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uvby-β PHOTOMETRY OF OPEN CLUSTERS. II. NGC 1342[1]

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RESUMEN

Se presenta fotometría fotoeléctrica en *uvby*-β del cúmulo abierto NGC 1342. Del análisis de los datos fotométricos se ha determinado para cada estrella su enrojecimiento, temperatura y gravedad y, de la distancia y el enrojecimiento de cada una, se ha asignado una distancia y un enrojecimiento medios de 8.62 $\pm$ 0.22 mag y E$(b-y)$ de 0.297 $\pm$ 0.112 respectivamente, para el cúmulo. Mediante comparaciones con modelos teóricos se ha determinado una edad de 4.0 $\times$ 10^8 años. Cinco estrellas en la dirección de NGC 1342 fueron identificadas como estrellas químicamente peculiares de las cuales cuatro pertenecen al cúmulo.

ABSTRACT

uvby-β photoelectric photometry of the open cluster NGC 1342 is presented. From the analysis of photometric data reddening, distance, temperature and gravity are determined for each star, and from the distance and reddening of each, a mean distance modulus and reddening of 8.62 $\pm$ 0.22 mag and E$(b-y)$ = 0.297 $\pm$ 0.112 respectively to the cluster is assigned. An age of 4.0 $\times$ 10^8 yr is determined through direct comparison with theoretical models. Five stars were identified in the direction of NGC 1342 as chemically peculiar stars of which four are cluster members.

Key words: **OPEN CLUSTERS AND ASSOCIATIONS - INDIVIDUAL (NGC 1342) — TECHNIQUES - PHOTOELECTRIC**

1. INTRODUCTION

This is the second paper of a series which has he purpose of examining the nature of the stars elonging to open clusters. Initially, this series was irected at a study of short period pulsating stars, nainly of the Delta Scuti type and in particular, of he coexistence of non-pulsating and variable stars ɔcated in the instability strip of the H-R diagram y first establishing the membership of each star to he cluster. Currently, this study has been extended ɔ include the determination of the abundance of he Ap phenomenom in open clusters, for clusters f different ages and metallicities.

In the present study, an analysis of the open cluster NGC 1342 is presented. This cluster was selected because it seems to have a relatively large number of young stars, as suggested by the direct photographs in which the extinction appears to be somewhat patchy. This conclusion is supported by the photometric studies in *UBV* presented by Hoag et al. (1961) from which it can be inferred that a fair number of early type stars belong to the cluster. A later study by Burki (1975) supports this assertion.

Another reason for selecting NGC 1342 was the fact that there is a large spread in the determination of its distance in the literature (Alter, Balazs, & Ruprecht 1970). Hence, the analysis presented in this paper contributes to clarifying a somewhat chaotic discrepancy in the establishment of distance, a fundamental quantity upon which the derived

[1] Based on observations collected at the Observatorio stronómico Nacional, San Pedro Mártir, B.C., México.

physical characteristics of the stars from the theoretical models is based.

2. OBSERVATIONS

The observations were carried out at the Observatorio Astronómico Nacional (OAN) of the Universidad Nacional Autónoma de México. A summary of the observations is presented in Table 1. For the acquisition of the photometric data, the 1.5-m telescope at the OAN was used. This telescope was provided with a multichannel spectrophotometer that allows the observation of the data simultaneously in the *uvby* filters and in the narrow and wide filters that define Hβ.

The photometric data reported here were acquired during two different seasons. Table 1 presents the dates and the number of objects observed. The characteristics and procedures of the observations of the first season, 1986, were presented in Peniche et al. (1990, hereinafter Paper I). In the 1989 season each observation consisted of two 30 s integration of the star and one 10 s integration of the sky. A total of 67 stars in the direction of the cluster were observed, 32 in 1986 and 47 in 1989, with a small sample of 12 included in both seasons.

TABLE 1

LOG OF OBSERVATIONS OF NGC 1342

Date	Observed stars
Sep. 5, 1986	32
Oct. 26, 1989	22
Oct. 27, 1989	10
Oct. 29, 1989	15

3. DATA REDUCTION

The reduction of the photometric data follows the procedure that has been described before (see for example Peña, Díaz, & Peniche 1990). As mentioned previously, the photometric data were acquired during two seasons, 1986 and 1989. The reduction of the photometric data of the 1986 season to the standard system was described in Paper I, whereas for the 1989 season the transformation coefficients to the standard system defined by Olsen in 1983 are presented in Table 2a. The dispersion of the indexes of the observed standard stars with respect to the standard star values (Olsen 1983) was evaluated numerically and is reported in Table 2b. A different approach to determine the uncertainties of the data presented is

TABLE 2a

TRANSFORMATION COEFFICIENTS FOR THE 1989 SEASON AT OAN[a]

B	D	F	J	H	I	L
0.0103	1.0005	0.9404	0.0130	1.0060	0.0783	1.2581

[a] The coefficients are defined by the equations given i Crawford & Barnes (1970) and in Crawford & Mande (1968). D, F, H, and L are the slope coefficients fc *(b–y)*, *m1*, *c1*, and β respectively; B, J, and I the color terı coefficients of *V*, *m1* and *c1*.

TABLE 2b

COMPARISON OF THE INSTRUMENTAL MAGNITUDE OF THE STANDARD STARS OBSERVED WITH PHOTOMETRIC VALUES[a]

	V	*(b–y)*	*m1*	*c1*	β
Num. stars	118	152	147	125	65
std. dev.	0.012	0.007	0.011	0.011	0.00

[a] Reported by Olsen (1983)

through photon statistics. Errors due to the star flu› measured in each filter were calculated as a functioı of magnitude, regardless of their brightness sinc‹ all the data were obtained in two integrations o 30 s each. These uncertainties are presented iı Table 3. The photometric values in the standar‹ system of all the observed stars are presented iı Table 4. Column 1 lists a sequential number of th‹ observed stars in decreasing β; columns two an‹ three, the identification numbers of each star b Hoag et al. (1961) and by Francic (1989). Wheneve possible, the nomenclature given by the first autho will be used in the rest of the text and will b‹ denòted by a prefix H.

TABLE 3

UNCERTAINTIES IN THE MAGNITUDES IN EACH FILTER[a]

Mag. interval	*u*	*v*	*b*	*y*	β
8.0 – 9.0	0.002	0.001	0.001	0.002	0.004
9.0 – 10.0	0.008	0.004	0.002	0.003	0.007
10.0 – 11.0	0.006	0.003	0.003	0.004	0.011
11.0 – 12.0	0.009	0.004	0.004	0.006	0.014
12.0 – 13.0	0.014	0.009	0.008	0.011	0.026
13.0 – 14.0	0.027	0.014	0.012	0.015	0.033

[a] Arising from the counts as a function of the sta magnitude.

TABLE 4

uvby-β PHOTOELECTRIC PHOTOMETRY OF NGC 1342

PP	Hoag	Frc	X	Y	*V*	*b–y*	*m1*	*c1*	β
1	19	151	2.92	2.30	11.807	0.445	0.127	1.035	2.910
2	...	157	4.9	24.2	13.649	0.678	0.033	1.420	2.910
3	...	204	15.9	0.08	11.743	0.357	0.118	1.096	2.904
4	12	212	19.98	-13.64	10.797	0.273	0.078	1.140	2.894
5	16	142	-0.22	1.67	11.140	0.344	0.117	1.106	2.889
6	8	107	-10.81	-6.72	10.269	0.217	0.109	1.100	2.885
7	10	125	-4.69	7.99	10.579	0.292	0.101	1.132	2.885
8	9g	95	-13.13	0.37	11.281	0.238	0.121	1.108	2.882
9	17	112	-8.39	-2.05	11.245	0.264	0.162	1.000	2.881
10	22	203	15.83	7.16	12.698	0.424	0.210	0.940	2.876
11	11	167	7.32	-3.50	10.589	0.290	0.111	1.035	2.870
12	...	199	14.0	30.5	12.228	0.448	0.124	1.066	2.868
13	60g	194	13.58	8.74	13.744	0.604	0.221	0.957	2.867
14	...	87	-15.7	-2.7	12.342	0.337	0.247	0.764	2.862
15	13g	152	2.95	-3.8	10.728	0.399	0.112	1.186	2.860
16	...	163	5.7	-0.9	12.414	0.413	0.112	1.369	2.849
17	33g	122	-5.59	-11.49	12.390	0.300	0.256	0.804	2.843
18	...	187	11.8	-15.2	12.035	0.352	0.110	1.035	2.840
19	3	...	8.04	17.08	9.202	0.161	0.185	1.028	2.839
20	24	191	12.54	5.34	13.208	0.502	0.158	0.847	2.832
21	31g	147	0.73	4.77	12.136	0.605	0.082	1.146	2.830
22	24g	110	-8.81	3.49	11.548	0.384	0.124	1.099	2.830
23	18	211	19.03	-00.85	11.605	0.415	0.117	0.926	2.819
24	14	117	-6.82	-10.21	11.189	0.246	0.132	1.088	2.818
25	29g	106	-11.19	3.57	11.855	0.336	0.135	0.958	2.818
26	43g	...	-0.85	-4.32	12.770	0.309	0.191	0.717	2.811
27	...	130	-2.9	-6.5	12.986	0.393	0.193	0.627	2.799
28	...	...	4.2	13.2	14.234	0.788	0.187	1.458	2.764
29	...	156	3.1	-20.0	12.881	0.412	0.178	0.732	2.737
30	...	178	8.9	-16.1	12.763	0.439	0.110	0.800	2.729
31	46g	136	-1.27	-2.95	13.045	0.434	0.190	0.427	2.720
32	2	145	0.30	-5.32	8.738	0.202	0.076	0.797	2.716
33	67g	177	8.72	8.34	13.697	0.679	0.200	0.549	2.714
34	45g	198	14.36	-0.38	13.089	0.461	0.108	0.756	2.708
35	36g	...	7.69	-1.65	12.847	0.667	0.152	0.365	2.689
36	7g	...	-12.91	-4.10	10.003	1.370	0.339	1.106	2.672
37	...	...	7.0	34.0	14.738	0.878	-0.321	0.994	2.672
38	35g	137	-1.95	-14.58	12.496	0.605	0.173	0.397	2.667
39	1	...	5.57	12.56	8.411	0.296	0.160	0.485	2.654
40	39g	...	-4.49	-7.84	12.719	0.570	0.036	0.462	2.643
41	9g	94	-13.13	0.37	10.298	0.368	0.136	0.479	2.641
42	...	188	11.8	2.8	13.478	0.571	0.034	0.621	2.638
43	52g	129	-3.44	-6.52	13.176	0.467	0.116	0.508	2.638
44	...	...	20.6	29.6	13.391	0.527	0.098	0.821	2.610
45	...	...	1.1	17.5	13.356	0.560	0.361	0.435	2.594
46	4	189	12.04	1.02	9.272	0.878	0.315	0.402	2.581
47	...	...	10.5	22.6	14.430	0.707	0.261	0.358	2.572
48	...	...	5.0	29.3	11.841	0.515	0.269	0.382	2.568
49	30	171	7.40	10.83	10.804	1.054	0.250	0.440	2.567
50	7	174	8.57	12.56	10.108	0.798	0.267	0.329	2.565
51	41g	144	-1.00	-0.23	12.827	0.561	0.089	0.294	2.560
52	...	201	14.3	28.9	13.954	0.568	0.161	0.621	2.555
53	...	...	17.3	-1.2	10.787	1.154	0.704	0.430	2.554
54	6	121	-5.69	-1.90	9.530	0.766	0.301	0.352	2.552
55	...	...	35.0	30.3	13.514	0.955	0.313	0.407	2.518
56	72g	115	-7.84	-10.74	14.331	0.587	0.405	-.015	2.510
57	26	176	8.64	-3.62	13.561	0.635	0.164	0.321	2.504
58	70	128	-4.14	-0.75	14.175	0.426	0.182	0.359	2.498

TABLE 4 (CONTINUED)

PP	Hoag	Frc	X	Y	V	$b-y$	$m1$	$c1$	β
59	...	...	27.0	29.5	14.812	0.799	-0.057	0.503	2.481
60	25	...	0.00	0.00	13.383	0.689	0.036	0.411	2.477
61	...	...	23.2	-0.1	14.209	0.634	0.299	0.323	2.462
62	...	...	23.5	-3.0	13.342	0.841	0.237	0.613	2.457
63	...	...	12.1	23.8	12.821	1.344	0.658	0.502	2.446
64	...	...	15.0	34.9	14.458	0.788	0.054	0.448	2.388
65	...	...	32.5	31.5	13.973	0.698	0.158	0.458	2.379
66	59g	162	5.77	2.84	13.562	0.738	0.201	0.907	2.343
67	...	...	11.2	27.8	14.215	1.405	0.703	-.531	2.160

[a] g denotes list from photographic photometry.

For those stars that have not been previously observed photometrically, positions were determined from the ID chart of Hoag et al. (1961); columns four and five list their reported or measured coordinates. In these columns numbers with two decimal figures are taken directly from the photoeletric and photographic list of Hoag et al. (1961); numbers with only one decimal figure were determined from the chart. The rest of the columns list the photometric values obtained. A small sample of 12 stars was observed in each one of the two observing runs. The mean value of the differences and their rms values of the magnitude and the color indexes for these stars were evaluated to obtain an estimate of the internal precision of the program star data. These mean values of the rms's were $\delta(V, b-y, m1, c1, \beta)$ equal to (0.021, 0.026, 0.054, 0.023, 0.027) which describe the overall repeatability of the observations. An exception was constituted by H7 which showed an abnormally large magnitude difference. The large mean difference value of $m1$, of 0.054 pointed out a systematic difference between the two seasons. Since the number of standard stars in the 1989 season is tenfold that of the 1986 season, it was assumed that the transformation in 1989 was correct and that of 1986 showed a systematic error. A plot of the $m1$ values showed that they can be adjusted by a straight line of the form y = 0.069 + 1.063 x with a correlation coefficient of 0.956. In view of these, all the 1986 $m1$ values were transformed accordingly. A comparison of the V magnitude for those 21 program stars reported in the present paper in common with Hoag et al. (1961) was evaluated along with the relationship $(B-V)$ – $(b-y)$. The correlation coefficient in each case is of 0.999 and 0.959 respectively. In both cases the relationships looked fairly good except for two stars in the latter case one of which, H7, has already been mentioned. This difference might be due to the fact that these stars are variable, but no further research to determine their nature was undertaken.

4. DISCUSSION

Since the aim of the present paper is to establish physical and geometrical characteristics of the cluster stars, the first step was to establish membership of the observed stars to the cluster. To fulfill this goal, two different approaches were used:

1) Distance modulus determination via Stromgren photometry.

2) Comparison of membership with previous proper motion work by Francic (1989).

In the first case, we first defined which objects were main sequence stars and the broad spectral regions to which they belonged by constructing the Stromgren's (1966) $[m1]$–$[c1]$ diagram. It defines three main spectral regions: early type stars of class B and early A; late A and F stars and late type stars. The distance for each group has been calculated separately.

For the A and F stars the calibration utilized has been described before (Paper I) and follows a procedure proposed by Nissen (1988) which is based on Crawford's (1975, 1979) calibrations.

For the B and early A type stars, a method for the determination of the reddening, proposed by Shobbrook (1984), has been utilized. This method is based on a polynomial representation of $(b-y)_0$ as follows:

$$(b-y)_0 = -0.1146+0.0805c_0 +0.0616c_0^2 + 0.2719c_0^3 -0.7801c_0^4 -0.4679c_0^5$$

solving it iteratively. As a first step, the value of c_1 was assumed for c_0 and, from this initial value $(b-y)_0$, $E(b-y)$ and c_0 were evaluated. The iterative procedure was interrupted when the change of the numerical value of $(b-y)_0$ was less than 0.001 mag. The expressions of Shobbrook (1984) of $m_0 = m_1 +$

).33 E$(b\text{–}y)$, $c_0 = c1 - 0.19$ E$(b\text{–}y)$ and $V_0 = V - 4.3$:$(b\text{–}y)$ were considered.

For the determination of the absolute magni-ude the method proposed by Balona & Shobbrook 1984) was employed. The distance moduli and dis-ances were evaluated in the customary ways. The inal results of the cluster members are presented in Table 5.

An alternative method for the determination of he absolute magnitude for early type stars consid-:rs the empirical calibration of M_V–(β) by Crawford 1978). This calibration was based on a large sam-)le of early type stars that belong to nearby open lusters with distances determined by different nethods. This method yields absolute magnitudes hat differ numerically from the previous ones of 3alona & Shobbrook (1984). The relationship)etween both absolute magnitudes obtained is inear and can be represented by the equation M_V(Crawford) = 0.378 + 0.832 M_V (Balona & Shobbrook) with a correlation coefficient of 0.999 from a sample of 12 pairs.

The distances presented here were determined using the absolute magnitudes of Balona & Shobbrook (1984) because these distances were in better agreement with the distances determined for the A and F stars.

Once the distances of the stars were determined through the application of the previously described methods, a histogram of the distances in parsecs was constructed and is presented in Figure 1 for each group of stars for which the distances were determined, i.e., B and early A; A and F type stars as well as for the whole sample. The histogram of distances has been constructed in parsecs and not in distance modulus, in magnitudes (although these values are presented in column 8 of Table 5) because distance can be directly added whereas

TABLE 5

REDDENING AND UNREDDENED PARAMETERS FOR THE STARS MEMBERS OF NGC 1342

								Membership probability	
ID	E$(b\text{–}y)$	$(b\text{–}y)_0$	$C1_0$	$m1_0$	M_V	DM	D(pc)	Frn	PP
				B type stars					
H19	0.468	-0.023	0.946	0.282	1.37	8.42	483.30	1.00	0.81
3	0.363	-0.006	1.027	0.238	1.28	8.90	602.27	1.00	0.68
H12	0.255	0.018	1.092	0.162	1.15	8.55	513.77	1.00	0.95
H16	0.346	-0.002	1.040	0.231	1.13	8.52	505.92	1.00	0.91
H8	0.212	0.005	1.060	0.179	1.08	8.28	452.42	1.00	0.70
H10	0.279	0.013	1.079	0.193	1.07	8.31	459.69	1.00	0.72
8	0.231	0.007	1.064	0.197	1.05	9.24	704.84	1.00	0.51
H17	0.287	-0.023	0.945	0.257	1.11	8.90	602.07	1.00	0.69
H11	0.308	-0.018	0.976	0.213	0.98	8.28	453.07	1.00	0.70
12	0.369	0.030	1.116	0.234	0.76	8.39	475.78	1.00	0.78
23	0.610	-0.005	1.030	0.283	0.48	9.04	641.90	1.00	0.59
24	0.390	-0.006	1.025	0.253	0.48	9.39	753.98	0.95	0.50
H2	0.243	-0.041	0.751	0.156	-1.14	8.83	584.50	1.00	0.75
				A type stars					
H22	0.356	0.068	0.869	0.317	2.18	8.99	628.08	0.75	0.62
19	0.240	0.097	0.716	0.319	3.65	7.66	340.41	1.00	0.52
21	0.192	0.108	0.766	0.314	3.09	8.48	496.19	1.00	0.87
H3	0.072	0.089	1.014	0.207	1.03	7.87	374.13	...	0.54
H24	0.389	0.113	0.769	0.275	2.58	8.95	617.37	1.00	0.64
H18	0.299	0.116	0.866	0.207	1.73	8.59	522.19	1.00	0.98
26	0.222	0.114	0.914	0.202	1.43	9.47	783.98	1.00	0.50
27	0.165	0.144	0.684	0.241	3.49	8.57	516.74	...	0.96
28	0.231	0.162	0.581	0.262	4.12	7.87	375.17	1.00	0.54
32	0.192	0.242	0.389	0.248	4.59	7.63	336.31	0.99	0.51
				F type stars					
33	0.434	0.245	0.462	0.330	3.39	8.44	487.95	0.99	0.82
41	0.278	0.292	0.406	0.119	2.89	8.64	533.53	...	0.96

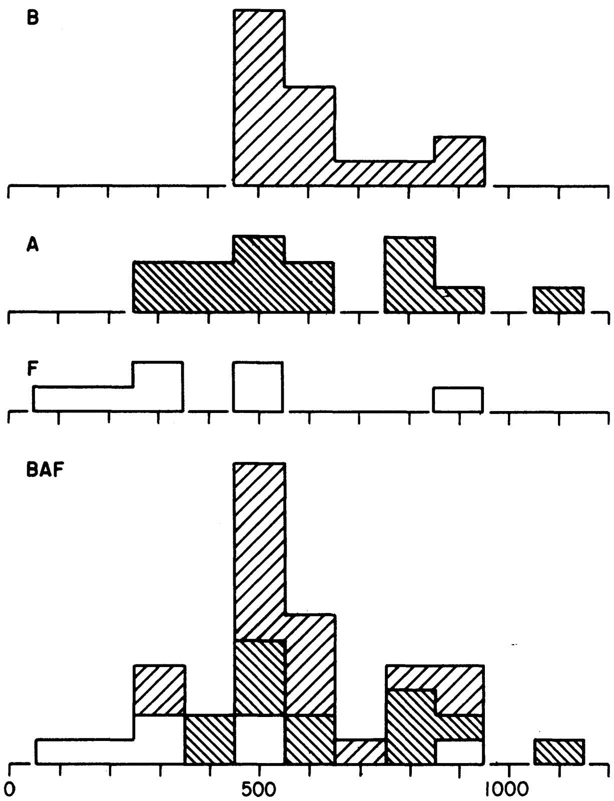


Fig. 1. Histogram of the distances obtained for B, and early A type stars; late A; and F type stars. In the lower section the whole sample (B + A + F stars) is shown.

distance modulus, being of a logarithmic nature, cannot. From the histogram, it is clear that the majority of the stars are centered around 500 pc and not distributed in a random mode. It should be emphasized that most of the stars around the peak consist of B and early A type stars. A membership probability has been defined from this histogram by adjusting a Gaussian distribution to it. However, the membership probability is assigned by considering the distance limits of the B and early A type stars to the whole set of stars; i.e., a Gaussian distribution was adjusted by considering only an interval between 350 and 750 pc, where most of the B and early A type stars lie. The mean distance in this interval is 530 pc with a standard deviation of 118 pc, i.e., a distance modulus (hereinafter, DM) in the range 8.23 to 8.93 in which the mean distance corresponds to a DM of 8.62). This Gaussian has also served to assign a statistically significant membership probability at the 0.05 level. These values are listed in column 10 of Table 5, along with the probabilities assigned by Francic (1989), column 9.

To separate binaries from single stars a $\beta - V_0$ diagram of the data presented in Table 5 which separates the binaries from the single stars was constructed. There are only a few stars, namely 21, H18, 33 and 40 that lie above of the band of what can be considered to be single stars. When these stars are removed from the distance histogram, the principal peak still remains clearly conspicuous at 500 pc, the most likely distance of the cluster. The satisfactory nature of this criterion was corroborated by plotting the accurate photometric data of Nissen (1988) for NGC 2287 in the $\beta - V_0$ diagram. Only those stars which he considered to be possible binaries were above the band defined by the single, main sequence stars.

The apparent magnitudes of those stars with high probability of membership in the cluster have been represented in a histogram along with the observed stars (Figure 2). From it, one can conclude that the apparent magnitude of the cluster members of B, A and F type stars lies in the range 9 to 14 mag. There are two F stars whose probability indicates that they might belong to the cluster. Of the remaining observed stars which have not been considered as B, A or F stars, some have to belong to the cluster since they are both cooler and fainter than the F stars. To determine the membership of the stars in this group to the cluster, a $(b-y)$–V diagram was constructed using only those B, A

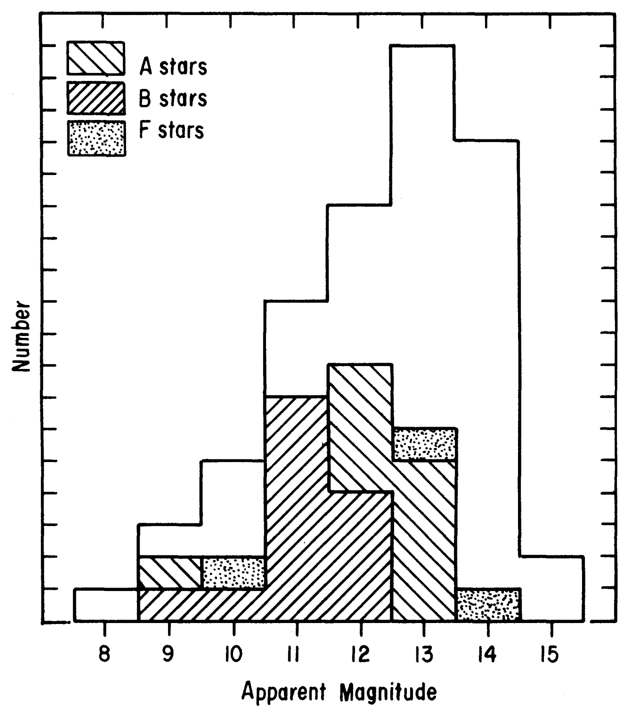


Fig. 2. Histogram of the distribution of the observed stars as a function of apparent magnitude. Shaded areas indicate stars that belong to the cluster. The F type star at the left of the B and early A type stars cannot belong, by any means, to the cluster.

nd F type stars for which a high probability of membership was established. These are shown in Figure 3, in which the upper and middle sections of the main sequence are well defined. Then, all the cool stars were located in this diagram and those stars that lie in the extension of the previously defined MS into the cooler zone were regarded as stars with high probability of membership. These stars are the following: 47, 48, 51, 52, 56, H26, 59, H25, 61, 64, 65 and 66. Figure 3 also shows five stars (H4, 49, H7, and 53) which belong to the giant class; and these might be cluster members. This diagram has also served to discard some stars that because of their position in the H-R diagram cannot belong, by any means, to the cluster.

The membership assigned through the proper motion study by Francic (1989) was also considered. From his identification chart, the observed stars were determined and the probabilities given by him

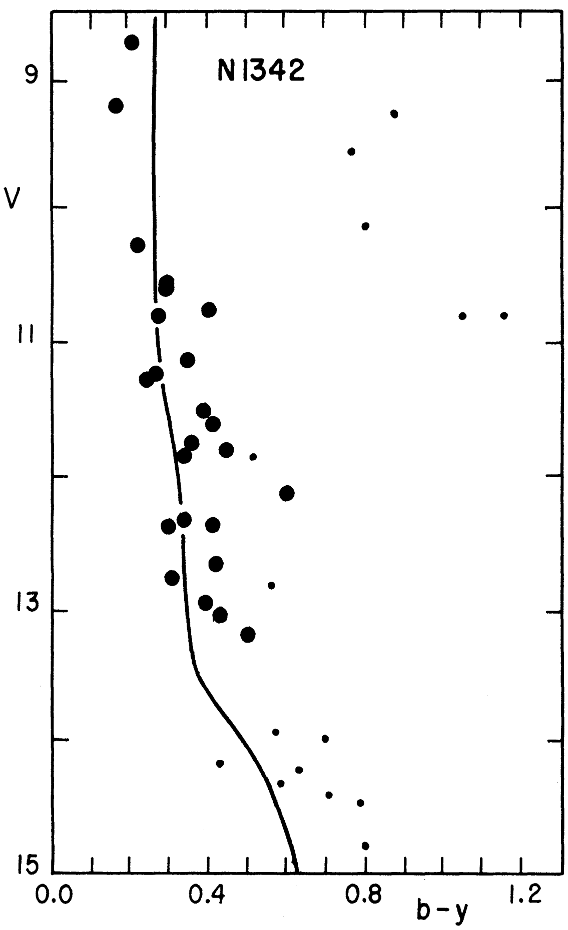


Fig. 3. V-$(b$–$y)$ diagram of the B, A and F stars established as cluster members (large dots). The cooler stars (small dots) that have been considered to be cluster members lie in the extension of the main sequence defined by the previous stars. The five giant stars might be cluster members.

have been listed in column 11 of Table 5. As can be seen, the agreement between the two studies is remarkable. In order to estimate the age of the cluster the following procedures were undertaken:

First, an estimate of the turn-off point was carried out by determining the temperature and surface gravity of the member stars, plotting them in the $m1_0 - c1_0$ theoretical grids for [Fe/H] of 0.0 of Relyea & Kurucz (1978). These are shown in Figure 4. The error bars were determined from the uncertainties that define the internal precision of the program stars. This is an upper limit since the uncertainties from the photon counts (Table 3) give much lower uncertainty values. From this diagram, the hottest stars, H2, and H8 were determined, with log T_{eff} around 4.0 and log g of 4.2, although the first one, H2, the hotter star looks like a blue straggler.

Second, their log L/L_o were determined from the M_V values reported in Table 5, and the bolometric corrections taken from two sources (Schmidt-Kaler 1982; Code et al. 1976). With these values and a metallicity value characteristic of these clusters, [Fe/H] = 0.0, a direct comparison with the theoretical models of VandenBerg (1985) was made. The age of the model that best satisfies the above mentioned restrictions is 3.2×10^8 yr.

A different procedure for determining the temperature of the B stars was applied from the calibration between $[u$–$b]$ and ϑ_e. We have followed Perez et al. (1989) who used the calibrations of Philip & Newell (1975) defining four linear segments over the entire $[u$–$b]$ range, in one of which lie the values for the 13 B stars members of the cluster. With the temperature evaluated in this fashion and the luminosity determined with the same previously mentioned procedure, the location of these stars on the theoretical H-R diagram of VandenBerg (1985) was carried out. The turn-off point for such stars suggests an age around 4.0×10^8 yr.

Overlapping the evolutionary tracks from the models by Iben (1985) an approximate age of 4.8×10^8 yr is derived. The adopted value, considering the mean of the determined ages, is in agreement with the age suggested by Payne-Gaposhkin (1979) for NGC 1342.

The values determined in the present paper for distance, reddening and age for NGC 1342, 530 ± 118 pc, $E(b$–$y) = 0.297 \pm 0.112$ and 4.0×10^8 yr respectively, are in agreement with some values previously reported. However, the spread of such values in the literature (Alter et al. 1970) is so large that a confirmation of a few of them can contribute to eliminating those which are unreasonably discordant and that, up to now, have created confusion in establishing fundamental parameter data that can be derived from studies of open clusters.

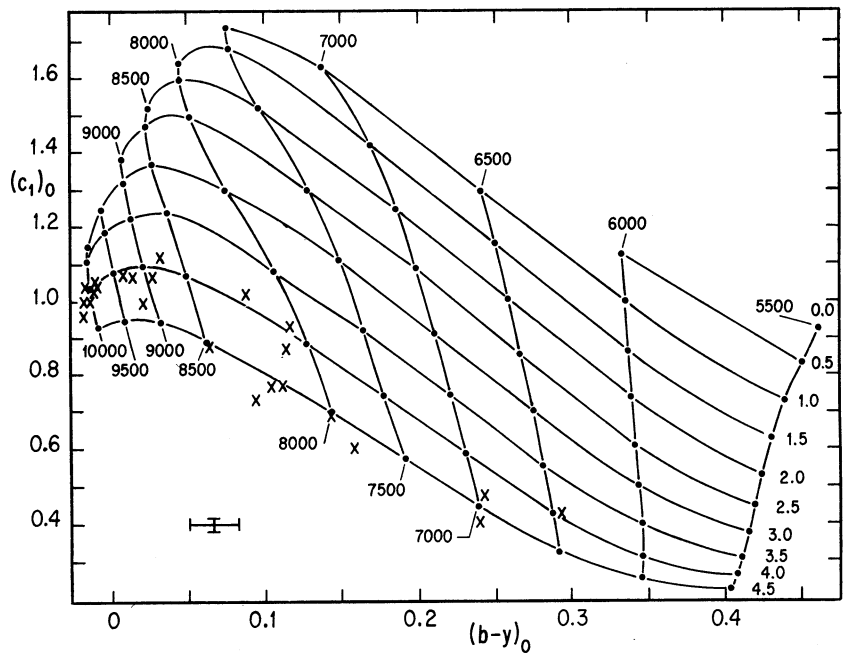


Fig. 4a. Diagrams of Relyea & Kurucz (1978) to determine the temperature and surface gravity of the member stars $(b-y)_0 - (c1)_0$ grids for stars below 10 000 K. The error bars were evaluated from the uncertainties due to the estimation of the internal precision of the program star data.

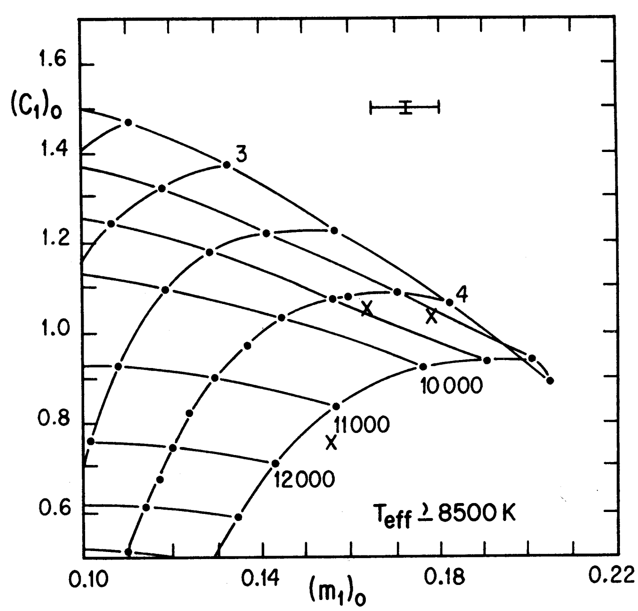


Fig. 4b. Diagrams of Relyea & Kurucz (1978) to determine the temperature and surface gravity of the member stars. $(m1)_0 - (c1)_0$ grids for stars above 8 500 K. The error bars were evaluated from the uncertainties due to the estimation of the internal precision of the program star data.

5. FREQUENCY OF PECULIAR A STARS IN NCG 1342

There have been at least two studies devoted to the determination of the abundance of the Ap phenomenon in open clusters. These studies are important since, according to Hartoog (1976): "Galactic clusters and associations provide a potentially powerful tool for the study of the origin and evolution of Ap and Am stars".

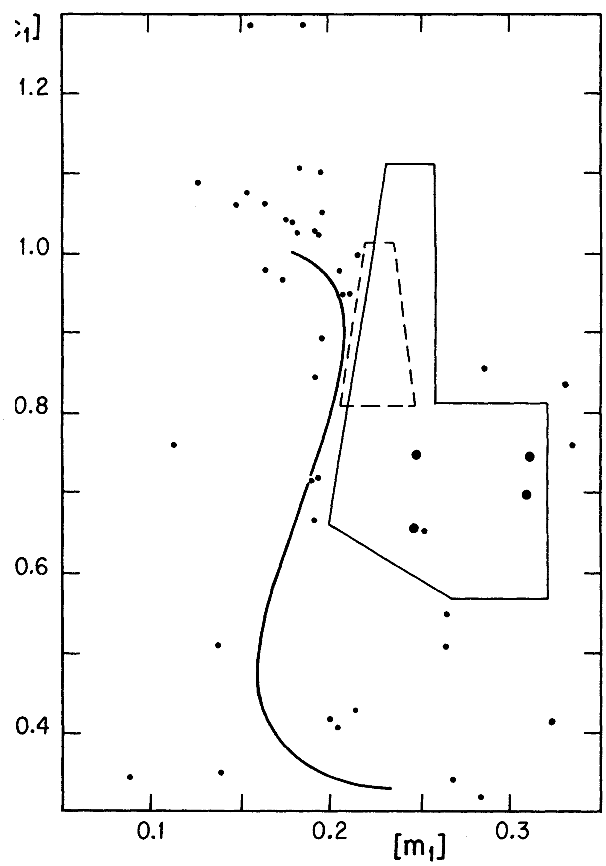
These two studies were carried out spectroscopically and both were oriented towards the establishment and discovery of new members to the chemically peculiar group. The first study by Young & Martin (1973) considered the classification of 62 stars in 13 open clusters with low dispersion spectrograms. Three Ap stars were determined which constitute only 5 percent of the entire sample which according to the authors, is rather less than field-stars statistics for Ap stars.

In a later study, Hartoog (1976) determined the MK spectral types of 263 B and A stars in 7 southern galactic clusters in order to investigate the frequency of Ap and Am stars in galactic clusters.

As in the previous work by Young & Martin (1973), he found a lower frequency of Ap and Am stars in open clusters than that found in vo independent field samples since, in the seven usters studied, only 11 Ap stars out of 203 B5 to A5 warfs were found. This gives him a ratio of 0.051 ›r the frequency of Ap stars, smaller than the 0.070 etermined for field stars. However, he established difference of frequency with the age of the clusters eing larger for the older clusters; this confirms the pparent deficiency of Ap stars suggested by Young : Martin (1973).

In the present study, the determination of the p frequency was carried out through *uvby-β* hotometry. It is well-known (Golay 1974) that the p stars lie in a specifically defined zone in the [*m1*] [*c1*] diagram. Figure 5 has been constructed from olay's diagram. The zones of the Ap Sr-Cr-Eu and r-Cr stars have been clearly marked. The main equence has also been drawn.

From the photometric values listed in Table 4, ie unreddened [*m1*], [*c1*] indexes have been etermined for each star, and those lying within or ear the boxes of Figure 5 have been plotted. Of



ig. 5. [*c1*]–[*m1*] diagram from Golay (1974) utilized to etermine the peculiar stars in the direction of NGC 1342. arge dots indicate stars of high probability of members- ip to the cluster.

the five stars inside the box of the Sr-Cr-Eu stars (H24, 19, 21, 27 and 30) the following, H24, 19, 21 and 27, have been established as cluster members. Of them, the membership probability found for 27 is high, 0.96. Regarding H24, both Francic's and the present paper's probabilities indicate it to be a cluster member. Of the remaining two, 19 and 21, both Francic and the present paper's results assign a high probability of membership.

We have determined the following: out of 25 B, A and F member stars, four have been determined photometrically to belong to the Ap class. The ratio 0.16 is higher than that given by the previous studies of Young & Martin (1973) and of Hartoog (1976), but it must be kept in mind that unlike these authors this ratio was evaluated only with the member stars. However, if the whole sample of BAF stars observed (45 objects) is considered, the ratio of the photometrically determined Ap stars (5 stars) to the whole sample is 0.11. It should be kept in mind that the whole sample of stars with (B–V) less than 0.45, corresponding to stars of spectral class earlier than F5 in the list of Hoag et al. (1961), was observed in the Stromgren System. If the photographic photometry is considered in the same reference, only two stars were missing. Hence, the search for Ap stars in the direction of NGC 1342 was practically exhaustive.

6. CONCLUSIONS

It can be concluded that the results presented in the current study on NGC 1342 are in agreement with the previous determinations of membership by Francic (1989). It can also be concluded that the cluster is constituted by a fairly large number of early type stars. Distance and reddening have been determined for each star and from them the mean values of distance of 530 ± 118 pc and reddening E(b–y) of 0.297 ± 0.112, respectively have been suggested for the cluster. Temperatures determined of the hottest stars along with their luminosities compared with the models, have yielded for NGC 1342 an age of 4.0 × 10^8 yr.

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