A low-resolution spectrometer (spectropolarimeter) with a transparent grating for the 1 m telescope

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Abstract. A low-resolution spectrometer has been built to study depressions in spectra of stars. It can be used as a spectropolarimeter provided that a double block of calcite is placed in front of it.

A spectrometer has been made to study depressions in the continuous spectrum of peculiar stars. Its block diagram is displayed in Fig. 1a. A converging beam of light coming from a star in the first order of the transparent grating enters the CCD detector after having been reflected from the flat mirror 1. With the aid of the additional mirror 2 the zero-order light is brought to a viewing television device (TV guide) for guiding. The spectrometer can be used as a spectropolarimeter provided that a polarimeter in the form of a compound beam-diverging calcite spar crystal composed from two similar plates cut along cleavage plane and turned by an angle of 90° with respect to one another is installed at the entrance. This arrangement constructs two spectra in orthogonal polarizations in the CCD detector plane. To measure linear polarization and determine position of the plane of predominant polarization, one has to make not less than two exposures with different orientations of the spectrometer with respect to the telescope (executed by turning the exit flange of the telescope).

Basic parameters

Spectral range	4000 Å – 7000 Å
Spectral resolution (depending on seeing)	10 Å – 30 Å
Average dispersion	2.6 Å/pixel
Efficiency at 5200 Å	13^m over 10 min with S/N=100

In Fig. 1b is displayed the spectrum of the star λ Gem in orthogonal linear polarizations. Fig. 1c shows the cross-section of the double spectrum transverse the dispersion, and in Fig. 1d is the horizontal section of the lower part of the spectrum given in Fig. 1b.

Fig. 2 is the plot of the degree of linear polarization of the polarization standard HD 23512 as a function of wavelength. The horizontal line corresponds to a polarization of 2.3 %.

Fig. 3 presents a portion of the spectrum of the peculiar star HD 74521 with a large depression value ($\Delta a = 75$, Lebedev, 1986) divided by the spectrum of the HD 43384. Three bands are isolated in Fig. 3 at half-width of the filters' pass-bands used by Maitzen and Vogt (1983) in the photometer to determine the depression value. It is seen from the figure that a considerable part of the depression falls within the bands of the neighbouring reference channels gl and y, i.e. the depression is underestimated. Thus a more refined approach to estimating the depression is needed.

References

Lebedev V.S., 1986, Astrofiz. Issled. (Izv SAO), 21, 30

Maitzen H.M., Vogt N., 1983, Astron. Astrophys.,123, 48
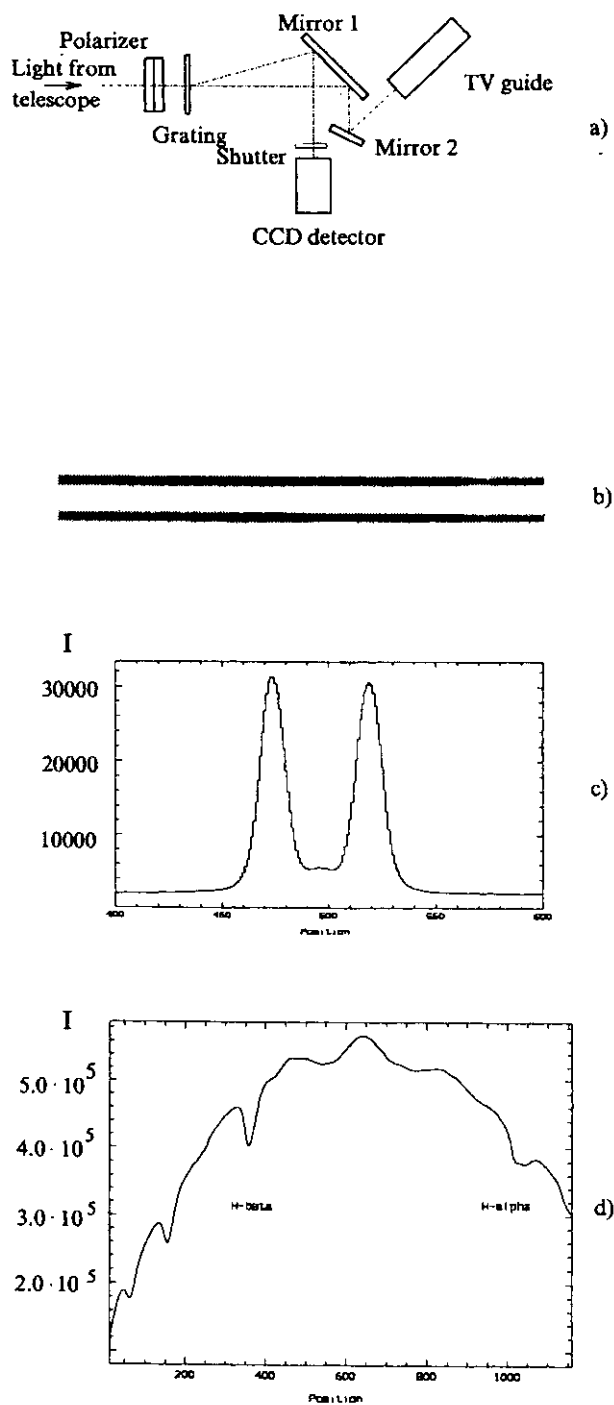
Figure 1: a) A block diagram of the spectropolarimeter for the telescope Zeiss-1000.
b) The spectrum of λ Gem in the orthogonal linear polarizations.
c) A vertical cross-section of λ Gem spectrum.
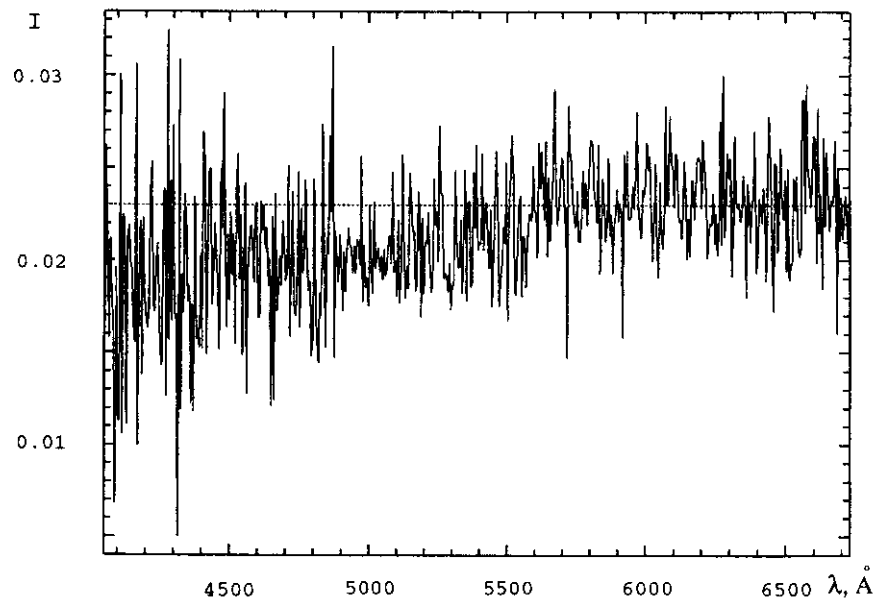d) A horizontal cross-section of λ Gem (along the lower part of the spectrum).

Figure 2: *Linear polarization of HD 23512 as a function of wavelength.*
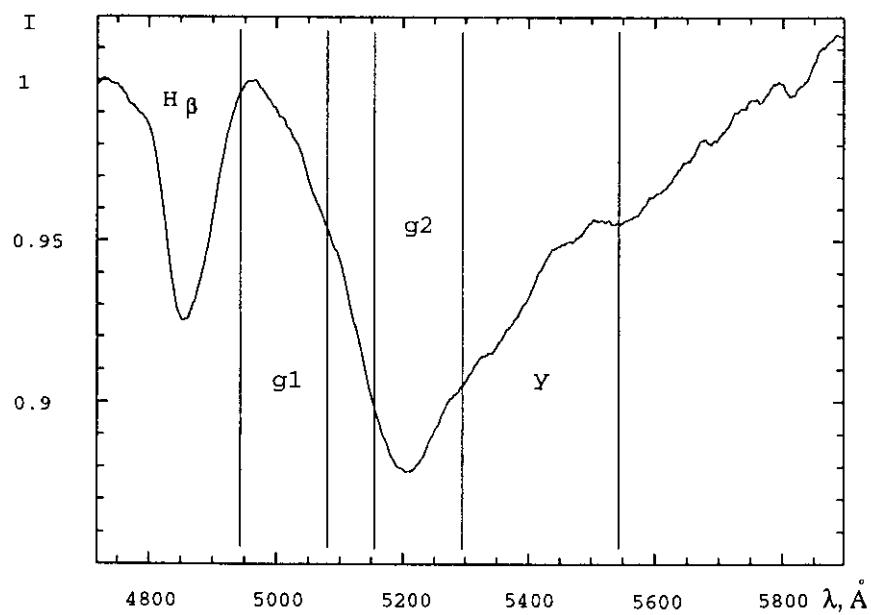

Figure 3: *The portion of the spectrum of HD 74521 with a large depression divided by the spectrum of the HD 43384.*