

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

Number 3936

Konkoly Observatory
Budapest
14 September 1993
HU ISSN 0324 - 0676

**SPOT PHOTOMETRY OF AD Leo
IN 1992 AND 1993**

AD Leo (Gliese 388, dM4.5e) is a well known flare star. A magnetic field of 3800 G was found by Saar and Linsky (1985). Rotational modulation of light of the quiet star with a period of 2.7 was revealed by Spiesman and Hawley (1986), probably due to starspots. However, the amplitude in the visual band was found to be only ~ 0.02 mag. Clearly, this result needs an independent confirmation.

In an attempt to confirm the spot modulation of light and the rotational period, spot photometry of AD Leo was carried out in 1992 and 1993 at the Bulgarian National Astronomical Observatory with the 60 cm telescope and the UBV photon-counting, computer controlled photometer. HD 89471 was the comparison star and BD+20°2475 served as a check. Table I contains the observations in the filters V and B as differential magnitudes: HD 89471-AD Leo. Differential observations were taken also in the U-filter, but only for the purpose of having an indication for flare activity during the time of spot photometry. The observations were taken with 10s integration and each individual observation (comparison-variable-comparison) was the mean of 4 consecutive integrations. The nightly mean points (data in Table I) were then obtained from 3-5 individual observations.

The light curves, plotted with the 2.7 day period, are shown in Figure 1 and Figure 2 for 1992 and 1993, respectively. The epoch was set at JD 2449099.498 (minimum light, i.e. maximum spot visibility), to calculate the phases. The amplitudes of the spot modulation in 1992 were ~ 0.02 mag, but they appear larger in 1993: ~ 0.04 mag in the visual and ~ 0.06 mag in the B filter. The observational errors can be estimated from the check star observations in 1992: $\sigma=0.003$ mag. Therefore, the amplitude of the spot modulation of AD Leo in 1992 was only marginal. In 1993 the check star BD+20°2475 exhibited light variability of the order of several percent (the reason is yet unknown) and an estimate of errors from that star was not possible. From the differential photometry of AD Leo in 1993 the errors are usually 0.005-0.008 mag. The light curves in 1993 look generally better, but there are some deviating points. Flare activity seems to affect the observations at three phases: 0.43 and 0.46 in 1992, and 0.41 in 1993. The point at phase 0.46 was not plotted because of its strong blue shift. For the other two phases (0.43 and 0.41), only the B-filter values (but not the V-filter) seem to be affected by flares.

Generally, these observations seem to support the 2.7 period, but the amplitudes of spot modulation are near the detection limit. No search for other possible periods has been done. The variation of colour $\Delta(B-V)$ in 1993 with an amplitude of ~ 0.03 mag also seems to support the spot hypothesis: the star is redder, when fainter. Apparently, the small amplitudes of rotational modulation so far observed result from the small inclination of the rotational axis to the line of sight: 38° , according to Pettersen, Coleman, and Evans (1984). Recent study of Marcy and Chen (1992) confirms this result ($33^\circ < i < 44^\circ$), provided that the 2.7 rotational period is real.

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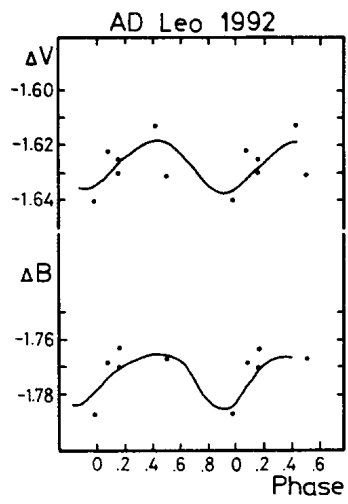


Figure 1

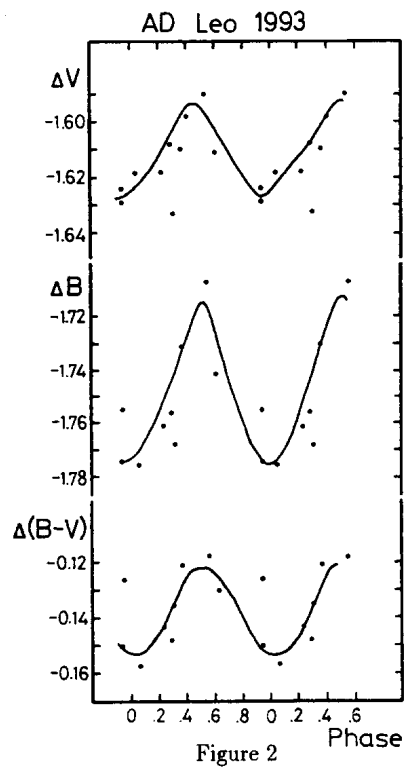


Figure 2

Table I
Differential observations: HD 89471–AD Leo

| JD 2400000+ | Phase | ΔV | ΔB | $\Delta(B-V)$ |
|-------------|-------|------------|------------|---------------|
| 1992 | | | | |
| 48662.543 | 0.16 | -1.630 | -1.770 | -0.140 |
| 48663.459 | 0.50 | -1.631 | -1.767 | -0.136 |
| 48679.469 | 0.43 | -1.613 | - | flare? |
| 48694.455 | 0.98 | -1.640 | -1.787 | -0.147 |
| 48716.320 | 0.08 | -1.622 | -1.768 | -0.146 |
| 48717.329 | 0.46 | -1.583 | -1.708 | flare? |
| 48754.321 | 0.16 | -1.625 | -1.763 | -0.138 |
| 1993 | | | | |
| 49018.393 | 0.96 | -1.624 | -1.774 | -0.150 |
| 49019.364 | 0.32 | -1.633 | -1.768 | -0.135 |
| 49038.422 | 0.38 | -1.610 | -1.731 | -0.121 |
| 49062.343 | 0.24 | -1.618 | -1.761 | -0.143 |
| 49063.385 | 0.62 | -1.611 | -1.741 | -0.130 |
| 49098.327 | 0.57 | -1.590 | -1.708 | -0.118 |
| 49099.390 | 0.96 | -1.629 | -1.755 | -0.126 |
| 49100.317 | 0.30 | -1.608 | -1.756 | -0.148 |
| 49102.328 | 0.05 | -1.618 | -1.775 | -0.157 |
| 49103.309 | 0.41 | -1.598 | - | flare? |

This study was supported by the Bulgarian Ministry of Education and Science with grant F-108.

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