

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

Number 4010

Konkoly Observatory  
Budapest  
5 April 1994  
HU ISSN 0324 - 0676

**NEW PHOTOMETRIC VARIABLE STARS IN THE FIELD  
OF SOUTHERN OPEN CLUSTERS**

During the course of photometric investigation of the southern open clusters NGC 2354, NGC 2447, Trumpler 10, Collinder 367 and IC 2714, a number of stars were found to be low amplitude photometric variables. These clusters were selected for observation because they have either not been previously observed photoelectrically (NGC 2354 and Cr 367) or the existing data are far from being complete (NGC 2447, Tr 10 and IC 2714). The results of the photometric study of IC 2714 have been recently published by Clariá et al. (1994a), while those of the clusters NGC 2354, NGC 2447, Tr 10 and Cr 367 are being prepared for publication (Clariá and Piatti, 1994).

The purpose of this note is to report the variability detected photoelectrically in eight stars located in the field of the above five clusters. UBV observations of a total of 453 stars in NGC 2345, NGC 2447, Tr 10, Cr 367 and IC 2714 have been carried out during various observing runs between 1991 and 1993. The measurements were performed using the 61-cm and 1-m telescopes of Cerro Tololo Inter-American Observatory (CTIO) and the 2.15-m telescope of the Complejo Astronómico El Leoncito (CASLEO) located in San Juan (Argentina). Dry-ice cooled RCA 31034, EMI 9781A and Hamamatsu R943-02 photomultipliers were used in these observatories with pulse-counting equipments and standard UBV filters. Mean coefficients were employed in CTIO to correct for atmospheric extinction, whereas the coefficients published by Minniti et al. (1989) were used to reduce the CASLEO observations. The UBV standard system was established by nightly observing between 10 and 18 standard stars from the lists of Cousins (1973, 1974) and Graham (1982). The external mean errors of the UBV data are all about 0.01 mag, while the mean internal errors, deduced from the night-to-night dispersion of the program stars, are about 0.02 mag, practically independent of the V magnitude and telescope used.

We have considered a star to be a photometric variable when its individual V magnitudes during different nights display variations larger than five times the mean internal error, i.e.,  $\Delta v > 0.1$  mag.

Cluster membership was evaluated following the photometric criteria described by Clariá and Lapasset (1986), namely by requiring that the location of a given star in the  $V/(B-V)$  and  $V/(U-B)$  diagrams correspond to the same evolutionary stage and that the location of the star in the  $(U-B)/(B-V)$  diagram be close to the main sequence, the maximum departure accepted being 0.10 mag. The probable membership of star 179 in the field or NGC 2354 was determined by applying the criteria described by Clariá and Lapasset (1983). Finding charts for the new variables in Tr 10 and Cr 367 are shown in Figures 1 and 2. The new variables found in NGC 2354, NGC 2447 and IC 2714 are shown in the finding charts published by Dürbeck (1960), Becker et al. (1976), and Clariá et al. (1994a), respectively.

Table 1

Individual UB<sub>V</sub> data of new variable stars found in five southern open clusters

NGC 2354 (Dürbeck, 1960)					
Star	V	B-V	U-B	Sp. Type	Membership
179	11.36	0.88	0.48	G2	m
	11.49	0.85	0.53		
NGC 2447 (Becker et al., 1976)					
Star	V	B-V	U-B	Sp. Type	Membership
39	12.81	0.35	0.01	F2	nm
	12.45	0.46	0.05		
	12.52	0.37	0.03		
	12.73	0.35	0.05		
72	13.01	0.37	-0.01	F5	nm
	12.78	0.49	0.09		
	13.14	0.38	0.01		
77	13.35	0.38	-0.05	F6	nm
	13.24	0.41	-0.09		
Trumpler 10 (Figure 1)					
Star	V	B-V	U-B	Sp. Type	Membership
29	11.20	0.30	0.15	F0	pm
	11.06	0.31	0.11		
Collinder 367 (Figure 2)					
Star	V	B-V	U-B	Sp. Type	Membership
13	11.45	0.27	0.09	B8-B9	nm
	11.35	0.42	0.27		
101	11.96	0.79	0.35	?	nm
	11.27	1.06	0.58		
IC 2714 (Clariá et al., 1994a)					
Star	V	B-V	U-B	Sp. Type	Membership
174	11.83	0.22	0.20	B9V	m
	11.51	0.29	0.28		
	11.57	0.27	0.29		
	11.46	0.34	0.17		

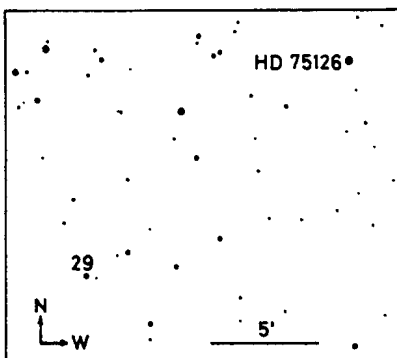


Figure 1. Finding chart for the variable star found in Trumpler 10

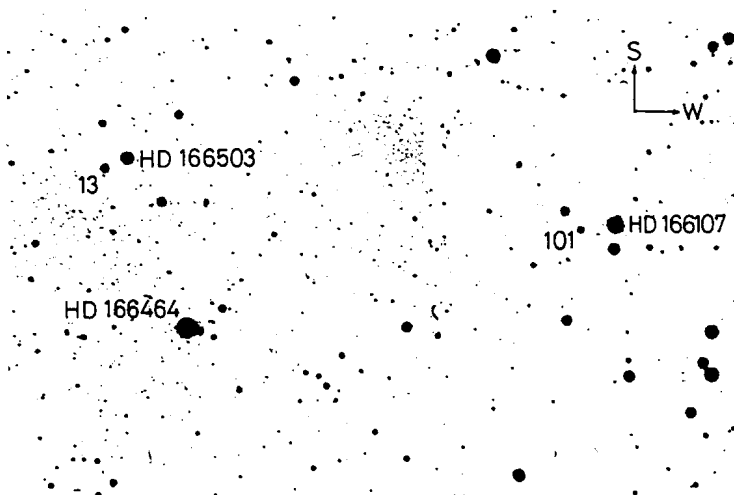


Figure 2. Finding chart for the variable stars found in Cr 367

The individual UBV measurements of the new variables are listed in Table 1. The references for star identifications are given at the head of each section of the table. Column (5) gives the spectral type as estimated from the UBV colours, excepting for star 179 of NGC 2354 whose spectral type was inferred from the unreddened DDO colours using the calibration of Clariá et al. (1994b). The last column of Table 1 indicates if the star is considered to be a cluster member, or nonmember.

Among the new variables found there are three which are believed to be members or probable members of the studied clusters, whereas the remaining five stars are very likely field stars. Four of the variables display  $\Delta V$  variations larger than 0.30 mag and the remaining four stars exhibit  $\Delta V$  variations between 0.10 and 0.15 magnitudes.

We are very grateful for the allotment of observing time at CTIO and CASLEO. Thanks are also due to Jorge E. Laborde for the preparation of the figures. This work was partially supported by CONICET and CONICOR of Argentina.

A. E. PIATTI<sup>1,2</sup>

J. J. CLARIÁ<sup>1</sup>

Observatorio Astronómico  
Universidad Nacional de Córdoba,  
Argentina

E-mail: claria@uncbob.edu.ar

<sup>1</sup> – Visiting astronomer of Cerro Tololo  
Inter-American Observatory supported  
by the National Science Foundation  
under contract No. AST 74-04128.

<sup>2</sup> – Visiting astronomer of Complejo  
Astronómico El Leoncito (Argentina).

#### References:

- Becker, W., Svolopoulos, S. N., Fang, C., 1976, Katalog Photographischer und Photoelektronischer Helligkeiten von 25 Galaktischen Sternhaufen im RGU und UcbV System, Separate print Astron. Univ. Basel, No. 89
- Clariá, J. J., Lapasset, E., 1983, *J. Astrophys. Astron.*, **4**, 117
- Clariá, J. J., Lapasset, E., 1986, *Astron. J.*, **91**, 326
- Clariá, J. J., Mermilliod, J. C., Piatti, A. E., Minniti, D., 1994a, *Astron. Astrophys. Suppl.* (in press)
- Clariá, J. J., Piatti, A. E., Lapasset, E., 1994b, *Publ. Astron. Soc. Pacific* (in press)
- Clariá, J. J., Piatti, A. E., 1994, in preparation
- Cousins, A. W. J., 1973, *Mem. Roy. Astron. Soc.*, **77**, 223
- Cousins, A. W. J., 1974, *Mon. Not. Astron. Soc. S. Africa*, **33**, 149
- Dürbeck, W., 1960, *Z. f. Astrophysik*, **49**, 214
- Graham, J. A., 1982, *Publ. Astron. Soc. Pacific*, **94**, 244
- Minniti, D., Clariá, J. J., Gómez, M. N., 1989, *Astrophys. Space Sci.*, **158**, 9