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NEW AND NEGLECTED VARIABLES IN THE CEPHEUS OB 2 ASSOCIATION

An objective prism search for H α emission stars in the region of IC 1396 was begun at Konkoly Observatory in 1980 in order to find the possible low mass members of the association Cep OB 2. The first results of this survey are already published (Kun, 1986). Further emission stars were detected on four plates taken in 1985-86. Among them there are four stars which were found to be variable by Gieseeking (1976). A photographic UB V photometry of the H α emission stars led to the discovery of five new variable stars. Their coordinates for 1950, V magnitudes at three different epochs, B-V and in some cases U-B colour indices are given in Table I. Identification charts are presented in Fig. 1.

The photometric plates were obtained with the 60/90/180 cm Schmidt telescope of Konkoly Observatory. The variability of the stars was established from six plates taken on three nights (27/28 June 1968, 20/21 Oct 1985 and 13/14 Sept 1986). The photographic magnitude scale was calibrated using Lichtbuer's (1982) photoelectric sequence. The mean internal error of the magnitudes derived as averages from six plates is about 0.1 mag. A star is regarded here variable if the rms scatter of its magnitude averaged from six plates exceeds $0^m.4$. The Julian dates given in Table I are the means of the beginning of the first exposure and the end of the second exposure of the given night. The magnitudes listed at a given JD are averages of two plates. B-V, and where the brightness of the star made it possible, U-B colour indices were also derived from two plates in each colour taken on the same night (20/21 Oct 1985).

We extended the photometry for some already known variable and extremely red stars situated within our field which is of five degrees in diameter and is centred on HD 206267, the exciting star of IC 1396, because there is very scarce information in the literature for these stars. These stars are as follows:

a) DZ, GL and GM Cep, probable Orion-variables. Their light variations have been investigated photographically by Suyarkova (1975) and Albo (1979a,b). DZ and GM Cep show H α emission on our objective prism plates.

Table I

N	R.A.(1950)	D(1950)	JD 2400000+				
			39035.5 V	46359.4 V	B-V	U-B	46691.5 V
1	21 ^h 27 ^m 10 ^s .0	+58°06'00"	15.33	15.94	2.76		16.19
2	21 31 47.4	+57 34 52	16.28	15.10	2.23	0.14	14.95
3	21 37 9.2	+57 16 53	16.47	14.22	2.44	1.16	15.55
4	21 48 5.8	+56 32 34	13.18	14.38	0.96	1.03	14.22
5	21 49 9.0	+55 57 6	13.80	14.22	1.15	0.04	13.29

Notes to Table I:

1. Star No.20 from Dorschner et al. (1973)
3. Star No.80 from Kun (1986)
- 4,5. Stars 21-040 and 21-041 from Dolidze (1975), respectively

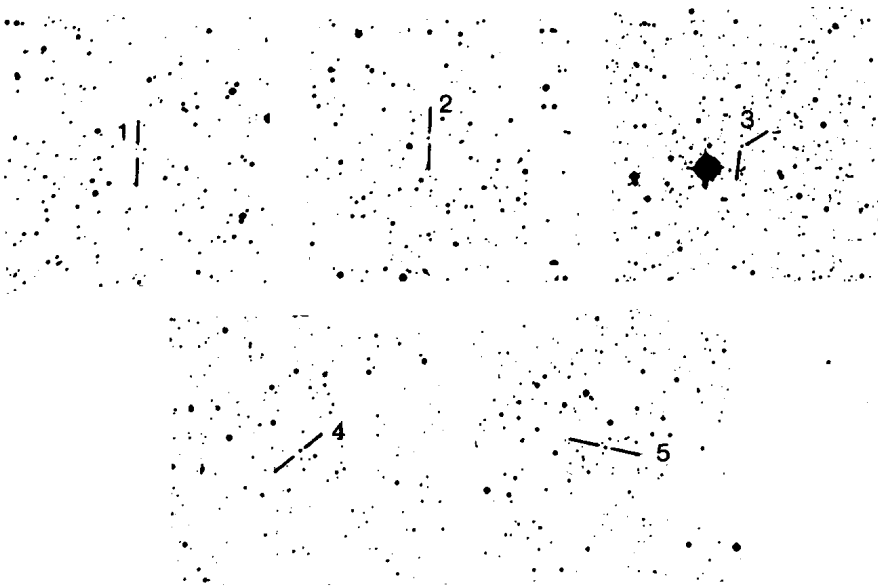


Figure 1. North is at the top and east is to the left. $10''=4\text{cm}$.

b) Red variables, which, because of their colour and large amplitude are regarded as possible Miras. They are as follows:

- V 345 Cep which was listed as an extremely red star by Dorschner et al. (1973). Its light variation was discovered by Friedemann et al. (1977).
- V 346, V 347, V 348 and V 349 Cep, red variables found by Pfau and Friedemann (1980).
- Stars C, D and E from a list of red variables by Friedemann et al. (1977), later designated as IV 19, 20 and 21 by Pfau and Friedemann (1980).

Table II

Name	JD 2400000+				V	Remark
	39035.5 V	46359.4 V	B-V	U-B		
GL Cep	11.34	11.38	2.37		11.57	
GM Cep	12.87	14.30	3.01		15.02	Ha emission
DZ Cep	13.63	14.30	1.21	0.67	13.93	Ha emission
V 345 Cep	12.22	13.73	4.34		14.86	
V 346 Cep	14.07	13.91	2.76		14.56	
V 347 Cep	15.80	12.58	3.17	0.88	15.62	Giesecking 11
V 348 Cep	14.55	14.52	1.67		14.42	
JV 19	16.43	15.93	4.06		16.71	
JV 20	—	17:	2.8:		14.13	
JV 21	—	16.9	1.9		16.8	
Giesecking 6	15.25	15.03	1.87		14.86	
Giesecking 15	13.20	13.56	1.21		13.38	
Giesecking 17	15.18	15.39	0.66	0.56	15.42	Ha emission
Giesecking 18	15.18	15.57	1.09	0.45	16.17	Ha emission
Giesecking 19	14.75	16.70	2.15	-0.09	15.68	CSV 8684
Giesecking 20	15.39	15.07	1.02		15.68	Ha emission
Giesecking 23	—	16.0	1.04		15.68	
Giesecking 24	15.10	15.45	0.52	0.50	15.13	Ha emission
Dorschner 21	14.68	14.32	4.87		14.57	
Dorschner 22	15.35	14.75	4.42		15.16	
Dorschner 23	15.75	15.70	1.33		15.68	
Dorschner 24	12.51	12.39	3.36		12.17	
Dorschner 25	16.10	16.00	2.30		16.28	

Table III

IRAS source		Associated object		
R.A.(1950)	D(1950)	R.A.(1950)	D(1950)	
21 ^h 24 ^m 58 ^s .7	+57°54'01"	21 ^h 24 ^m 59 ^s .0	+57°54'	V 346 Cep
21 28 2.2	+57 46 12	21 28 6.0	+57 46 12"	V 347 Cep
21 28 54.5	+55 14 18.9	21 28 55	+55 14	JV 19
21 30 45.5	+56 13 16.0	21 30 46	+56 14	JV 20
21 31 47.6	+57 34 52.0	21 31 47.4	+57 34 51.7	No. 2
21 32 56.2	+56 47 36	21 32 59	+56 48	Dorschner 24
21 33 47.2	+57 23 8.0	21 33 47.7	+57 23 15	Giesecking 15
21 36 15.3	+57 30 42.0	21 36 12.0	+57 31 0	GL Cep*
21 36 44.7	+57 17 45.0	21 36 44.0	+57 19 12	GM Cep*
21 37 9.0	+57 16 42.9	21 37 9.2	+57 16 53	No. 3
21 41 16.5	+58 43 32.9	21 41 16.4	+58 43 34	Giesecking 19

* The identification is given in the IRAS Point Source Catalogue.

c) Unnamed faint variables found by Geyer and Giesecking (1975) and Giesecking (1976) during a photographic search for variable stars around Mu Cephei. Stars Nos. 6, 11, 15, 17, 18, 19 (=CSV 8684), 20, 23 and 24 are situated within our field. No. 11 happens to be identical with V 347 Cep but Giesecking finds it equally bright in the red and blue. Among these stars, Nos. 17, 18, 20 and 24 show Ha emission on our objective prism plates. Regarding their relatively blue colour they are possibly Orion-variables.

d) Stars Nos. 20, 21, 22, 23, 24 and 25 from a list of extremely red stars by Dorschner et al. (1973) were also measured because their very red colour suggests that they might be variables. No. 20 is found to be variable and in addition it shows H α emission on two objective prism plates taken in 1986. We remark here that our photometry shows these stars systematically brighter and bluer than the original photometry which was based on measuring the diameters of the stars on the Palomar Observatory Sky Survey prints.

Table II summarizes the photographic magnitudes and colour indices for the above listed stars.

Finally we mention that some of these stars seem to have counterparts in the IRAS Point Source Catalogue. GL and GM Cep are identified with infrared sources in the Catalogue. In Table III we give a comparison of the coordinates of further IRAS sources with those of our stars. In some cases there are other optical objects within the uncertainty ellipse. In these cases, beside the very good agreement of the coordinates the fact that these stars were selected on the basis of their red colour and/or H α emission supports the identity of the stars and infrared objects.

The poor information available for these stars is not enough to establish their types. The large amplitudes of their light variation, the H α emission, red colour and the possible infrared excess together with their apparent location in a region of star formation suggest that at least some of them are pre-main sequence variables; these properties do not exclude, however, that some of them are of Mira type. They are worthy of further study.

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