tages of simultaneous multi-channel photometry compared to conventional single-channel photometry. If the seeing is variable on short-time scales, this will affect differently every single filter measurement made with a single-channel photometer, thereby ruining both colour indices and magnitudes. In simultaneous photometry only the magnitudes are affected, but colour indices are unaffected, i.e., it is still possible to obtain the astrophysical information about temperature, absolute magnitude and metallicity with the highest accuracy. Any variable absorption, *which is grey*, has the same effect on the measurements. This means that field star programmes aiming at, e.g., galactic structure studies, are unhampered by cirrus clouds. Variable star research with our equipment, however, still requires photometric conditions.

We hope that even more observers will exploit the Danish equipment in the future.

Welcome to the Strömgren Automatic Telescope.

A New CCD Camera for the Echelec Spectrograph

A. GILLIOTTE and P. MAGAIN, ESO

The Echelec spectrograph, installed at La Silla in 1973, was designed to be used with an electronographic camera. However, by adding a flatfield corrector, it can be operated with other detectors, such as CCD's. As part of the upgrading programme of the 1.52-m telescope, and in order to improve the spectroscopic capabilities of that instrument, the Echelec spectrograph has been modified and is now working with the same CCD detector as used on the Boller and Chivens spectrograph.

The main modifications of the Echelec consist in the installation of a support for the CCD cryostat, a new Echelle grating, a TV slit viewer and a new calibration lamps unit, with flat-field and thorium lamps (and some others possibly available). The motorization of the cross-dispersion device, for automatic selection of the central wavelength, is in progress. An autoguider system should also be installed in the future.

In the present configuration, the Echelec is equipped with a 31.6 gr/mm Echelle grating and a 632 gr/mm Carpenter prism as cross-disperser. The linear dispersion varies from 3.1 Å/mm at 4000 Å to 4.5 Å/mm at 6000 Å. The cross dispersion amounts to 35 Å/mm. With an RCA chip as the detector, one frame covers approximately 275 Å, in 5 to 10 orders (see Fig. 1). A reasonable order overlap is insured up to 6500 Å, but the presently used flat-field corrector limits the spectral range to wavelengths lower than about 5500 Å. A 15 μm pixel corresponds to 0.65 arcsec on the sky, so that an optimal sampling is obtained with a 1.3 arcsec slit.

A few nights were allocated for the astronomical tests of this new combination in September and October 1987. The use of a 1.4 arcsec slit led to a resolving power of 32,000 (FWHM) as measured on the Th lines. As such, the Echelec resolution falls in between those of the CES with short camera ($R \approx 50{,}000$) and CASPEC ($R \approx 20{,}000$). The efficiency of the instrument was estimated by observing the spectrophotometric standard star HR 9087. With the same 1.4 arcsec slit, the measured count rate at 5000 Å corresponds to 0.6 electrons per second per wavelength bin (0.06 Å) for a star of visual magnitude 10. Taking into account the readout noise (57 e^- per pixel) and the dark current (60 e^- per pixel per hour) of the CCD chip used (ESO number 13), a S/N of 10 would be reached in 1 hour for a star of $m_V = 10.1$ ($m_V = 7.3$ for S/N = 100) in unbinned mode. A limitation of the present configuration is the rather high readout noise of the CCD chip number 13. Fortunately, the wide separation of the orders allows some binning in the direction perpendicular to the dispersion. This improves the S/N without any loss of resolution. With a binning of 4 pixels, the limiting magnitudes would be $m_V = 10.6$ and 7.7, for a S/N of 10 and 100, respectively, in 1 hour.

To give the potential observer a better feeling of the quality of the Echelec spectra, we reproduce in Figure 2 one order of the spectrum of the solar-type star HR 810, after flat-fielding and calibration in wavelength. The exposure time was 30 minutes, in rather poor meteorological conditions.

In its present state, the Echelec spectrograph is able to produce useful results in the blue-green spectral range (up to 5500 Å). It is expected to help lowering the pressure on the CASPEC and CES spectrographs. Further improvements should allow to extend the

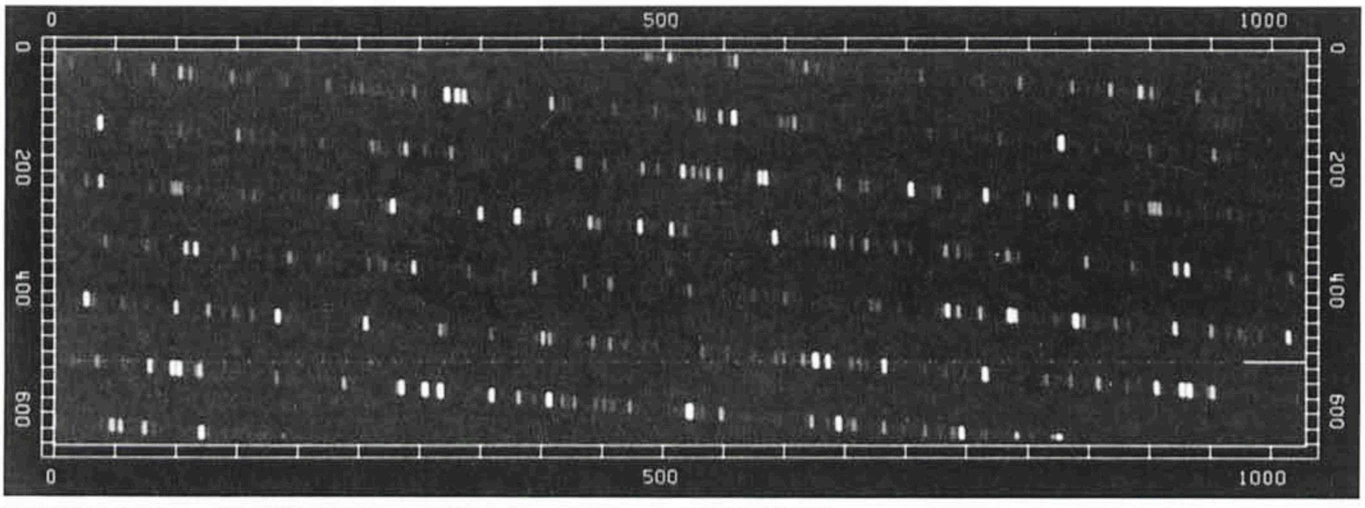

Figure 1: *CCD frame of the Thorium hollow cathode lamp in the region 5300–5600 Å.*

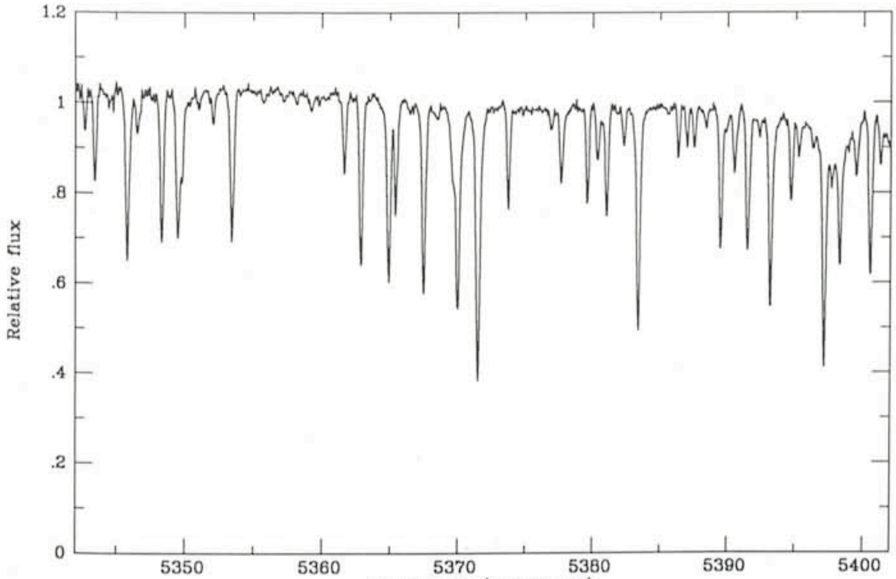

Figure 2: *Portion of the spectrum of the solar-type star HR 810 in the spectrum order 107 (5340–5400 Å) recorded on October 6, 1987 with the Echelec.*

spectral range available in one exposure.

Acknowledgements

We thank Mr. W. Eckert for his help on the mechanical design. The design of the Echelec spectrograph was by A. Baranne. The implementation of the CCD at the Echelec was proposed in a feasibility study by J. Breysacher, B. Delabre, S. D'Odorico, A. Gilliotte and P. Giordano on the improvement of the spectroscopic capability of the 1.5-m ESO telescope.

First Results from Remote Control Observations with CAT/CES

P. FRANÇOIS and E. BROCATO, ESO

As announced in the *Messenger* No. 49 (September 1987) by G. Raffi, the CES spectrograph with CCD (using the CAT telescope) is now available by means of remote control from Garching.

In testing remote control operations, in October 1987, we had time to obtain some spectra which are interesting from an astrophysical point of view.

Of course, even if a night assistant was available at La Silla, most of the standard observation procedures were done from Garching: the pointing of the telescope, identification of the stars, all the operations available on the instrumental console (setting of the instrument, definition and start of exposures, etc.). For files containing CCD spectra, a typical transfer time from La Silla to Garching was about 1–1.5 min. This means that quick-look analysis was possible on-line and that all spectra could be transferred to Garching, making full data reduction possible only few "hours" after the observing night.

Observations

Three stars have been observed: HD 211998, HD 219617 and HD 4307; the detector was a high-resolution CCD (1,024 × 512 pixels) and the CES was used with the long camera configuration. The resolving power was about 60,000 and the signal-to-noise ratio was not less than 100. The reduction procedure has been described in detail in a previous paper (François 1986). As an example, a part of the spectrum of HD 211998 is shown in Figure 1.

The observed stars have been previously studied by Laird (1985) and the main characteristics of their atmospheres are known. With these parameters, we have interpolated the models in the grid of Gustafsson's model for dwarf stars (Gustafsson 1981) computed under the same assumptions as in Gustafsson et al. (1975). The oscillator strengths of the lines have been determined by fitting the profiles of lines to the solar atlas of Delbouille et al. (1973). The oscillator strength of the Barium line has been taken from Wiese et al. (1980) and the value has also been checked on the solar spectrum. In the computations, the solar abundances of Holweger (1979) have been adopted and we have followed the results of François (1986) concerning the main assumptions and procedures used for computing the lines.

The errors have been estimated by assuming possible uncertainties in the atmospheric parameters ($\Delta T = 100°K$, $\Delta V = 0.5$ km/s, $\Delta \log g = 0.3$). This leads to an error estimation of ± 0.15 dex.

Results

In Figure 2, we have plotted the [Ba/Fe] as a function of [Fe/H] for our three stars and very recent data coming from Magain (1987) and Gilroy et al. (1987). Our measures are in good agreement with the observations of dwarf stars done by Magain. Gilroy and col-

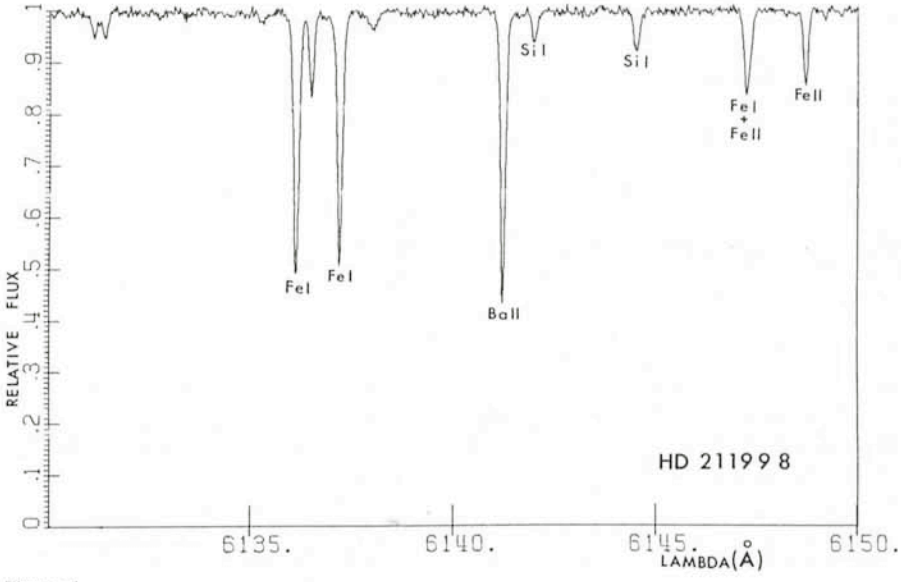

Figure 1.