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PHOTOELECTRIC OBSERVATIONS OF THE FLARE STAR EV Lac IN 1982

Photoelectric observations of flare stars have been continued at the National Astronomical Observatory of the Bulgarian Academy of Sciences and the Stephanion Observatory, Greece. In this paper we report about joint observations of the flare star EV Lac in 1982.

At the National Astronomical Observatory the observations were made with the 60 cm Cassegrain telescope and the UBV one-channel photometer. A photon counting system with an integration time of 1 sec was used. Details of the photometric equipment at NAO are published by Panov et al. (1982).

The transformation of the instrumental ubv system at NAO to the international UBV system for the time under consideration is given by the equations:

$$\Delta V = \Delta v + 0.08\ \Delta(b-v)$$
$$\Delta(B-V) = 1.12\ \Delta(b-v)$$
$$\Delta(U-B) = 0.84\ \Delta(u-b)$$

At the Stephanion Observatory the observations were carried out with the 30-inch Cassegrain reflector of the Department of Geodesy and Surveying, University of Thessaloniki, and a Johnson dual channel photoelectric photometer. The transformation of the Stephanion ubv system to the international UBV system for the period under consideration is given by the equations:

$$V = v_o - 0.011(b-v)_o + 3.288$$
$$B-V = 0.597 + 1.010(b-v)_o$$
$$U-B = -1.899 + 1.031(u-b)_o$$

Table I contains, for each night, the monitoring intervals in UT, the colour in which observations were made, the number of flares observed, the standard deviation of random noise fluctuations in mag for those nights, in which no flare was observed, and the total monitoring time. Designation NAO or Steph.O. stands for the National Astronomical Observatory or Stephanion

Table I

Flare star EV Lac, 1982

Date	Monitoring intervals (UT)	Total monit. time	Number of flares	Colour	NAO/ Steph.O.
1982 Aug.					
19/20	$23^h51^m34^s$-$23^h57^m30^s$,				
	23 58 41 -00 48 36 ,				
	00 49 25 -00 58 50 .	$1^h05^m16^s$	2	U	NAO
20/21	22 45 14 -00 20 18 ,				
	00 21 44 -00 38 15 ,				
	00 39 31 -00 51 35 ,				
	00 52 41 -01 05 41 ,				
	01 06 37 -01 33 56 ,				
	01 35 08 -01 49 51 ,				
	01 52 26 -01 58 01 .	3 04 16	3	U	NAO
Sep.					
2/3	22 16 39 -22 43 02 ,				
	22 43 58 -23 30 26 ,		0		
	23 31 22 -01 09 24 .	2 50 53	σ=0.16	U	NAO
Oct.					
8	20 11 12 -22 36 41 ,				
	22 37 53 -22 56 04 ,		0		
	22 57 16 -23 14 46 .	3 01 10	σ=0.05	U	NAO
23	19 14 00 -19 24 12 ,				
	19 32 22 -20 00 31 ,				
	20 02 24 -21 27 53 ,				
	21 31 00 -23 00 00 ,				
	23 02 36 -23 20 55 .	3 51 09	2	B	Steph.O.
24	19 15 34 -20 40 00 ,				
	20 41 24 -21 06 30 ,		0		
	21 10 30 -22 29 38 .	3 08 40	σ=0.02	B	Steph.O.
25	18 21 00 -18 44 14 ,				
	18 47 22 -20 19 43 ,				
	20 22 00 -21 12 30 .	2 46 05	1	B	Steph.O.
Nov.					
8	19 11 09 -20 43 33 ,				
	20 44 40 -21 06 11 .	1 53 55	2	U	NAO
13	17 03 15 -17 11 56 ,				
	17 15 01 -18 57 24 ,				
	19 20 47 -20 03 29 .	2 33 46	2	U	NAO
	Total:	$24^h15^m10^s$			

Observatory, respectively.

During the total of $14^h29^m16^s$ monitoring time in "u" colour (NAO) 9 flares were observed. During the total of $9^h45^m54^s$ monitoring time in "b" colour (Steph.O.) 3 flares were observed. All observations of EV Lac (at NAO and Steph.O.) include also the optical companion.

The characteristics of the observed flares are given in Table II.

Table II

Characteristics of the flares observed

Flare No.	Date 1982	U.T. max	t_b min	t_a min	Duration min	I_f/I_o max	Δm mag	σ mag	p min	Air mass
				N A O						
	August									
1	20^d	$0^h20^m16^s$	0.1	0.6	0.7	1.38	0.35	0.08	0.13	1.021
2	20	0 25 08	0.4	0.9	1.3	1.70	0.57	0.08	0.46	1.025
3	20	23 31 25	0.25	0.58	0.83	1.24	0.23	0.06	0.10	1.003
4	21	01 27 47	0.05	0.22	0.27	1.55	0.48	0.06	0.07	1.104
5	21	01 28 57	0.28	1.0	1.3	1.51	0.45	0.06	0.26	1.105
	November									
6	8	19 40 29	0.23	0.52	0.75	1.20	0.19	0.04	0.06	1.058
7	8	19 47 10	0.17	2.8	3.0	1.22	0.22	0.04	0.33	1.067
8	13	17 59 10	0.58	1.9	2.5	1.19	0.19	0.05	0.17	1.004
9	13	19 58 45	0.17	0.8	1.0	1.51	0.45	0.05	0.17	1.112
				Stephanion Observatory						
	October									
1	23	21 21 26	0.55	1.23	1.8	1.20	0.20	0.02	0.18	1.117
2	23	22 56 48	0.2	0.8	1.0	1.17	0.17	0.03	0.08	1.380
3	25	18 34 50	1.95	0.83	2.8	1.83	0.66	0.07	0.76	1.007

For each flare following characteristics (Andrews et al., 1969) are given:

a. the date and universal time of maximum,

b. the duration before and after maximum (t_b and t_a, respectively),

c. the total duration of the flare,

d. the value of the ratio I_f/I_o, corresponding to flare maximum, where I_f is the total intensity of the star plus flare less sky background, and I_o is the quiet state intensity less sky background,

e. the increase of star's brightness in magnitudes at flare maximum:

$$\Delta m = 2.5 \log(I_f/I_o)$$

f. the standard deviation of random noise fluctuations in mag:

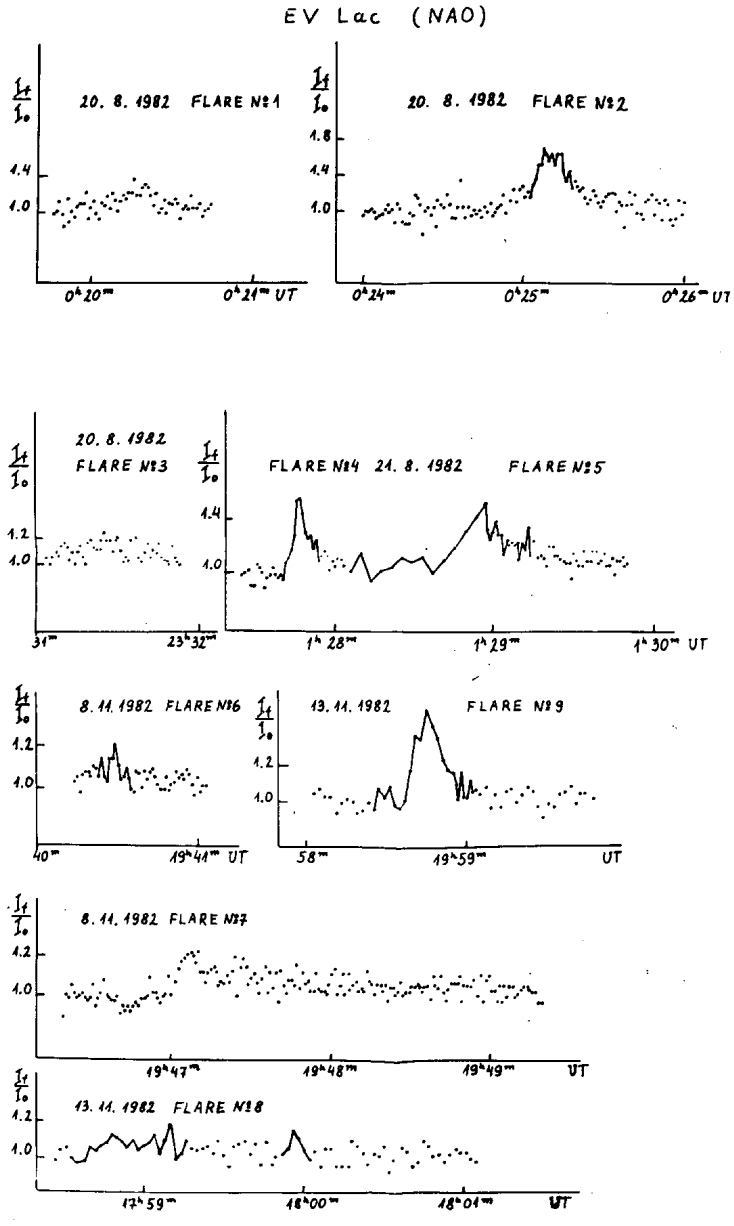
$$\sigma(\text{mag}) = 2.5 \log \frac{I_o + \sigma}{I_o} ,$$

g. the integrated intensity of the flare over its total duration:

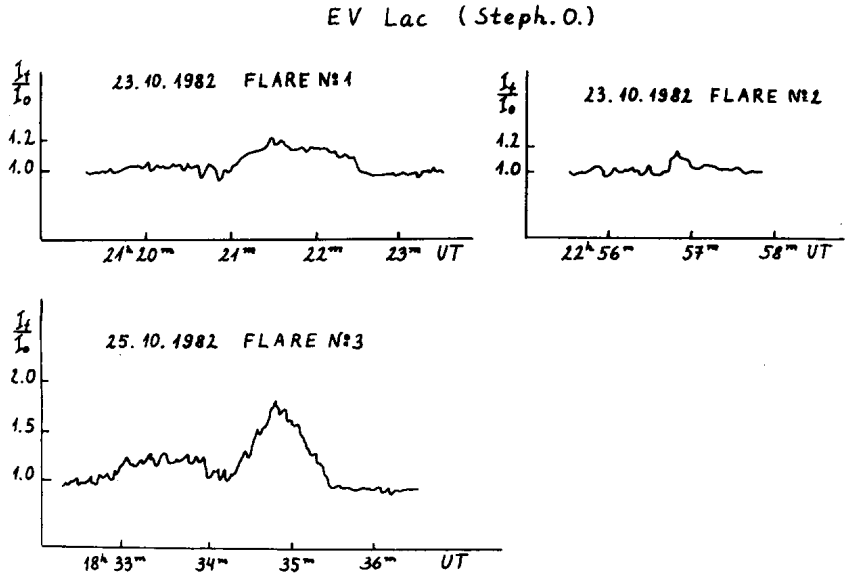
$$p = \int (I_f - I_o)/I_o \, dt ,$$

h. the air mass.

The light curves of the observed flares in colours "u" (NAO) and "b" (Steph.O.) are shown in Figures 1-12.



Figures 1 - 9



Figures 10 - 12

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K.P. PANOV

Department of Astronomy with
National Astronomical Observatory
Bulgarian Academy of Sciences
Sofia-1000, 7th November Str. No.1
Bulgaria

G. ASTERIADIS

L.N. MAVRIDIS

Department of Geodesy and Surveying
University of Thessaloniki
Thessaloniki, Greece

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