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The overlapping open clusters NGC 1750 and NGC 1758

I. UBVRI-CCD photometry[⋆,⋆⋆]

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Abstract. The existence and relationship of the possible clusters NGC 1746, NGC 1750 and NGC 1758 has been a matter of discussion during the last decades. This star field is close to the galactic anticenter and lies in the direction of the Taurus dark cloud complex. As part of a comprehensive astrometric and photometric analysis of this zone, we present a brief historical introduction together with deep *UBVRI*-CCD photometry of the area. The presence of at least one cluster can be deduced from these data. This object has a position and apparent size compatible with those previously quoted for NGC 1750 and NGC 1758. It is not possible to distinguish the single or double nature of the cluster on the sole basis of our photometry and the spatial distribution of the stars. No photometric evidence was found for NGC 1746.

Key words: open clusters and associations: individual: NGC 1750 – open clusters and associations: individual: NGC 1758 – stars: early-type

1. Introduction

Open clusters constitute one of the most important fields of research in observational astronomy. Beside the intrinsic interest of this kind of objects, the study of the open cluster system finds a set of applications in several subjects of modern astrophysics, such as establishing the distance scale (Efremov 1989, among others), theories of stellar formation and evolution (Meynet et al. 1993, Phelps & Janes 1993) and galactic structure and evolution (Janes & Adler 1982, Janes & Phelps 1994).

For research on galactic structure, the anticenter direction has special interest (McCarthy & Treanor 1965), because in this zone the line of sight intersects the outer arms of the Galaxy, without interference from the inner regions. The main difficulty for the photometric study of this zone arises from the complex structure of the absorbing material in this direction (McCuskey 1941).

The Milky Way in Auriga and Taurus is especially rich in open clusters, among which we find the bright systems NGC 1912 (M 38), NGC 1960 (M 36), NGC 2099 (M 37) and NGC 2168 (M 35). Most of the clusters in the area have been studied to a greater or lesser extent. From the first studies (Cuffey 1937) it became evident that the clusters found in this zone do not constitute a physical complex, although the existence of a binary cluster (NGC 1907 and NGC 1912) has been suggested. There are some less outstanding clusters in the area, such as NGC 1817, NGC 1647 or the trio constituted by NGC 1746, NGC 1750 and NGC 1758. This paper reports the photometric study of the area around the position of these three entries of Dreyer's (1888) *New General Catalogue of Nebulae and Clusters of Stars*.

The IAU official designations for these objects are C 0500+237 (NGC 1746), C 0500+235 (NGC 1750), C 0501+237 (NGC 1758). The identifications in Lyngå's (1987) *Catalogue of Open Cluster Data* are, in the same order, OCL 452, OCL 454 and OCL 453. They are located at about $\alpha_{2000} = 5^h 4^m, \delta_{2000} = +23^o 45'$, near the ecliptic plane and very close to the anticenter of the Galaxy ($l = 179°, b = -11°$). They lie well inside the sky zone occupied by the Taurus dark cloud complex. Their common angular diameter has been reported to be about $40'$. All references (see those in Alter et al. 1958, 1970 and Ruprecht et al. 1981) quote the open clusters as very loose and poor. Dreyer included the entries in his catalogue relying on the visual inspection of the area. From his description, one can deduce that the three objects proposed partially or wholly overlap. The reality of the clusters and the interpretation of this complex structure has been subject to discussion for the last few decades.

Carlson (1940) published a complete revision of Dreyer's NGC. From visual inspection of a set of photographic plates, she suggested joining all tree NGC entries in the area of NGC 1746. Some authors, before and after the publication of Carlson's (1940) corrections, simplified the description of the area by considering only the biggest object, NGC 1746. This criterion was

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[⋆⋆] Table 5 is only available in electronic form from CDS via anonymous ftp 130.79.128.5, and by e-mail request to dgaladi@pchpc5.am.ub.es adopted by Cuffey (1937) in his photometric study of this region. Later revisions of Dreyer's catalogue have adopted different criteria, from maintaining all three entries (Sinnot 1987) to suppressing one or more of them (Sulentic & Tifft 1973). Hirshfeld & Sinnot (1985) maintain only NGC 1746 and NGC 1750, adding to the second the remark "part of NGC 1746". Other authors (McCarthy & Treanor 1965), use the designation "NGC 1746" for NGC 1750 and "NGC 1750" for NGC 1758. The doubts are very similar among the cartographic representations of the area. Basic atlases ignore all three entries, or include only NGC 1746 (Tirion 1987). *Uranometria 2000.0* includes all three objects in the first editions (Tirion et al. 1987), but simplifies the description quoting only NGC 1746 in the most recent ones (Tirion et al. 1993). This situation of general confusion is caused by the lack of accurate data. The studies performed on these objects have been, up to now, very few and not conclusive.

The first systematic observations were done by Cuffey (1937). This author obtained photographic photometry in two bands (blue and red) down to $R \approx 14$ mag. Cuffey's data are included in a general survey of the open clusters in Auriga and Taurus. Although Cuffey (1937) did not mention NGC 1750 nor NGC 1758, he detected some peculiar traits in the colour-magnitude diagram, later authors (McCarthy & Treanor 1965) interpreted as possibly caused by two overlapping main sequences. Cuffey (1937) considered the denser star concentration labelled NGC 1758 to be an asymmetric nucleus of NGC 1746. Cuffey (1937) recognized the importance of interstellar extinction in this direction (caused by the Taurus clouds), and evaluated the colour excess in his *B–R* index as about 0.30 mag. His distance estimate for the cluster (not corrected for extinction) was 590 pc.

Li (1954) published a proper motion survey in this region, covering a $100' \times 100'$ area and with limiting magnitude $B \approx 14$ mag. He used four plates obtained with the Zô-Sè astrograph, spanning 12 years. The plate measurements were manual. He obtained proper motions for 2461 stars but did not analyze the results.

McCarthy & Treanor (1965) performed a systematic search for emission-line stars in the direction of the anticenter. They presented a brief discussion about the possible open clusters in this zone, based on their photographic material, Cuffey's (1937) work and Li's (1954) proper motions. Their conclusion was that Li's data are not accurate enough to lead to any definite conclusion about the structure of this field, but they considered as "premature" the suggestion by Carlson (1940) to leave only one NGC entry in NGC 1746 area.

The region around NGC 1746 remained unobserved until 1992, when Straižys, Černis & Meištas (heareafter referred to as SČM) published Vilnius photoelectric photometry for 116 stars in this zone. Their work covers an area of $2.5° \times 2.5°$ centered at $\alpha_{2000} = 5^{\rm h}1^{\rm m}, \delta_{2000} = +23°42'$. Their limiting magnitude was V = 10 in general, and 13 in the densest concentration, corresponding to the position of NGC 1758.

SČM deduced a distance of 175 pc to the Taurus dark cloud in this direction. They did not find any indication of the existence of NGC 1746, and they concluded that "NGC 1746 probably is not a cluster". They identified two overlapping open clusters, corresponding to NGC 1750 and NGC 1758. They assigned the stars to the field or to each cluster relying on spatial distribution, the colour-magnitude diagram and proper motion. Their reference for proper motions was Li (1954), which, as we have already mentioned, is inaccurate. In spite of this, the photometric information in the Vilnius system allowed them to suggest the existence of both clusters and to propose a distance for them. They estimated the angular diameters to be 28′ and 8′ arcmin for NGC 1750 and NGC 1758, respectively. They quoted the following parameters for the objects:

	A_V (mag)	d (pc)	assigned members
NGC 1750	1.31 ± 0.03	508 ± 26	14
NGC 1758	1.16 ± 0.06	680 ± 24	16

SČM admitted that further observations (fainter stars and more accurate proper motions) would be necessary in order to confirm their results.

We studied the area of NGC 1746, NGC 1750 and NGC 1758 with the aim of clarifying the existence of these objects and establishing whether the possible components constitute a bounded, multiple system. The present paper is the first in a series of three dedicated to a complete astrometric and photometric study of an area of $2.5° \times 2.5°$ around the center of NGC 1746. In this paper we summarize the Johnson-Cousins *UBVRI*-CCD photometry obtained and the conclusions drawn from only these data. We leave for two forthcoming papers the description of the astrometric measurements, the clusters-field segregation and the determination of the physical parameters of the clusters.

2. Observations and reduction

Deep *UBVRI* Johnson-Cousins CCD photometry was performed at Calar Alto (Almería, Spain) in November 1991 and December 1994 using the 1.23 m telescope of Centro Astronómico Hispano-Alemán (CAHA), and in December 1993 using the 1.52 m telescope of Observatorio Astronómico Nacional (OAN).

In the first run we observed two non-overlapping fields in the area of NGC 1758, and in the second and third runs we reobserved these fields and extended the photometry to cover almost the whole area of NGC 1750 and some of the surrounding field. The number of frames, exposure times, seeing conditions and chip specifications are given in Tables 1 and 2. Beside long, deep exposures of each field, additional shorter exposures were obtained when necessary, in order to avoid saturation of the brightest stars. Dome flat frames were obtained during daytime in each observing run.

Around 20 different Landolt's (1983, 1992) standard stars were observed each night in order to reproduce the Johnson-Cousins *UBVRI* system. These stars were carefully selected to cover a wide range of spectral types and air masses.

Table 1. Log of the observations (n means the number of observed frames)

Telescope	date	exposure time (s)					seeing($''$)	n
		U	B	V	R	I		
1.23 m CAHA	1991-11-07	3200	1200	600	300	540	1.6	1
1.23 m CAHA	1991-11-09	3600	1400	600	300	540	1.3	1
1.52 m OAN	1993-12-10	–	–	1000	600	800	1.5	3
1.52 m OAN	1993-12-11	2000	1200	800	–	–	0.9	3
1.52 m OAN	1993-12-12	2000	800	500	200	600	1.3	2
1.52 m OAN	1993-12-15	2000	800	500	200	600	2.0	3
1.52 m OAN	1993-12-16	2000	800	500	200	600	0.9	3
1.52 m OAN	1993-12-17	2000	800	500	200	600	1.5	2
1.52 m OAN	1993-12-18	2000	800	500	200	600	1.4	2
1.52 m OAN	1993-12-19	2000	800	500	200	600	1.0	3
1.23 m CAHA	1994-12-08	2000	500	500	200	300	1.3	2
1.23 m CAHA	1994-12-09	2000	500	500	200	300	1.9	1
1.23 m CAHA	1994-12-10	2000	500	500	200	300	2.5	2
1.23 m CAHA	1994-12-11	2000	500	500	200	300	1.9	2
1.23 m CAHA	1994-12-12	2000	500	500	200	300	1.4	3

Table 2. Chip specifications

	1.23 m telescope	1.52 m telescope	1.23 m telescope
Type:	GEC#10 coated	THK 31156 coated	TEK#6
Dimensions (pixels):	385×576	1024×1024	1024×1024
Pixel size:	22μm = 0.46$''$	19μm = 0.33$''$	24μm = 0.502$''$
Field of view:	$3.0' \times 4.4'$	$5.6' \times 5.6'$	$8.6' \times 8.6'$
Gain:	5.7e^-/ADU	3.5e^-/ADU	4.3e^-/ADU
Read-out-noise:	2.3 ADU	2 ADU	1.5 ADU
Dynamic range:	65535 ADU	65535 ADU	65535 ADU
Linear up to:	40000 ADU	50000 ADU	45000 ADU
Typical bias level:	260 ADU	240 ADU	261 ADU
Overscan region:	right-left	right-left	right-left

Table 3. Number of standard stars (N) and their rms residuals (σ)

Night	V_{B-V}		$B-V$		$U-B$		$V-R$		$V-I$		V_{V-R}	
	N	σ	N	σ	N	σ	N	σ	N	σ	N	σ
1991-11-07	20	0.026	20	0.018	17	0.018	20	0.015	20	0.020	20	0.026
1991-11-09	21	0.014	20	0.010	19	0.030	21	0.012	20	0.023	21	0.014
1993-12-10	18	0.021	–	—	–	—	17	0.017	17	0.020	18	0.021
1993-12-11	24	0.011	24	0.022	23	0.024	–	—	–	—	–	—
1993-12-12	23	0.049	21	0.030	19	0.030	18	0.021	17	0.019	16	0.050
1993-12-15	17	0.019	17	0.016	16	0.042	15	0.013	16	0.029	17	0.019
1993-12-16	23	0.039	22	0.038	21	0.043	19	0.035	18	0.050	22	0.034
1993-12-17	23	0.037	22	0.048	23	0.035	21	0.036	19	0.027	24	0.041
1993-12-18	19	0.009	20	0.018	18	0.050	20	0.012	18	0.017	19	0.009
1993-12-19	25	0.018	23	0.028	23	0.041	23	0.016	23	0.028	23	0.025
1994-12-08	25	0.013	24	0.024	22	0.041	25	0.013	25	0.022	23	0.011
1994-12-09	19	0.028	19	0.028	17	0.035	20	0.021	19	0.021	19	0.028
1994-12-10	10	0.030	10	0.040	9	0.045	11	0.016	10	0.025	11	0.040
1994-12-11	18	0.021	20	0.012	17	0.054	20	0.015	19	0.023	19	0.022
1994-12-12	35	0.017	32	0.013	32	0.037	32	0.011	30	0.021	32	0.019

The reduction from raw images to standard photometry was performed following Jordi et al. (1995), and we refer to them for a fully detailed description of the procedure. In the following paragraphs we summarize the main steps of this process.

Bias level was evaluated individually for each frame by averaging the counts of the most stable pixels in the overscan areas. The 2-D structure of the bias current was evaluated from a number of dark frames with zero exposure time. As pointed out in previous papers (Galadí-Enríquez et al. 1994, Jordi et al. 1995),

Table 4. Number of stars observed (N) and averaged internal errors (σ) of stars in Table 5 at different magnitude intervals

V range	V		$B-V$		$U-B$		$V-R$		$V-I$	
	N	σ	N	σ	N	σ	N	σ	N	σ
<9	8	0.028	8	0.037	8	0.044	6	0.037	6	0.044
9-10	12	0.022	12	0.032	12	0.040	12	0.030	12	0.037
10-11	18	0.017	18	0.030	18	0.039	18	0.024	18	0.033
11-12	62	0.019	62	0.026	62	0.042	61	0.023	61	0.031
12-13	89	0.020	89	0.028	89	0.046	89	0.024	87	0.031
13-14	137	0.022	137	0.029	135	0.049	136	0.025	136	0.032
14-15	241	0.023	240	0.035	232	0.057	241	0.028	241	0.034
15-16	378	0.025	372	0.041	335	0.078	375	0.030	376	0.035
16-17	576	0.030	531	0.057	315	0.115	571	0.036	570	0.041
17-18	796	0.043	551	0.079	123	0.132	787	0.053	784	0.055
18-19	697	0.063	255	0.100	2	0.179	689	0.079	677	0.079
19-20	202	0.084	12	0.147			202	0.106	199	0.104
20-21	8	0.139					8	0.157	8	0.151
TOTAL:	3224		2287		1331		3195		3175	

the way the shutter opens and closes affects both the sky images and the flat-fields. The shutters of the GEC#10 and TEK#6 at 1.23 m telescope and of the THK31156 at 1.52 m telescope were analyzed following Galadí-Enríquez et al. (1994), and shutter effects were removed from flat-field and object frames.

The frames were processed using the ESO image processing software MIDAS running in an IBM AIX6000 Mod. 540. Aperture photometry and growth curves were obtained using the DAOPHOT and DAOGROW programs (Stetson 1987, 1990). Cross identification of stars in different frames was performed using the DAOMATCH and DAOMASTER programs (Stetson 1993).

The coefficients of the transformation to the standard system were computed by a least square method using the instrumental magnitudes of the standard stars and their standard magnitudes and colours in the Johnson-Cousins system. Standard stars with residuals greater than 2σ were rejected. Transformation to the standard system was performed in two steps, determining first the extinction coefficients (Eqs. (2) and (3) in Jordi et al. 1995) and, having these fixed, fitting the remaining model parameters. Independent reductions were made for each night. The rms residuals of the standard stars are given in Table 3.

Internal errors of individual measurements were computed as described by Jordi et al. (1995), taking into account the errors in the instrumental magnitudes on the one hand, and the errors in the transformation equations on the other hand. Final magnitude, colours and errors were obtained by averaging the individual measurements of each star using the internal error as a weight (Jordi et al. 1995, Rosselló et al. 1985). No evidence of systematic differences between data acquired in different observational periods was found. The final errors as a function of apparent visual magnitude are given in Table 4 and Fig. 1. The non single-valued character of the errors as a function of brightness in Fig. 1 is a consequence of the different photometric quality of the nights.

The whole set of frames was assembled into a global frame with the pixel size of the TEK#6 chip, i.e. 0.502 arcsec, using the stars in the overlapping areas between contiguous frames. The total area covered by our observations is about 48 arcmin in α and 32 arcmin in δ.

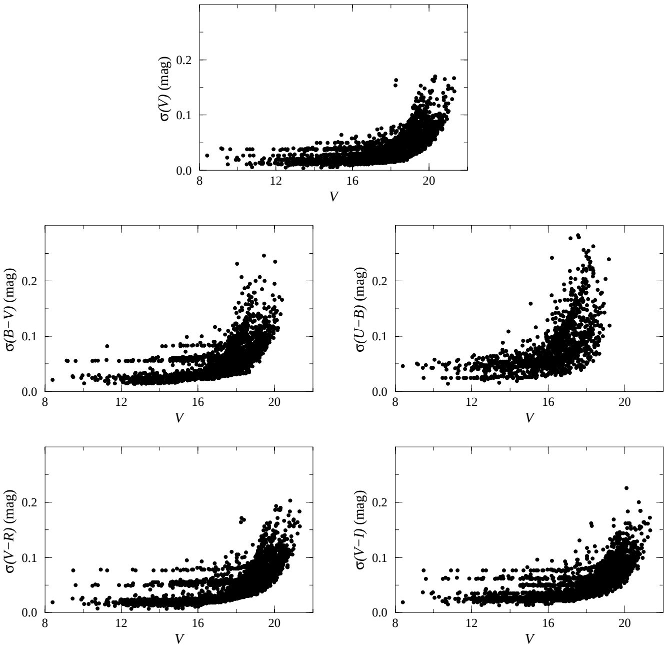

Fig. 1. Internal errors of stars in Table 5 as a function of apparent visual magnitude

Equatorial coordinates were computed in the global frame, using the PPM stars (Röser & Bastian, 1989) as reference, adopting one of them as origin and fitting the equations

$$\begin{aligned}\Delta\alpha\cos\delta &= a_0 + a_1\Delta x + a_2\Delta y\\ \Delta\delta &= b_0 + b_1\Delta x + b_2\Delta y\end{aligned}$$

where Δ means the difference *star* minus *origin*. The coefficients resulting from the fitting show good alignment of $+x$ coordinate with $+\alpha$ and of $+y$ with $+\delta$; the coefficients a_2 and b_1 being almost zero.

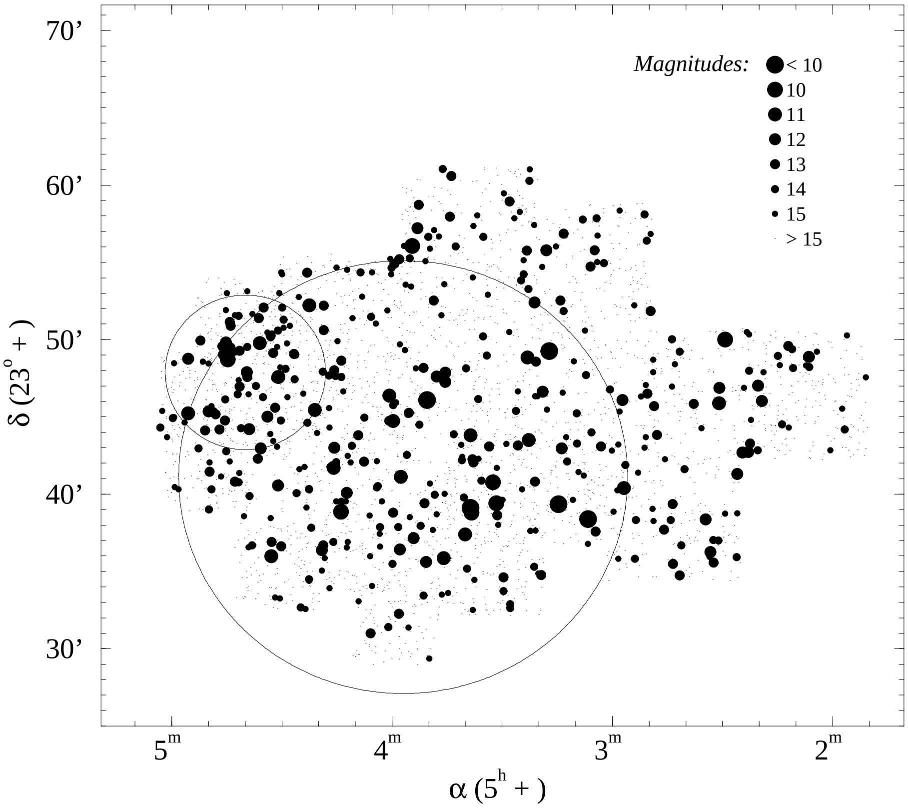

Fig. 2. Map of the area covered by the CCD photometry. The circles represent the approximated areas of NGC 1750 (big circle) and NGC 1758 (small circle). The positions and diameters are those quoted by SČM: $28'$ centered at $\alpha_{2000} = 5^{\rm h}4.0^{\rm m}, \delta_{2000} = +23°41'$ for NGC 1750, and $8'$ centered at $\alpha_{2000} = 5^{\rm h}4.7^{\rm m}, \delta_{2000} = +23°48'$ for NGC 1758.

Table 5 gives *UBVRI* data for 3224 stars down to visual magnitude 21. Star centers are given as frame (x, y) and equatorial (α, δ) coordinates. Each star was assigned an identification number following the order of increasing right ascension. Fig. 2 displays the positions and magnitudes of the stars observed. Notes to Table 5 quote the cross identifications with the following catalogues: SČM, Cuffey (1937), PPM (Röser & Bastian 1989), Bonner Durchmusterung, Henry Draper Catalogue and Tycho Catalogue (ESA 1997). No matches were found with HIP catalogue (ESA 1997).

Following Jordi et al. (1995) we estimated our sample to be complete in V, R, and I down to $V \approx 18.5$ mag. However, due to the lower response of CCD detectors at short wavelengths, the completeness in the four colour indices is maintained only down to $V \approx 15.5$ mag. Visual magnitude and four colour indices were determined for 1313 stars (41% of the sample).

We estimated the external error of the V magnitude through comparison with the values published by SČM. There are 43 stars in common and only star number 1577, SČM 50, shows a large difference (2 mag). A visual inspection of the POSS plates and checking of our original individual CCD values lead to the conclusion that this star is not as bright as quoted by SČM, V=9.62 mag, and our figure of V=11.63 mag is most probably the correct one. The remaining 42 stars in common give a mean difference in V (SČM-ours) of 0.003 ± 0.047 mag, showing no systematic trend with colours. No other Johnson-Cousins photometry is available in the area observed to compare our colour indices.

3. Discussion

Figs. 3, 4 and 5 summarize the photometric data. In these diagrams, we have represented with different symbols the stars corresponding to NGC 1750 (filled circles), NGC 1758 (squares) and the field (crosses). To perform this separation, we adopted the cluster positions and diameters from SČM, which coincide with the star concentrations seen in a visual inspection of the area (Fig. 2). We set a diameter of $28'$ centered at $\alpha_{2000} = 5^{\rm h}4.0^{\rm m}, \delta_{2000} = +23°41'$ for NGC 1750, and $8'$ centered at $\alpha_{2000} = 5^{\rm h}4.7^{\rm m}, \delta_{2000} = +23°48'$ for NGC 1758. These positions are close to the stars 1878 (Cuffey 31) and 2859 (SČM 72, Cuffey 46). All the stars inside the circle defined for NGC 1758 were assumed to represent this cluster, while those inside the NGC 1750 circle and outside the NGC 1758 circle were assigned to the bigger object. The other stars are assumed to belong to the field.

Of course, with this raw separation we should expect a certain degree of contamination by field stars in both clusters. In addition, due to the spatial overlap of the groups, a number of NGC 1750 stars are being assigned to NGC 1758. Furthermore, the areas covered by the clusters could be other different from that assumed. Nevertheless, the observational colour-magnitude diagram displays a fairly well defined main sequence in the cluster area down to $V = 19$ mag, especially outstanding against the field population in the region of the brighter and bluer stars. This apparent main sequence can be identified with the clusters present in the zone. The field does not show any clear main sequence. We did not find any trait in the diagrams that could be attributed to the object NGC 1746.

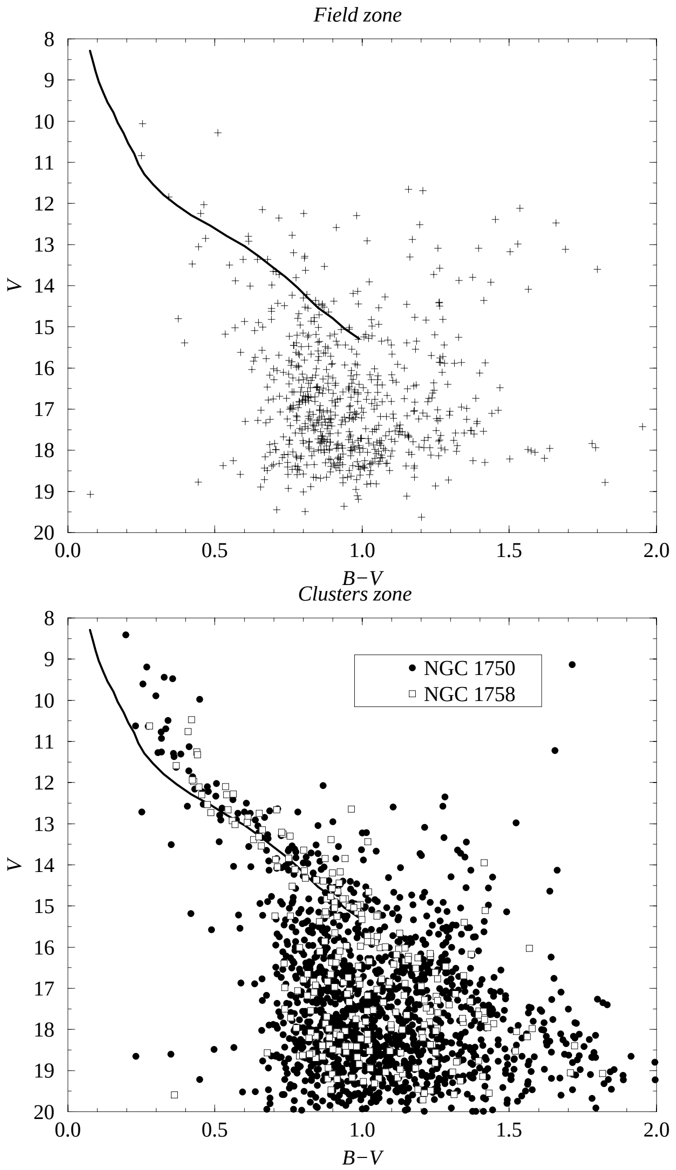

Fig. 3. Observational colour-magnitude diagram. The upper panel displays the data for the field stars, while the lower shows the diagram in the clusters (different symbols are used for NGC 1750 and NGC 1758). The solid line represents the ZAMS calibration by Mermilliod (1981) shifted by *E(B–V)*=0.34 mag, adopting A_V/*E(B–V)*=3.2 and $V_o - M_V = 9.2$ mag.

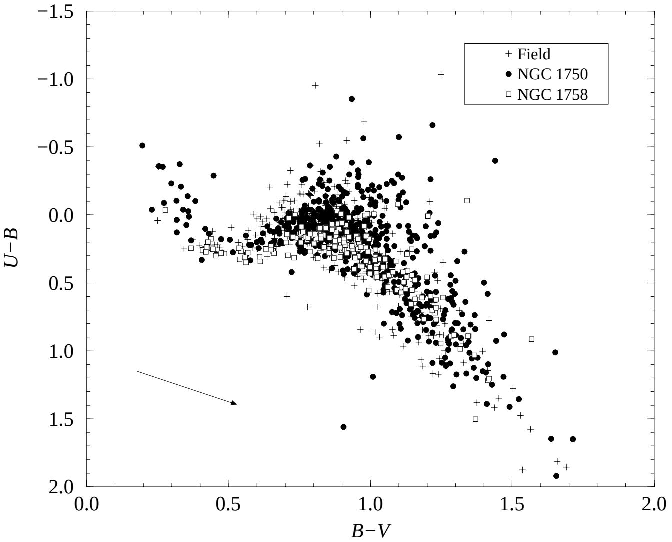

Fig. 4. Observational colour-colour diagram. Different symbols are used for NGC 1750, NGC 1758 and the field. The arrow signs the direction of the reddening vector.

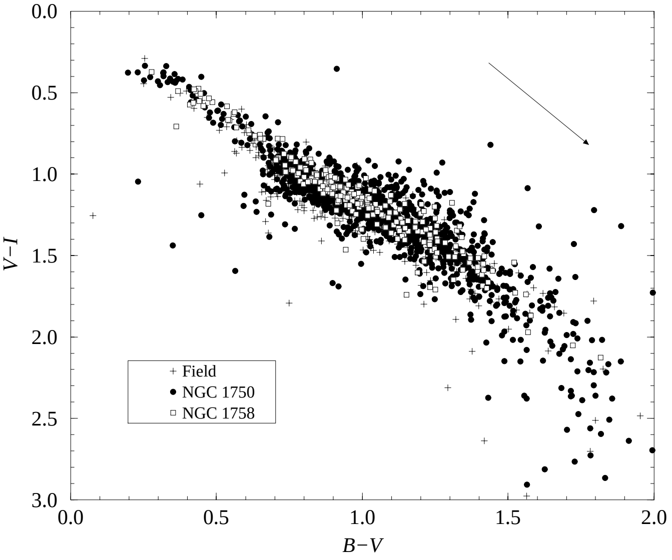

Fig. 5. Observational colour-colour diagram. Different symbols are used for NGC 1750, NGC 1758 and the field. The arrow signs the direction of the reddening vector.

Although the stars in the cluster zone (NGC 1750 and NGC 1758) constitute a main sequence that is much more clearly defined than those in the field zone, the possible presence of more than one cluster cannot be easily deduced from our CCD photometric data. The two clusters, if real, have a combination of distance and excess that make their main sequences very similar in the observational diagrams. The most evident difference between the possible clusters is the apparent brightness of the top of the main sequences: as expected from simple visual inspection of the area or looking at photographic plates, the star concentration identified as NGC 1758 lacks bright stars. The brightest stars found inside the NGC 1758 circle are fainter than V=10.5 mag, while NGC 1750 area contains stars as bright as V=8.4 mag.

Other possible slight differences between these sequences would be blurred out by the strong spatial overlap of the two systems, if we perform a classification on a purely spatial distribution basis. The two sequences could stand out separately if we had an independent method for classifying the stars that did not rely only on their spatial position.

We have performed different trials for applying the dereddening procedure on the (*B–V*,*U–B*) plane devised by Jordi et al. (1996) for the association Cep OB3. But the difficulties are great. In Cep OB3, the dependence of absorption on distance made it possible to apply a double criterion for the selection of member candidates, based both on colour excess and on distance modulus. In this case, however, the interstellar medium seems almost transparent beyond the Taurus dark clouds, where the two proposed clusters lie, and both these two and the background field stars have virtually identical reddening values. So, only the distance criterion would be at our disposal. But several factors make the reddening-distance determinations especially unreliable for our data. Most of the stars in the photometric region of interest, where we would like to distinguish two clusters, lie in the *(B–V,U–B)* zone where multiple solutions arise for all the stars. In this zone, corresponding to A, F and G spectral types, multiple reddening solutions are very difficult to classify and, also, more sensitive to observational errors. The computed reddening values are entered into an absolute magnitude calibration in order to obtain the final (multivalued) distance modulus, which would be used as the only criterion for classification. However, considered together, these factors mean that the dereddening procedure from Jordi et al. (1996) cannot be used for photometric classification in this case. B-type stars, whose reddening solutions are not ambiguous, are found only in the area of NGC 1750. The reddening values deduced for them are fully compatible with the average figure deduced from SČM data: *E(B–V)*=0.34 mag. If this colour excess is assumed, the fitting of Mermilliod's (1981) colour-absolute magnitude ZAMS calibration to the non evolved part of the joint (NGC 1750 and 1758) main sequence gives a distance modulus of $V_o - M_v$=9.2 mag for the stellar group. The apparent difference in age between both clusters (NGC 1758 looks older than NGC 1750) relies only on the brighter stars of NGC 1758. Two of them, at V=10.5–11.0 and *B–V*=0.4 mag were classified as belonging to NGC 1750 by SČM. If SČM's classification was right, the photometric differences between both clusters would be less evident.

The way to clarify whether the object found in this field is single or multiple would be to use a more powerful segregation method. Proper motions have shown to be the finest tool for this purpose. A second paper will describe our work to compute proper motions and photographic photometry in NGC 1750 and NGC 1758 field. A third article will include a detailed exploitation of the resulting set of astrometric and photometric (CCD and photographic) data.

4. Conclusions

Johnson-Cousins *UBVRI*-CCD photometry was obtained in a radius of about $15'$ around the center of NGC 1750. A total of 3224 stars were detected. The sample is complete down to $V \approx 18.5$ mag. A total of 1313 stars have complete photometry in all the filters.

The analysis of the colour-magnitude and colour-colour diagrams from a spatial point of view shows the presence of at least one cluster in the area of NGC 1750 and NGC 1758. From colour-magnitude and two-colour diagrams, we deduce a colour excess of *E*(*B*–*V*)=0.34 mag and a distance modulus of 9.2 mag for the joint main sequence. Separate reddening, distances and ages will be derived for both clusters from a suitable classification of members in the next papers of this series. There is no photometric evidence for the cluster NGC 1746.

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