EEV AND ELECTRON CORP. VIRTUAL PHASE CCDs IN THE NEAR IR REGION, He I λ 10830 Å

A. G. Shcherbakov, Z. A. Shcherbakova,

Crimean Astrophysical Observatory

I. Ilyin and I. Tuominen

Observatory, University of Helsinki

He I, λ 10830 Å observations of late-type stars provide valuable information about the chromospheric and low chromospheric-coronal transition regions. High resolution measurements of the helium λ 10830 Å line profile offer a convenient way to survey the coronal emission of the Sun as a point source, as well as a variety of stars (O'Brien and Lambert, 1986, Shcherbakov and Shcherbakova, 1991).

The He I λ 10830 Å survey of solar and stellar activity commenced in 1985 at the Crimean Astrophysical Observatory, using CCD cameras for spectral observations in the near infrared region. As is well known, the sensitivity of the CCD in the near infrared region is only a few percent of the maximum sensitivity. To increase sensitivity in the infrared region, keeping the noise to a moderate level, the working temperature of the CCD should be increased to an optimal value.

Fig. 1 represents our investigations of the CCD camera, manufactured by Astromed Ltd., Cambridge, England, with an EEV P88200 CCD. The tests were made with the high resolution echelle spectrograph SOFIN at the Nordic Optical Telescope, La Palma. The various parameters of the CCD were tested as contributors of the total noise: $\delta^2_{total} = \delta^2_{stat} + \sigma^2_{spn} + (\sigma_{dark}/C)^2$, where δ_{total} is the relative error of the output signal, δ_{stat} is the photon noise of the accumulated signal, σ_{spn} is the spatial noise in the pixel-to-adjacent-pixel scale and σ_{dark}/C is the ratio of the dark current noise and accumulated signal. It was assumed that the readout noise of the CCD was included in the dark current noise value. The value of the spatial noise gives information about the photometric quality of the CCD. The noise is almost removable by a flatfield. Dark current noise does not contribute seriously to the accumulated signal of about 10000 e^- per one hour at temperatures near to 170 - 180° K, compared with 120 - 140° K. On the other hand, the sensitivity is increased 2.5 times at λ 10830 Å when the temperature is raised from 120° K to 180° K.

To study the activity of late-type stars the Astromed Ltd. system [with EEV CCD P8600, as well as the ASTRO-550 system by Ista Ltd., St.Petersburg, Russia (Berezin et al., 1991), with a virtual phase CCD (developed and produced by Electron Corp., St.Petersburg, Russia)] were used with the coudé spectrograph of the 2.6-m telescope of the Crimean Astrophysical Observatory. Both systems make it possible to reach an S/N ratio in the range of 30 - 100 with a spectral resolution about of 30000 for a 5 - 6th magnitude star in the near infrared. Both EEV

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P88100 and P88200 are used with the SOFIN spectrograph at the Nordic Optical Telescope and allow a high S/N ratio of 90 - 100 with a spectral resolution up to 60,000. The ASTRO-550 system has been applied also to the observations of the Sun-as-a-star (with a resolution about of 200,000) with the 0.5-m Solar Telescope of the Crimean Astrophysical Observatory.

Fig. 2 shows the level of chromospheric activity of late-type stars as seen in the He I λ 10830 Å line profile. It is easy to see from the comparison of the line profiles for the Sun as a star, and for the active region on the solar disk, that a deeper and wider line is observed in more active stars.

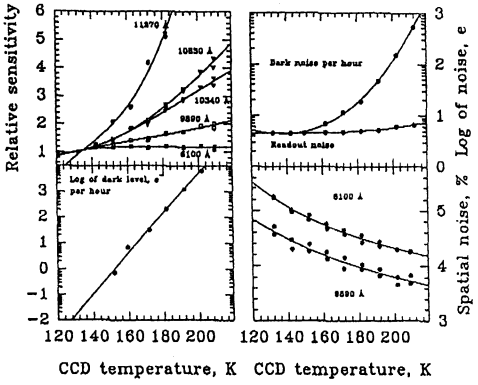

Fig. 1. Behavior of various parameters as a function of temperature for the EEV P88200 CCD.

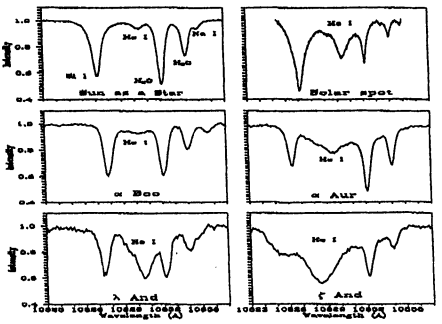

Fig. 2. He I λ 10830 Å line profile of the Sun and some other late-type stars

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