

NEW ASTRONOMICAL STATION ON MOUNT DUSHAK-EREKDAG. II. A DUAL-CHANNEL PHOTOMETER.

N. I. Dorokhov, T. N. Dorokhova
Astronomical Observatory, Odessa State University,
T.G.Shevchenko Park, Odessa 270014 Ukraine
E-mail: root@astro.odessa.ua

ABSTRACT. A dual-channel photometer has been constructed at Astronomical Observatory of Odessa State University to observe two astronomical objects simultaneously. The photometer has been attached to 0.8 m in diameter Ritchey-Chretien system telescope at a station of Odessa Observatory on the Mount Dushak-Erekdag in Turkmenistan. The equipment works in normal observing mode. Light curves of observations are presented.

Key words: Photometer: dual-channel; photometric observations.

A construction of the photometer of Astronomical Observatory of Odessa State University looks like a simple twin-beam photometer described in a work by De Biase et al. (1978), moreover some technical decisions we try to simplify. Our photometer permits to observe two astronomical objects at the same time.

Two symmetrical photomultipliers FEU-136 with thermoelectrically cooled photocathode S-20 are used in the photometer.

Each channel has a set of 5 diaphragms with diameters from 0.4 mm to 2.5 mm. A minimal distance between diaphragms of both channels is 4 mm in the focal plane, a maximal one is 100 mm (these correspond to 1' and 20' on a sky field for our telescope).

A wheel with 12 positions is located in each channel. The motor activated by the computer rotates the wheel. The moving time from one filter to another varies for disposition of the filters on the wheel from 1 to 3.5 sec.

We use the filters of the standard system of Johnson UBVRI and a narrow band interferometric filter with $FWHM=140\text{\AA}$ centered on the $\lambda=4110\text{\AA}$ (an analog of Stroemgren v-band) at present time. Besides, a radioluminescent sources for the stability equipment control and a set of neutral filters are mounted on the wheel. An observer can choose some set of filters.

It is possible for the photometer to observe the same star in both channels. A split prism moves in the way of the beam. We carry out simultaneous observations of the same star in different spectrum regions that permits to improve precision of the observations and to broaden the scope of astrophysical projects.

The photometer is adapted to decision of a wide range of astrophysical problems. An interface (it was produced in Kulibaba's V.V. laboratory) and a software of the system are described in a work by Dorokhov et al. (1990). The computer program provides integration times from 0.05 sec. to 32 sec. with a sampling 1 msec. A dead time between two measurements in the same filter is 0.018 sec.

The photometer has been attached to a 0.8 m telescope-reflector of the Ritchey-Chretien system (Dorokhov et al., 1994) at the Odessa Observatory station on the Mount Dushak-Erekdag in Turkmenistan.

In summer-autumn 1992 and in spring 1993 the observations of different astronomical objects were carried out on the photometer. Fig. 1 shows a light curve of the nova-like star TT Ari (Fig. 1a) and of the comparison star (Fig. 1b). Stroemgren band v was used

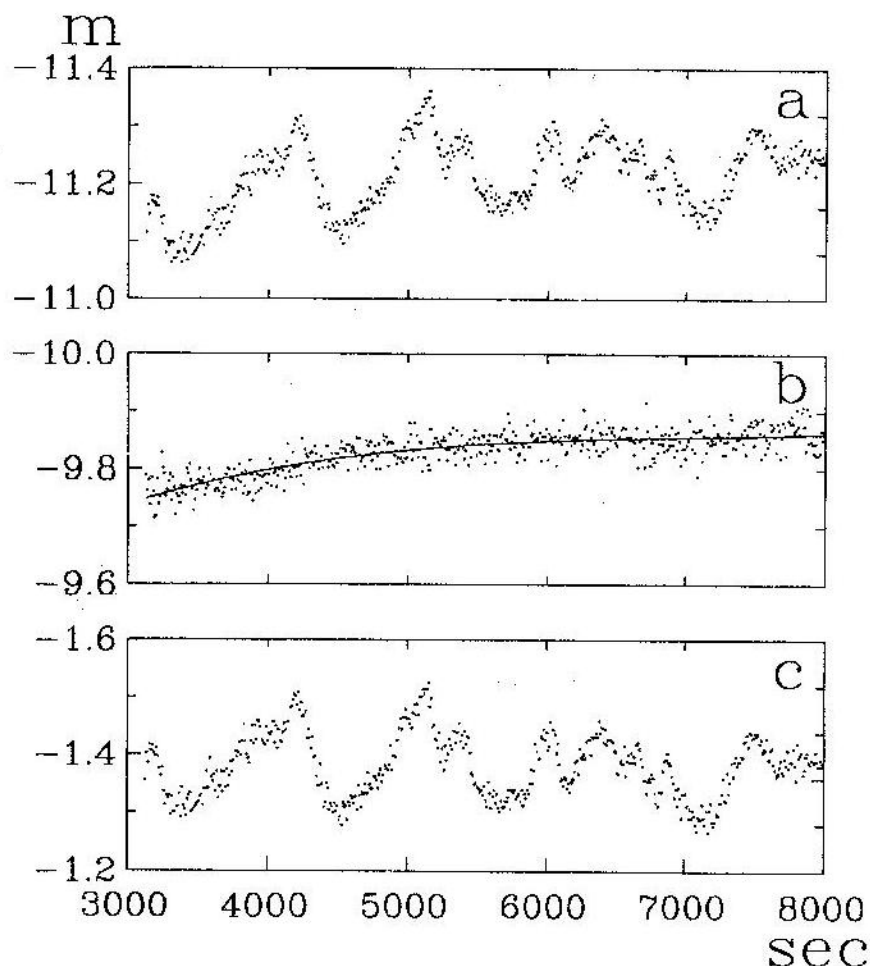


Figure 1: A light curve in instrumental magnitudes of the nova-like star TT Ari in a primary channel (a) with the comparison star in a secondary channel (b), a solid line is the smoothing data by polynomial of 3-rd order; c) – the result of subtraction of the smoothed secondary channel data from the primary channel data.

in both channels and integration time of 10 sec was chosen. A sky background was measured one time in an hour. Data are corrected for coincidence counting losses and a sky background contribution. A comparison star "c" (Götz 1985), an average of 1.4 mag fainter than TT Ari, is in 15' distance from the variable. We smoothed the comparison star's data by polynomial of 3 degree for decreasing the statistical noise and subtracted this smoothed curve from light curve of variable star (in magnitude of instrumental system). This difference is shown in Figure 1c.

At present time we value a precise of observations by using the photometer in one-channel mode as 0.003–0.004 mag for the stars of 6 mag and as 0.01 mag for the stars of 10–12 mag for 10 sec. integration time when there is a good atmospheric transparency.

A dual-channel mode was not investigated enough but the instrumental drift in each of channels obtained by using radioluminescent sources is up to 3% during a night.

References

- De Biase G.A., Paterno L., Pusilio M., Sedmak G.: 1978, *Applied Optics*, **17**, 3, 435.
 Dorokhov N.I., Dorokhova T.N.: 1990, in: *Photometry and its metrological equipment*, Moscow, 21.
 Dorokhov N.I., Dorokhova T.N., Komarov N.S., Mukhamednazarov S.: 1994, *Odessa Astron. Publ.*, **7**, 167.
 Götz W.: 1985, *Inf. Bull. Var. Stars*, **2823**, 2pp.