COMMISSIONS 27 AND 42 OF THE IAU
INFORMATION BULLETIN ON VARIABLE STARS

Number 4156

Konkoly Observatory
Budapest
3 February 1995

HU ISSN 0374 – 0676

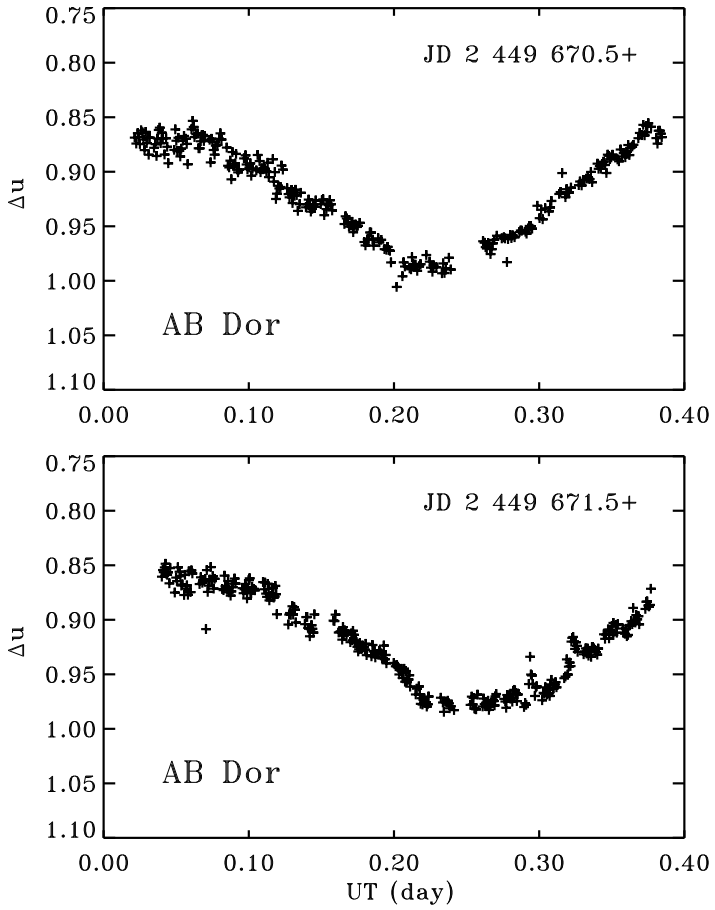
U-FILTER PHOTOMETRY OF AB DORADUS

AB Doradus (HD 36705) is a rapidly-rotating (0.515 day), late-type star (K0-2 IV-V) in the solar neighborhood, at a distance of about 25 pc. The rapid rotation is due to its youth, as indicated by the presence of strong lithium absorption (Rucinski 1985). The star apparently belongs to the Pleiades moving group (Innis et al. 1986). It is a very active star, one of the most active presently known. Several investigations of different aspects of its activity have been cited in papers by Vilhu et al. (1987, 1993) and by Lim et al. (1992)

The great importance of this star resulted in the award of a substantial amount of observing time of the Space Telescope for spectral monitoring of selected UV spectral regions with the Goddard High Resolution Spectrograph. The two adjacent HST programs, conducted on 14 – 15 November 1994 were led by the Principal Investigators F. Walter and O. Vilhu. In addition, simultaneous optical spectroscopy was obtained from CTIO, as were simultaneous observations with the EUVE and ROSAT. The present note describes photometric support monitoring of AB Dor performed on two nights, 13/14 and 14/15 November 1994 with the Helen Sawyer Hogg 61 cm telescope of the University of Toronto at Las Campanas. These observations were meant as a check of the star's flaring activity. Also, since X-ray and EUV satellites have relatively low spatial resolution, possible flares of the optical companion of AB Dor, Rst 137B, could contaminate the high-energy data. Our observations could be used to monitor and detect strong flares of Rst 137B.

The photometric monitoring was done with a CCD camera (Photometrics, 512×512 pixels, $0\farcs45$ per pixel) and with a fixed U-band filter of the UBV set. The exposures of the variable were 15 seconds long and they were done in as rapid succession as was practicable given the relatively long readout time. The effective sampling was thus typically one frame per minute. The UT time was recorded manually with an uncertainty of about 2 – 3 seconds. Every 15 minutes the comparison star HD 37297 was observed. The photometric data have been extracted from the CCD images using simple aperture photometry. The final results are in instrumental magnitude differences Δu, in the sense AB Dor *minus* HD 37297. In addition to AB Dor, several observations of the second comparison, HD 35474, were obtained each night. They gave the mean differences Δu between the two comparison stars, HD 35474 − HD 37297, equal to 0.764 ± 0.012 and 0.783 ± 0.008 for each night, respectively.

The results for AB Dor are displayed in graphical form as a function of the heliocentric Universal Time (expressed in fraction of Julian Day) in the accompanying figure. The basic results are:



The U-filter differential light curves of AB Dor obtained on nights 13/14 and 14/15 November 1994 at Las Campanas.

1. A well defined spot modulation with $\Delta U \simeq 0.12$ was observed over basically the same rotation-phase window (about 3/4 of full rotation) on both nights. The wave minima were located approximately at JD 2 449 670.72 and JD 2 449 671.76.

2. The minima correspond to phase 0.5 of the ephemeris given by Innis et al. (1988): JD(min) = 2444296.575 + 0.51479×E. Minima placed at that phase could be explained by a feature designated Spot B by Innis et al.

3. Assuming that $U = 7.22$ for HD 37297 (Cutispoto & Rodonó 1988), and that our instrumental system U is the same as the standard one (which we cannot confirm), we observed variability of AB Dor between approximately $8.08 < U < 8.20$. Assuming further that AB Dor has typically $U - V \simeq 1.20$, the corresponding visual range was $6.88 < V < 7.00$. This would indicate that the star is still faint and that a brightening trend of the spot cycle, whose first signs were reported by Anders (1994), has not yet fully taken place.

4. No flare activity of any importance was noted. During the second night, low-level activity might have been present during the ascending branch of the spot wave.

5. The visual companion of AB Dor was not observed in any of the CCD images. Because our system had low sensitivity in U and exposures were short, the detection limit for Rst 137B was at relatively high brightness, about $5-6$ magnitudes below that of AB Dor, i.e. at about $U \simeq 13-14$. Rst 137B is a faint ($V \simeq 13$) M2–4 dwarf (Vilhu et al. 1989) with unknown, probably very low brightness in ultraviolet. Thus, we could detect only the largest flares from this star.

The tabular data with our observations of AB Dor is available from the authors at the following e-mail addresses: *rucinski@astro.utoronto.ca* or *garrison@astro.utoronto.ca*.

This research has been supported by the Natural Sciences and Engineering Research Council of Canada through operating grants to Garrison and Rucinski.

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