one expects taking into account the Rs product of this grating (7700 for a 1 arcsec slit), the slit width (0.5 arcsec) and pixel size (0.45 arcsec).

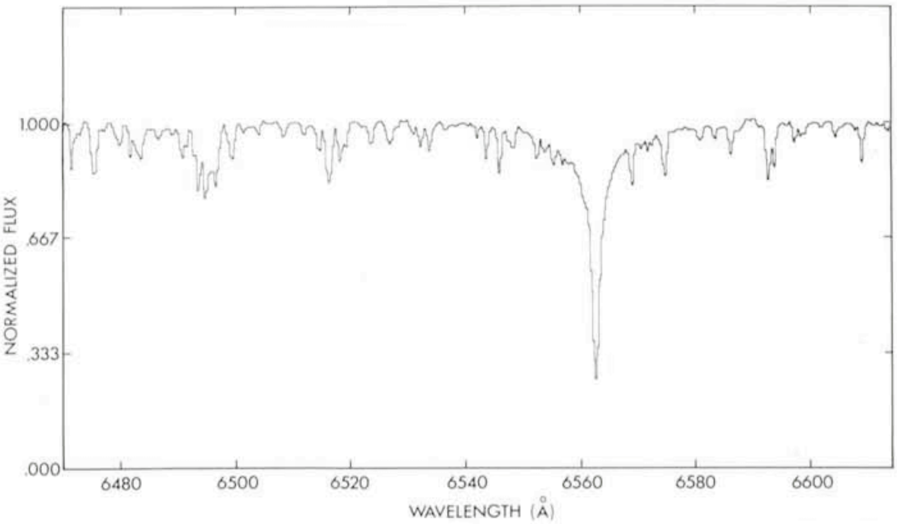

Figure 4: *A portion of order 24 extracted from the echellogram of Figure 3 showing the region around H_α.*

References

Moore, C.E., Minnaert, M.G.J., Houtgast, J.: 1966, *National Bureau of Standards Monograph*, **61**.

The Thomson 1024^2 Pixel CCD at the New Technology Telescope

S. D'ODORICO, ESO

Many of the guests who admired on the recent inauguration the impressive images taken with the NTT telescope (see the leading article in this issue of the *Messenger* and Fig. 1) were probably not aware that one of the most important components in the chain that produced those results is a 19 × 19 mm silicon device, a 2D detector usually known as a charge-coupled device or in short a CCD, and its associated electronics.

CCDs are nowadays the more intensively used detectors in astronomy because of the convenience of their digital output, the precise geometry of their discrete elements, the good linearity and uniformity, the high quantum efficiency and the low values of the intrinsic sources of noises such as read-out and dark current. At ESO, the six largest telescopes are now equipped with CCD cameras for imaging and spectroscopy and they are used in these modes for the largest fraction of the observing time.

Several industrial companies produce CCDs of interest to astronomical applications: those who currently deliver chips which are in regular use at different telescopes are Thomson CSF and EEV in Europe and Tektronix, Texas In-

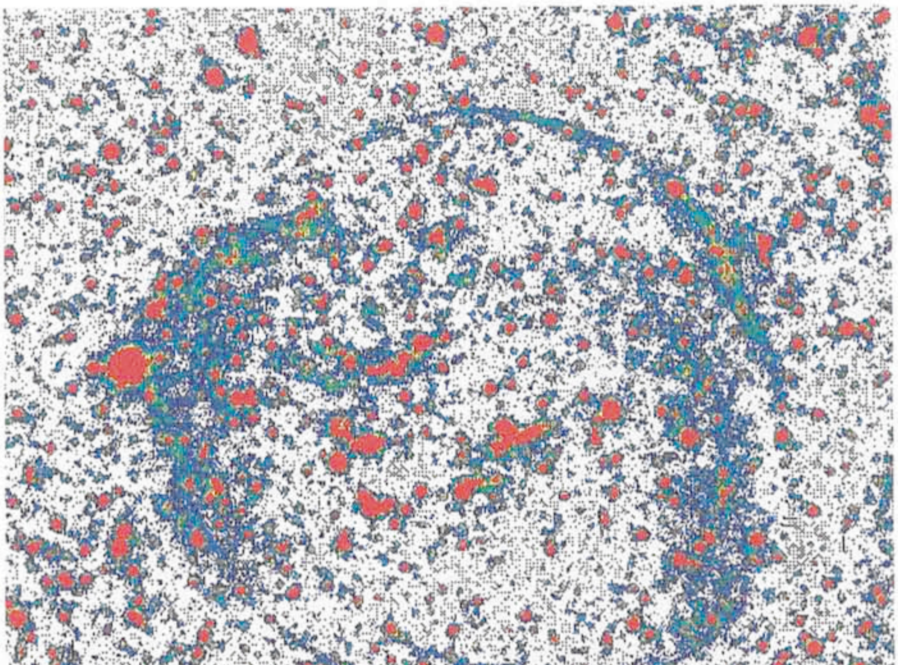

Figure 1: *A 30-minute exposure of the Balmer-line dominated supernova remnant 0548-70.4 in the LMC taken at the NTT with EFOSC2 and the Thomson 1024^2 pixel CCD in the light of Hα and [N II]. In this false-colour reproduction, objects of higher intensity, both stars and nebulae, are shown in red. The field is 2.6 × 2.6 arcmin with a sampling of 0.152 arcsec/pixel. The low read-out noise of this CCD device (< 10 e^-/pixel) is an important asset for this kind of observations where one wants to detect faint features against a relatively low background.*

strument and EG & G Reticon in the USA.

While many of these devices show excellent properties, they hardly fulfil the desiderata of astronomers either in term of size (they are just too small!) and of other working parameters. In one of many initiatives to foster the development of better devices for astronomy, ESO joined INSU of France in 1988 to support the production of 1024 pixels, front-illuminated CCDs by Thomson CSF.

Three devices of this type (TH 31156) were delivered to ESO during 1989 and they were intensively tested in the ESO detector laboratory. One was installed on the EFOSC2 focal reducer at the NTT in December 1989. It had been previously coated at ESO with laser dyes to enhance the UV-blue quantum efficiency. Figure 2 shows the final efficiency curve. The other characteristics of this CCD, now designated as ESO # 17, can be summarized as follows: r.o.n = 6 e^- pixel, dark current at 140 °K 30 e^-/pix/hr, high charge transfer efficiency, linearity over a dynamic range of 10^5, cosmic events rate 1.5 events/cm^2/min, saturation level of one pixel 1.6 10^5 e^-, absence of any major blemish. These properties make the TH 31156 CCDs a good choice for a wide range of observing programmes and explains why devices of this type have now also been introduced at the AAT 150-inch and the Tololo 4-m telescopes.

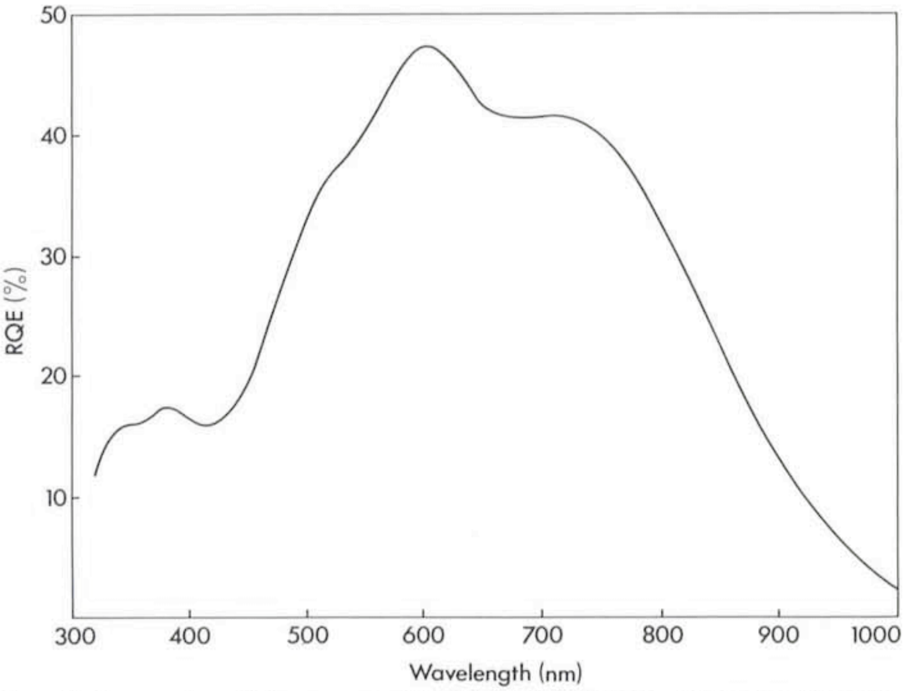

Figure 2: *The quantum efficiency curve of the TH 31156 CCD (ESO # 17) after coating in the ESO laboratory.*

The December 1989 commissioning run at the NTT represented also the culmination of two other important developments carried out at ESO in the field of optical detectors. The CCD was installed with a new, versatile control camera based on commercially available VME-bus boards and on custom-made boards interfacing the CCD to the VME-bus. The camera (Reiss et al. 1989, SPIE Vol. 1170) was developed in the ESO electronics lab in the last three years and finds a wide range of applications in present and future ESO instruments.

The CCD was installed in the dewar on a new front-end also designed at ESO for use with CCDs as large as 6 × 6 cm (Fig. 3). Other novel features of the new mounting are the location of the pre-amplifier board close to the chip to minimize the system noise and various artifices adopted to maximize the thermal insulation and to facilitate a precise spatial adjustment of the chips.

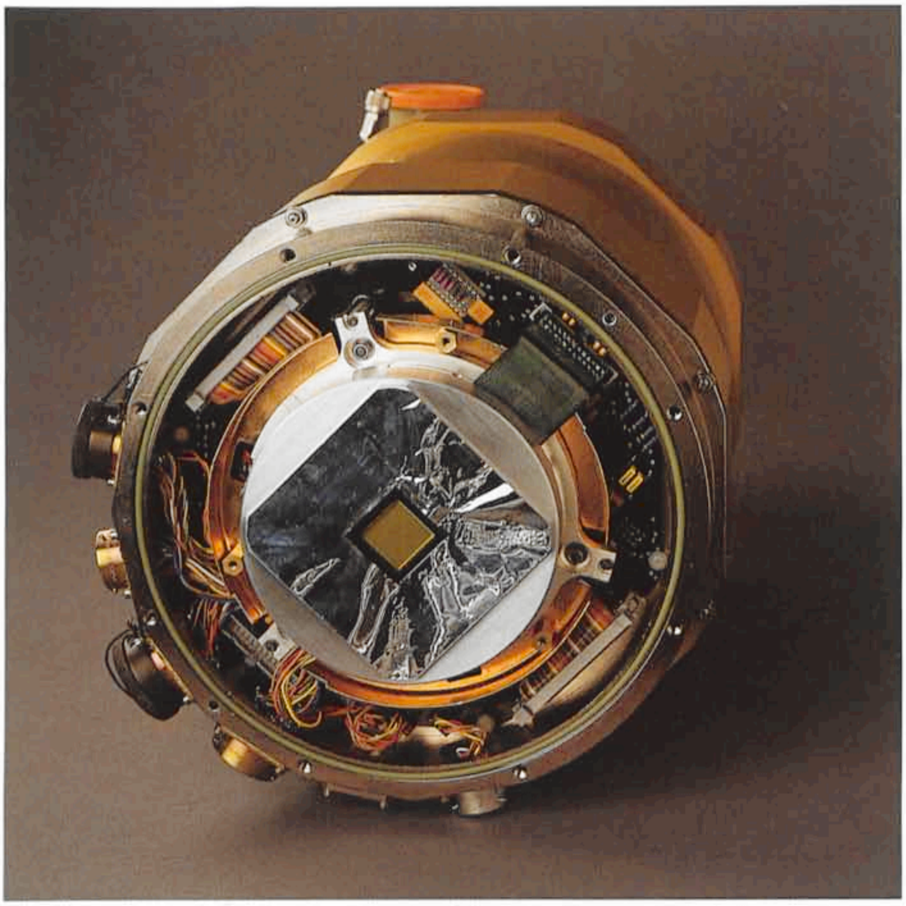

Figure 3: *A view of the TH 31156, 1024^2 pixels CCD on the new mounting designed and realized at ESO. With a 2.3-l liquid nitrogen tank, the dewar can operate the CCD at the required temperature of 140 °K for periods longer than 24 hours without refilling.*

First Announcement

HIGH-RESOLUTION IMAGING BY INTERFEROMETRY. II

From 15 to 18 October 1991

European Southern Observatory
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Chair: **J.M. Beckers and F. Merkle.** For further information contact "Interferometry 91", c/o Christina Stoffer at ESO, Karl-Schwarzschild-Strasse 2, D-8046 Garching bei München, F.R. Germany.