

# NEWS FROM MT. DUSHAK-EREK DAG STATION OF ODESSA ASTRONOMICAL OBSERVATORY

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**ABSTRACT.** This report continues the series of articles about observations at the Mt. Dushak-Erekdag station of Astronomical Observatory, Odessa State University in Turkmenistan. A 0.8 m telescope with the dual-channel PMT photometer is installed at the station. From 1993 to 1997 years the photometer participated in 6 asteroseismological campaigns and in some international programs. The instrumentation is modernized and quality of observations is improved. The following scientific researches are carried out at the station:  $\alpha$  (rapidly oscillating) Ap,  $\delta$  Scuti and  $\lambda$  Booti stars, variability in the spots of cool stars, close binary systems, etc. Besides the station participated in the programs of asteroids' security and investigations of Solar system by means of photometric observations of eclipses and occultations of large planets' satellites. This work became possible thanks to cooperation with colleagues from different countries.

**Key words:** Observatories, instrumentation

In volume 7 of these "Publications" the first report (Dorokhov et al., 1994) about observations from Mt. Dushak-Erekdag station of Astronomical Observatory, Odessa State University, appeared. It was based on 1992 year's observations, mainly, so this communication may be considered as the 5-year report of observational activity, events and results of the station. From 1993 to 1997 years 5 prolonged (2 - 4 months') expedition were realized to the station in Turkmenistan. Because of the

difficulties in financial support, the participation in international programs and asteroseismological campaigns was the main work of the station. It should be reminded that the location of the Mt. Dushak-Erekdag Observatory ( $\phi = +37^{\circ}56'$  N,  $\delta = 3^h52^m$  E) is very suitable for cooperation with existing asteroseismological networks, such as DSN (Delta Scuti Network) or WET (Whole Earth Telescope).

During 1993-1997 the station took part in the next multisite photometric campaigns:

- VW Ari ( $\delta$  Scuti star) with STEPPI (STellar PHotometry International) network campaign in October 1993 (see Dorokhova et al., 1998);
- ET And, coordinated by W.W.Weiss, in September 1994;
- TT Ari (cataclysmic variable), organized by I.L.Andronov, in October-November 1994 (see, for example, Andronov et al., 1995);
- $\theta$ 2 Tau ( $\delta$  Scuti star), organized by M.Breger, in November-December 1994;
- BH Psc ( $\delta$  Scuti star), organized by E.Poretti, in October 1995;
- 4 CVn ( $\gamma$  Dor star), coordinated by M.Breger, from the beginning of March to the end of May 1997.

The participation in international campaigns is very important and useful (see, for example, Butler, 1994). This work at the forward level of scientific investigations in the world gives an opportunity to take part in the projects of the leading specialists in the corresponding branches of astronomy, directly acquaint ourselves with the work in observatories of other countries, to compare quality of observations, to

gain an experience in uniting of the data from different light detectors.

At the same time such work demands selflessness of an observer who has to refuse from own observational plans, permanent readiness of equipment and high accuracy of observations. That is the necessity of permanent modernization and improvement of the instrumentation with an excellent chance to control.

All observations from the Mt. Dushak-Erekdag were performed with a dual-channel PMT photometer (Dorokhov & Dorokhova, 1994), mounted on 0.8 m telescope. Last year and this one we prepared and installed a new interface and software for the suitable managing by the photometer and data viewing. It was difficult to do this during short sojourn at the station, and the base work was done in the laboratories of Odessa Observatory and Majaky station.

As a result photometer's characteristics were improved: the integration times may be used from 1 msec. to essential value with a dead time 1 msec. In one-channel mode an accuracy of observations is reached to  $0^m.001$  for stars to  $6^m$  and  $0^m.005$  mmag for stars of  $10^m$ - $13^m$  in B, V, R filters. In dual-channel mode an accuracy of observations is  $0^m.001$ - $0^m.002$  for integration time in order 10 sec.

A problem was with the correction of the channels' drive (usually less than 3% during a night) which was done before this year by using the comparison star's observations through the primary channel and the secondary one in turn. Such channel calibrations took a lot of time and brought low accuracy (see Dorokhova et al., 1998). A correction by using the observations of the sky background in both channels as it realized in some type of multichannel photometers involves a large uncertainties in resulting data, too, from the low counts. This year we have constructed and installed the inside calibration system. The light from a single optical diode is passed simultaneously to 2 photomultipliers by using fiber light guides. Switching from working mode of the photometer to calibrations is made automatically. The time taking for channel reduction is about 2 min., an accuracy of the calibration coefficient

is about 0.02 %, that inserts the error less than  $0.^m0002$  in resulting data.

Dual channel mode is useful not only for improvement of accuracy: many times we could test and verify the parameters of low amplitudes' variability comparing the data from both independent channels. Particularly dual channel observations were to the point when we participated in the Program Russian Ministry of Science "Monitoring of Unique Astrophysical Objects". At the night 28/29 Oct. 1995 the great unusual outburst of X-ray pulsar A0535+26 was detected (see Dorokhov & Dorokhova, 1996b). The outburst consisted of a great number of transitory individual pulses, an amplitude of single pulse at the maximum of the outburst's intensity amounted to  $1^m.73$ . The specialists were in doubt to explain the phenomena and proposed its instrumental origin. But the dual channel observations were satisfied very much: a comparison star was observed permanently in the second channel and twice for 5-7 min in the first channel during the event with a mean square error about  $0.^m0005$  due to exclusively stable sky transparency at that night.

Separately it should be mentioned a split prism which may be adapted for simultaneous observations of the star in different spectral regions. We used the prism for roAp stars observations in B and R filters (Dorokhov & Dorokhova, 1996a) and for research of the behavior of TiO spots in the red stars (Komarov et al., 1998) with a narrow band interferometric filter centered on TiO-band (Johnson V filter was in the second channel). We planned observations with using series of narrow band interferometric filters. Unfortunately this project has not been realized yet because of financial difficulties.

The dual-channel mode is very suitable, but in the cases, when comparison star is outside the field of view, the well-known three-star mode (Breger & Handler, 1993) are adapted for accurate observations. Now we have just begun to construct the device for automatic moving of the telescope on three-star program. The cycle of observations Sb-C1-V-C2-Sb may be fulfilled in 5 minutes.

This way the general trends of scientific researches came into view:

- the searches and investigations of roAp (rapidly oscillating) Ap stars (Dorokhova, 1998);
- variability of low amplitudes'  $\delta$  Scuti and  $\lambda$  Booti stars (Dorokhova & Dorokhov, 1996; Dorokhova et al., 1998);
- close binary systems (Andronov et al., 1995; Dorokhov & Dorokhova, 1996b);
- variability in the spots of cool stars (Komarov et al., 1996).

Besides the station participated and further can participate in international program of asteroids' security and in new investigations of Solar system by means of photometric observations of eclipses and occultations of large planets' satellites (see, Emelianov, 1997).

An important aspect of cooperation with Turkmenian colleagues should be noted. A mutual assistance is absolutely valuable in hard economical situation in our countries.

Unfortunately the station does not work a significant part of the year due to lack of state financial support. We use any opportunity to continue observations and we are ready to cooperate with other investigators. Welcome to the Mt. Dushak-Erekdag!

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