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PHOTOELECTRIC OBSERVATIONS OF THE FLARE STAR BY Dra IN 1973, 1974

Continuous photoelectric monitoring of the flare star BY Dra has been carried out at the Stephanion Observatory ( $\lambda = -22^{\circ}49'44''$ ,  $\varphi = +37^{\circ}45'15''$ ) during the years 1973, 1974 using the 30-inch Cassegrain reflector of the Department of Geodetic Astronomy, University of Thessaloniki. Observations have been made with a Johnson dual channel photoelectric photometer in the B colour of the international UBV system. The telescope and photometer will be described elsewhere. Here we mention only that the transformation of our instrumental ubv system to the international UBV system is given by the following equations:

$$\begin{aligned}V &= v_0 + 0.053(b-v)_0 + 2.380, \\B - V &= 0.858 + 1.043(b-v)_0, \\U - B &= -1.782 + 1.020(u-b)_0.\end{aligned}$$

The monitoring intervals in UT as well as the total monitoring time for each night are given in the Tables Ia, Ib. Any interruption of more than one minute has been noted. In the fourth column of Tables Ia, Ib the standard deviation of random noise fluctuation  $\sigma(\text{mag}) = 2.5 \log(I_0 + \sigma)/I_0$  for different times (UT) of the corresponding monitoring interval is given.

During the 60.63 hours of monitoring time 2 flares were observed the characteristics of which are given in Table II. For each flare following characteristics (Andrews et al. 1969) are given: a) the date and universal time of flare maximum ( $t_b$  and  $t_a$ , respectively), as well as the total duration of the flare, c) the value of the ratio  $(I_f - I_0)/I_0$  corresponding to flare maximum, where  $I_0$  is the intensity deflection less sky background of the quiet star and  $I_f$  is the total intensity deflection less sky background of the star plus flare, d) the integrated intensity of the flare over its total duration, including pre-flares, if present,  $p = \int (I_f - I_0)/I_0 dt$ , e) the increase of the apparent magnitude of the star at flare maximum  $\Delta m(b) = 2.5 \log(I_f/I_0)$ , where b is the blue

magnitude of the star in the instrumental system, f) the standard deviation of random noise fluctuation  $\sigma(\text{mag}) = 2.5 \log(I_0 + \sigma)/I_0$  during the quiet - state phase immediately preceding the beginning of the flare and g) the air mass at flare maximum. The light curves of the observed flares in the b colour are shown in Figs 1,2.

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References:

Andrews, A.D., Chugainov, P.F., Gershberg, R.E. and Oskanian, V.S.:  
I.B.V.S. No. 326, 1969

Table Ia

Date	Monitoring interval (U.T.)	Total Monitoring Time	$\sigma$ (U.T.)
1973			
May			
19	21 <sup>h</sup> 19 <sup>m</sup> - 21 <sup>h</sup> 51 <sup>m</sup> , 22 <sup>h</sup> 04 <sup>m</sup> - 22 <sup>h</sup> 17 <sup>m</sup> , 22 <sup>h</sup> 19 <sup>m</sup> - 22 <sup>h</sup> 29 <sup>m</sup> , 23 02 - 23 08, 23 11 - 23 22, 23 30 - 23 42, 23 46 - 23 54, 23 59 - 24 00 .	1 <sup>h</sup> 23 <sup>m</sup>	0.01(21 <sup>h</sup> 49 <sup>m</sup> ), 0.01(22 <sup>h</sup> 20 <sup>m</sup> ), 0.01(23 20), 0.01(23 31)
20	00 02 - 00 05, 00 08 - 00 15, 00 21 - 00 42, 21 32 - 21 39, 21 40 - 21 51, 21 54 - 22 04, 22 06 - 22 07, 22 10 - 22 22, 22 25 - 22 48, 22 50 - 22 52, 22 56 - 23 06, 23 08 - 23 19, 23 21 - 23 31, 23 32 - 23 44, 23 45 - 23 51, 23 59 - 24 00 .	31	0.01(00 22) 0.02(21 41), 0.02(22 35), 0.01(23 23).
25	00 00 - 00 09, 00 10 - 00 23, 00 24 - 00 35, 01 33 - 01 47 .	1 56	0.01(00 29), 0.01(01 45), 47
30	20 51 - 21 04, 21 08 - 21 38, 21 40 - 22 17, 22 27 - 22 59, 23 04 - 23 14, 23 16 - 23 27, 23 29 - 23 39, 23 42 - 24 00 .	2 41	0.01(20 54), 0.01(21 25), 0.01(21 52), 0.01(22 34), 0.01(23 31), 0.01(23 54).
31	00 00 - 00 04, 00 08 - 00 17, 01 34 - 01 43 .	22	0.01(01 35).
June			
2	22 04 - 22 17, 22 19 - 22 31, 22 34 - 22 58, 23 02 - 23 13, 23 15 - 23 26, 23 28 - 23 31, 23 40 - 24 00 .	1 34	0.01(22 20), 0.01(22 48), 0.01(23 16), 0.01(23 54).

Table Ia (Continued)

June	00 <sup>h</sup> 00 <sup>m</sup> - 00 <sup>h</sup> 03 <sup>m</sup> , 00 <sup>h</sup> 05 <sup>m</sup> , 00 <sup>h</sup> 07 <sup>m</sup> , 01 <sup>h</sup> 11 <sup>m</sup> - 01 <sup>h</sup> 19 <sup>m</sup> , 01 22 - 01 31, 01 32 - 01 39 .	29 <sup>m</sup>	0.01(01 34 <sup>m</sup> )
3	00 <sup>h</sup> 00 <sup>m</sup> - 00 <sup>h</sup> 03 <sup>m</sup> , 00 <sup>h</sup> 05 <sup>m</sup> , 00 <sup>h</sup> 07 <sup>m</sup> , 01 <sup>h</sup> 11 <sup>m</sup> - 01 <sup>h</sup> 19 <sup>m</sup> , 01 22 - 01 31, 01 32 - 01 39 .		
9	19 52 - 20 04, 20 07 - 20 19, 20 23 - 20 38, 20 41 - 20 48, 20 50 - 21 05, 21 07 - 21 19, 21 28 - 21 35, 21 37 - 21 49, 21 51 - 21 59, 22 03 - 22 14, 22 17 - 22 27, 22 31 - 22 39, 22 40 - 22 47, 22 49 - 22 58, 23 04 - 24 00 .	2 31	0.011(20 12), 0.010(20 31), 0.008(21 10), 0.008(21 42), 0.008(22 19), 0.006(22 35)
10	00 00 - 00 04, 00 06 - 00 14, 00 16 - 00 24, 00 29 - 00 35, 00 37 - 00 45, 00 47 - 00 54, 19 51 - 20 06, 20 08 - 20 16, 20 19 - 20 25, 20 26 - 20 41, 20 43 - 20 47, 20 51 - 21 03, 21 06 - 21 16, 21 27 - 21 37, 21 39 - 21 46, 21 48 - 21 57, 22 01 - 22 07, 22 09 - 22 21, 22 23 - 22 26, 22 30 - 22 39, 22 41 - 22 59V.		0.006(00 08), 0.006(00 48), 0.009(20 03), 0.006(20 37), 0.006(20 57), 0.006(21 39), 0.006(22 11), 0.006(22 35).
11	00 42 - 00 51, 00 53 - 01 02, 01 04 - 01 11, 01 13 - 01 21, 20 20 - 20 34, 20 36 - 20 50, 20 53 - 21 07, 21 10 - 21 24, 21 28 - 21 40, 21 44 - 21 56, 22 06 - 22 19, 22 21 - 22 33, 22 39 - 22 49, 22 53 - 23 03, 23 06 - 23 10, 23 13 - 23 19, 23 20 - 23 29, 23 32 - 23 40 .	3 05	0.006(01 05), 0.007(20 38), 0.008(21 14), 0.007(21 48), 0.006(22 24), 0.007(22 55), 0.005(23 24).
12	01 22 - 01 30, 01 33 - 01 42 .	17	0.005(01 28)
13	20 29 - 20 43, 20 45 - 20 59, 21 04 - 21 14, 21 16 - 21 23, 21 25 - 21 29, 21 32 - 21 46, 21 48 - 22 00, 22 09 - 22 13, 22 19 - 22 29, 22 32 - 22 36, 22 40 - 22 50, 22 54 - 23 04, 23 09 - 23 18, 23 21 - 23 30, 23 33 - 23 37 .	2 15	0.008(20 48), 0.006(21 11), 0.009(21 53), 0.006(22 21), 0.006(22 43), 0.008(23 22),



Table Ib

Date	Monitoring interval (U.T.)	Total Monitoring Time	$\sigma$ (U.T.)
1974			
July			
6	21 <sup>h</sup> 08 <sup>m</sup> - 21 <sup>h</sup> 36 <sup>m</sup> , 21 <sup>h</sup> 38 <sup>m</sup> - 22 <sup>h</sup> 06 <sup>m</sup> , 22 <sup>h</sup> 08 <sup>m</sup> - 22 <sup>h</sup> 18 <sup>m</sup> , 23 02 - 23 32, 23 47 - 24 00 .	1 <sup>h</sup> 49	0.01(21 <sup>h</sup> 27 <sup>m</sup> ), 0.01(21 <sup>h</sup> 46), 0.01(23 05 ), 0.01(23 50).
7	00 00 - 00 18, 00 21 - 00 44	41	0.01(00 34).
10	20 08 - 20 38, 20 41 - 21 03, 21 07 - 21 11, 21 14 - 21 26, 21 30 - 21 32, 21 33 - 21 35, 21 39 - 21 48 .	1 21	0.01(20 23 ), 0.01(20 59), 0.01(21 19 ).
11	20 21 - 20 50, 20 53 - 21 19, 21 26 - 21 41, 21 44 - 21 55 .	1 21	0.01(20 31 ), 0.01(20 57), 0.01(21 33 ).
14	20 42 - 21 07, 21 09 - 21 48, 22 13 - 22 28, 22 31 - 22 44, 23 50 - 24 00 .	1 42	0.01(20 50 ), 0.01(21 20), 0.01(22 32 ).
15	00 00 - 00 25, 00 27 - 01 02, 22 37 - 23 09, 23 13 - 23 18, 23 33 - 23 48, 23 50 - 34 00 .	2 02	0.01(00 04), 0.01(00 39), 0.01(23 03 ), 0.01(23 35), 0.01(23 51).
16	00 00 - 00 26, 00 31 - 00 37, 20 23 - 20 44, 20 50 - 20 54, 20 57 - 21 32, 21 35 - 21 51, 22 00 - 22 07 .	1 55	0.01(00 33 ), 0.01(20 38), 0.01(21 28), 0.01(21 37).
17	20 05 - 20 33, 20 37 - 21 10, 21 13 - 21 36, 21 38 - 21 41 .	1 27	0.01(20 11), 0.01(21 03), 0.01(21 17).
19	20 22 - 20 53, 20 56 - 21 14, 21 18 - 21 24, 21 28 - 21 48, 21 53 - 21 59 .	1 21	0.01(20 44), 0.01(20 59), 0.01(21 39).
August			
6	20 10 - 20 39, 20 42 - 21 15, 21 17 - 21 37, 21 53 - 22 19, 22 21 - 22 49, 22 52 - 23 20, 23 32 - 23 55 .	3 07	0.005(20 21 ), 0.004(20 44), 0.005(21 19 ), 0.005(22 04), 0.008(22 42), 0.007(23 02 ), 0.008(23 49).

T a b l e I b (Continued)

August					
7	00 <sup>h</sup> 02 <sup>m</sup> - 00 <sup>h</sup> 29 <sup>m</sup> , 00 <sup>h</sup> 33 <sup>m</sup> - 01 <sup>h</sup> 00, 19 <sup>h</sup> 52 <sup>m</sup> - 20 <sup>h</sup> 25 <sup>m</sup> ,			0.008(00 05), 0.007(00 35), 0.007(20 17),	
	21 17 - 21 49	1.42		0.006(21 21).	
		Total	18 <sup>h</sup> 35 <sup>m</sup>		

T a b l e I I  
Characteristics of the Flares Observed

Flare No.	Date	U.T. max.	t <sub>b</sub> min.	t <sub>a</sub> min.	Duration min.	(I <sub>f</sub> -I <sub>o</sub> )/I <sub>o</sub> max.	P min.	Δm mag.	σ mag.	Air mass.
1	10	20 <sup>h</sup> 12 <sup>m</sup> 22 <sup>s</sup>	0.8	1.3	2.1	0.025	0.012	0.027	0.005	1.08
2	14	22 14.2	0.6	13.3	13.9	0.310	0.720	0.300	0.010	1.04

