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CEPHEIDS IN GALACTIC CLUSTERS. IV. DL CAS IN NGC 129

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ABSTRACT

Light-curves in three colors have been measured photoelectrically for DL Cas, a cepheid which is a member of the galactic cluster NGC 129. Photometric data are given for 192 stars in the cluster area. The obscuration is not uniform across the cluster, but the average reddening in the vicinity of DL Cas is $E_{B-V} = 0.53$ mag. The true modulus of the cluster is derived to be $m - M = 11.0 \pm 0.15$ mag. The cluster is therefore at a distance of 1590 ± 220 parsecs in the direction of $l = 88°$, $b = -2°$. The cepheid DL Cas is found to have a period of 8.000 days; an amplitude of $\Delta V = 0.58$ mag.; mean normal color indices of $(B - V)_0 = 0.71$ and $(U - B)_0 = 0.47$ mag.; and mean absolute magnitudes of $\overline{M}_B = -2.91$ and $\overline{M}_V = -3.62$ mag.

In Paper II of the present series, Kraft (1958) has shown that the cepheid DL Cas has the appropriate radial velocity and luminosity class to be a member of the galactic cluster NGC 129. The present paper presents the photometric results on the cepheid and the cluster and increases to three the cepheids with precisely known luminosities and colors (Papers I, III [1958], and this paper of the present series). Work is now in progress on the cepheids CE Cas a and b, CV Mon, AO CMa, XZ CMa (recently indicated by Kraft as a possible member of a cluster), and the clusters believed to be associated with them, as well as a suspected cepheid in NGC 2355 (A. Brun, private communication). Final results for these remaining cepheids in galactic clusters will be published as part of the present series as they become available.

I. COLOR-MAGNITUDE DIAGRAM

a) Photoelectric Measures

During the 1957 observing season, 26 stars were measured photoelectrically in the region of NGC 129. The measures of these stars are listed in Table 1, and the stars are identified in Figure 1 by letters. These original photoelectric measures were made with the same techniques as those described in Paper III. Upon completion of the investigation, however, it was found that the reddening values exhibited a larger range than did the errors of measurement. Also, there was only one star with a known spectral class, No. C, that was near enough to the main sequence that the derived spectroscopic and three-color reddening could be cross-checked. Therefore, in order to gain more certain knowledge of the reddening, the additional stars listed in Table 1*a* were measured during the 1958 season. The ultraviolet filter had been changed in the interim from a Corning 5840 to the standard Corning 9863 and these later measures are now exactly on the Johnson-Morgan *U*, *B*, *V* system without the minor qualification noted in Paper III. At the same time, Kraft obtained spectra for three of the additional main-sequence B stars (24, 61, and 121) listed in Table 1*a*.

b) Photographic Observations

Two plates each in ultraviolet, blue, and visual wave lengths were taken of NGC 129 with the 60-inch telescope diaphragmed to 32 inches. The plate and filter combinations were 103*a*-O + UG2 (*U*), 103*a*-O + GG13 (*B*), 103*a*-D + GG11 (*V*).

The plates were measured with the iris-diaphragm Eichner photometer at the Cali-

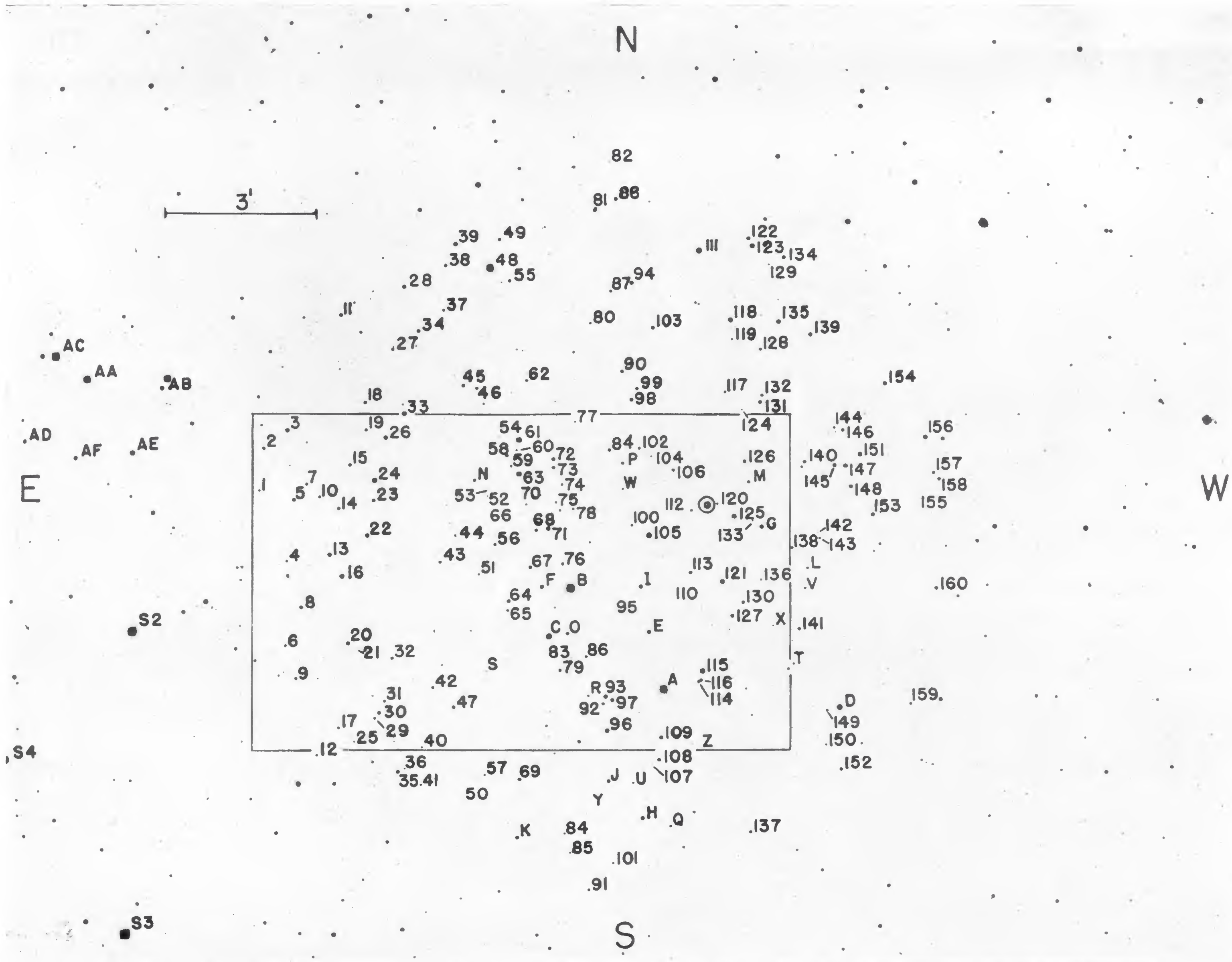

FIG. 1.—The galactic cluster NGC 129. The plate is blue-sensitive, 103*a*-O plus a GG13 filter. DL Cas is circled. The region inside the rectangle is called region 1, the remaining area is called region 2. Photoelectrically measured stars are identified by letters, and photographically measured stars are identified by numbers. Star AC was previously designated as S1 in Paper II.

TABLE 1

PHOTOELECTRIC STANDARDS IN NGC 129

Star	Photoelectric Values				Photographic Values			Region*	Spectra (Kraft)
	V	*B−V*	*U−B*	*n*	*V*	*B−V*	*U−B*		
A........	8 85	0.96	+0.67	9	8.84	0 94	+0.70	1	F5 I*b*
B........	9 26	0.44	− .17	5	9.30	0.41	− .19	1	F6 V non-member
C........	10.91	0.42	− .08	3	10.88	0.43	− .08	1	B6 III–IV
D........	11.12	0.33	+ .19	1	11.18	0.31	+ .16	2	....
E........	12.58	0.41	+ .09	1	12.59	0 43	+ .04	1	....
F........	12.76	0 46	+ .14	1	12.80	0 48	+ .16	1	....
G........	12.81	0.62	+ .07	2	12.76	0.58	+ .16	1	
H......	12.84	0.52	− .06	1	12.86	0 49	− 07	2	....
I........	12.88	0 37	− .11	1	12.88	0.37	− .14	1	....
J.	13.13	0 54	+ .04	1	13 12	0.51	− .05	2	....
K........	13.71	0.59	+ .29	1	13 64	0.59	+ .13	2	....
L........	13.93	1.55	....	1	13.85	1.66	....	2	....
M........	13.99	0 83	+ .24	1	13 99	0.57	+ .35	1	....
N........	14.01	0 46	+ .28	1	14.00	0 56	+ .17	1	....
O........	14 08	0 46	+ .36	1	14.09	0.53	+ .32	1	....
P........	14.33	0.63	+ .54	1	14.34	0.55	+ .52	1	....
Q........	14.58	0 74	+ .60	1	14.56	0.84	+ .46	2	....
R........	14 61	0.90	+ .18	1	14.64	0.88	+ .26	1	....
S........	14.74	1.59	+ .80	1	14.68	1.68	....	1	....
T........	14.77	1.69	....	1	....	....	....	2	....
U........	14.92	0.80	....	1	14.86	0.84	+ .71	2	....
V........	15.01	0.67	+ .43	1	15 04	0.58	+ 50	2	....
W	15.22	0.70	+ 45	1	15.32	0.60	+ .46	1	....
X........	15 27	0.84	+0.85	1	15.20	0.89	+0 87	2	....
Y........	15.96	1.38	....	1	15.96	1.38	....	2	....
Z........	16.40	1.17	....	1	....	....	....	2	....

* Region 1. Star is inside rectangular area marked in Fig. 1; region 2: star is outside rectangular area marked in Fig 1.

TABLE 1*a*

SUPPLEMENTARY PHOTOELECTRIC MEASURES IN NGC 129

Star	*V*	*B−V*	*U−B*	*n*	Spectra (Kraft)
AA......	8.57	1.92	+2.15	2	K2 I*b*
AB......	8.71	1.76	+2.15	2	M0 II*p*
AC......	10 01	0.14	−0.16	1	B9 V non-member
AD......	12.36	1.95	+2.32	1	....
AE......	12.37	0.35	−0.09	1	....
AF......	13.54	0.76	+0.25	1	....
24......	11.77	0.38	−0.13	1	B6 V
61......	11.71	0.34	−0.17	2	B5 V
63......	11.87	0.39	−0.07	2	....
105......	11.14	0.35	−0.16	2	....
121......	12.15	0.43	0.00	2	B7 V
125......	11.79	0.40	−0.13	2	....

fornia Institute of Technology, and the 26 stars measured photoelectrically were used as standards in plotting calibration-curves to determine the magnitudes of the unknown stars. The V, $B - V$, and $U - B$ magnitudes of the 160 stars which were measured photographically are listed in Table 2 and identified in Figure 1. The probable errors of the magnitudes in this table are ± 0.031 for the ultraviolet, ± 0.033 for the blue, and ± 0.029 for the visual.

The magnitudes and colors of the 26 photoelectric standards were read back through the photoelectric calibration-curves. The mean magnitudes determined in this way are listed in the right-hand columns of Table 1. The residuals of these values from the photoelectric values show no dependence on either V or $B - V$. Therefore, there is no magnitude or color equation between the photoelectric and photographic results, and all magnitudes are on the U, B, V system to within the accuracy of the measurements.

When the color-magnitude diagram for the original 160 stars was plotted, it was found that stars contained within the approximate rectangle shown in Figure 1 defined a more exact main sequence than did those outside this area. It is noted later that the stars in the southern area of the cluster show much higher reddening values than in the central and eastern positions. It is not clear whether they are non-members of the cluster or whether these outer stars are just more heavily reddened members. Since it makes no difference to the calibration of the cluster, however, a clearer picture of the cluster was obtained by restricting the plotted stars to the rectangle of Figure 1.

c) The Color-Magnitude Diagram

Figure 2 shows the colors and magnitudes of all stars within the rectangular region 1 of Figure 1. Only photographically determined values have been used, except for DL Cas, where photoelectric colors and magnitudes have been plotted to show the excursion of this cepheid in the color-magnitude plane. Although the bright star No. B at $B - V = 0.44$ and $V = 9.26$ is not a member, because of its luminosity class, it is apparent that the majority of the remaining stars form a galactic-cluster color-magnitude diagram of which the cepheid is a member. The next step is to derive the interstellar reddening in front of the cluster and to determine whether the spread off a narrow main sequence is due to non-homogeneous reddening.

d) Two-Color Diagram

The two-color diagram for the stars in Figure 2 is shown in Figure 3. It is clear that the majority of these stars define a single sequence and that this normal main sequence has been reddened by about $E_{B-V} = 0.53$ mag.

Star No. A (F5 I*b*) and DL Cas fall below the two-color curve for main-sequence stars, as is normal for luminosity class I*b* stars. A few stars show large scatter from the curve in Figure 3. These might be cluster stars which are somewhat more heavily reddened than the average of the cluster. Since they lie close to an unreddened main-sequence line, however, they might also be unreddened or little-reddened foreground stars. For the purposes of this paper it would not seem profitable to obtain the spectra necessary to make this decision.

e) Reddening Correction

The main-sequence or nearly main-sequence cluster members for which both photoelectric measures and spectra are available are listed in Table 3. The agreement between reddening values obtained by the three-color photometry, on the one hand, and the spectral type-apparent color index, on the other, is excellent. The different amounts of reddening found for different stars would seem to be significant when larger than a few hundredths of a magnitude and is probably due to differential reddening across the cluster. A plot of the color excesses of individual stars across the face of the cluster shows

TABLE 2

STARS MEASURED PHOTOGRAPHICALLY IN NGC 129

Star	V	$B-V$	$U-B$	Region*	Star	V	$B-V$	$U-B$	Region*
1	14.90	0.84	+0 54	1	63	11.88	0.43	−0.12	1
2	14 28	0.49	+0 33	1	64	13.30	0.63	− .02	1
3	13 04	0 66	+0.08	1	65	14.86	0.61	+ .51	1
4	13.88	1 79	+1.29:	1	66	14.58	1.58	....	1
5	13.75	0 44	+0 39	1	67	13.36	0.59	+ .31	1
6	14.85	0.70	+0.49	1	68	14.00	0.50	+ .34	1
7	14 48	0.45	+0.38	1	69	14.08	0.50	+ .51	2
8	13.76	0.49	+0.23	1	70	15 20	0.73	+ .55	1
9	14.46	0.64	+0 44	1	71	12.32	0 39	− .07	1
10	14.86	0.44	+0.24	1	72	13.34	0 46	+ .12	1
11	13 13	1.40	+0.65	2	73	13.74	0.59	+ .20	1
12	14.82	0 84	+0.54	2	74	14.88	0.65	+ .47	1
13	12.72	0 79	+0.18	1	75	13.74	2 08	+ .67	1
14	14 15	0.42	+0.26	1	76	14.45	0.51	+ .41	1
15	14 22	0.57	+0.36	1	77	15.02	1.17	+ .77:	1
16	12 38	0 37	0.00	1	78	14.70	0.57	+ .59	1
17	14.86	0.66	+0.46	1	79	14.20	0.51	+ .46	1
18	14.00	0.45	+0.33	1	80	14.08	1.69	....	2
19	14.50	0.33	+0.09	1	81	13.21:	0.54:	+ .45:	2
20	12.69	1.09	+0.83	1	82	13.36:	1.13:	+ .82:	2
21	15.26	1.75:	....	1	83	15.66:	0.79:	....	1
22	12.96	0.43	+0 04	1	84	14.92	0.91	+ .08	2
23	13.75	0.50	+0.25	1	85	15.16	0.91	+ .47	2
24	11.74	0.45	−0 17	1	86	14.32	0.49	+ .49	1
25	15.39	0.67	+0.50:	2	87	14.34	0.59	+ .47	2
26	12.81	0.42	−0.11	1	88	13.47	0.53	+ .30	2
27	14.44	0.45	+0.41	2	89	13.90	0.47	+ .37	1
28	13.66	0 49	+0.40	2	90	13.52	0.87	+ .17	2
29	14.50	0.93	+0.16	1	91	14.50	0.74	+ .42	2
30	13 76	0.49	+0 37	1	92	14.23	0.54	+ .41	1
31	14.24	0.93	+0 25	1	93	12.50	0.43	− .09	1
32	14.46	0 55	+0 40	1	94	13.22	0.30	+ .16	2
33	12.55	0 42	−0.03	1	95	15.43	1.56:	....	1
34	13.86	0 53	+0.41	2	96	12.35	0.44	− .13	1
35	13 57	0.60	+0.17	2	97	13.10	0.49	− .03	1
36	15.18	1.03	+0 41	2	98	13.14	0.73	+ .09	2
37	14.68	0.42	+0.58	2	99	13.13	1.32	+ .91	2
38	14.34	0.49	+0.41	2	100	14.84	0.65	+ .51	1
39	12.48	0.37	+0.01	2	101	14.86	1.10	+ .26	2
40	14 88	1.07	+0.24	2	102	14.39	0.74	+ .19	1
41	15 05	0 96	+0.18	2	103	13.80	0.34	+ .35	2
42	14.44	0.62	+0 40	1	104	15.56	0.81	+ .46:	1
43	14 54	0 65	+0.55	1	105	11.20	0.35	− .19	1
44	14.98	1 01	+0.83	1	106	14.08	0.61	+ .43	1
45	13.94	0 35	+0.37	2	107	14.86	2.02	....	2
46	14.49	0 37	+0.44	2	108	13.16	0.73	+ .13	2
47	13.65	0.52	+0.06	1	109	13.03	0.52	+ .23	1
48	9 68	0.31	−0.02	2	110	15.52:	1.57	....	1
49	13.82	0.73	+0.41	2	111	10.88	0.53	+ .32	2
50	15.44	1.71:	....	2	112	15.02	0.72	+ .47	1
51	15 33	0 76	....	1	113	13.86	0.41	+ .47	1
52	15.74	0 75	....	1	114	14.03	0.46	+ 49	1
53	15.14	1.90	....	1	115	11.44	0.79	+ .11	1
54	15.72	1.08	....	1	116	13.96	0.23	+ 49	1
55	14 00	0 46	+0 37	2	117	14 61:	0.57	+ .48	2
56	14 26	0 99	+0 35	1	118	11.88	0 56	+ .49	2
57	14 81	1.10	+0 33	2	119	13 78	2.13	....	2
58	13 78	0 41	+0.16	1	120	14.93	0.56	+ .51	1
59	14 54	0 73	+0 55	1	121	12 14	0.45	− .09	1
60	15 29	0 68	+0.59	1	122	13.20	0.61	+ 18	2
61	11.74	0.40	−0 24	1	123	11.96	0.35	−0.13	2
62	14 30	0 44	+0 47	2	124	14.70	1.53	....	2

* See note to Table 1 for description of region designation.

TABLE 2—*Continued*

Star	V	$B-V$	$U-B$	Re-gion*	Star	V	$B-V$	$U-B$	Re-gion*
125.......	11.82	0.39	−0.14	1	143.......	14.56	0.95	+0.29	2
126.......	13.58	0.43	+ .16	1	144.......	14.56	0.94	+ .36	2
127.......	13.28	0.45	+ .01	1	145.......	13.18	0.44	+ .07	2
128.......	13 92	0.64	+ .19	2	146.......	14.14	0.30	+ .37	2
129.......	14.72	1.60	....	2	147.......	12.88	0.26	+ .06	2
130.......	13.74	0.53	+ .35	1	148.......	13.18	0.25	− .03	2
131.......	13 24	0.45	+ .13	2	149.......	14.38	0.94	+ .56	2
132.......	14.32	0.52	+ .48	2	150.......	14.08:	1.66	+ .47	2
133.......	15.56	0.63	+ .62:	1	151.......	12.07	0.34	− .19	2
134.......	13.78	0.28	− .22	2	152.......	12.73	1.38	+ .85	2
135.......	12.52	0.35	+ .05	2	153.......	12.82	0.46	+ .06	2
136.......	15.34	0.72	+ .71	1	154.......	13.05	0.12	+ .11	2
137.......	14.16	0.55	+ .33	2	155.......	14.58	2.48	....	2
138.......	14.46	0.76	+ .50	2	156.......	12.52	0 32	+ .35	2
139.......	12.57	0.77	+ .41	2	157.......	14.20	0.31	+ .13	2
140.......	13.26	0.79	+ .28	2	158.......	13.58	0.67	+ .15	2
141.......	13.74	0.57	+0.34:	2	159.......	14.28	1.03	+ .61	2
142.......	14.14	2.53	....	2	160.......	13.54	0.49	+0.11	2

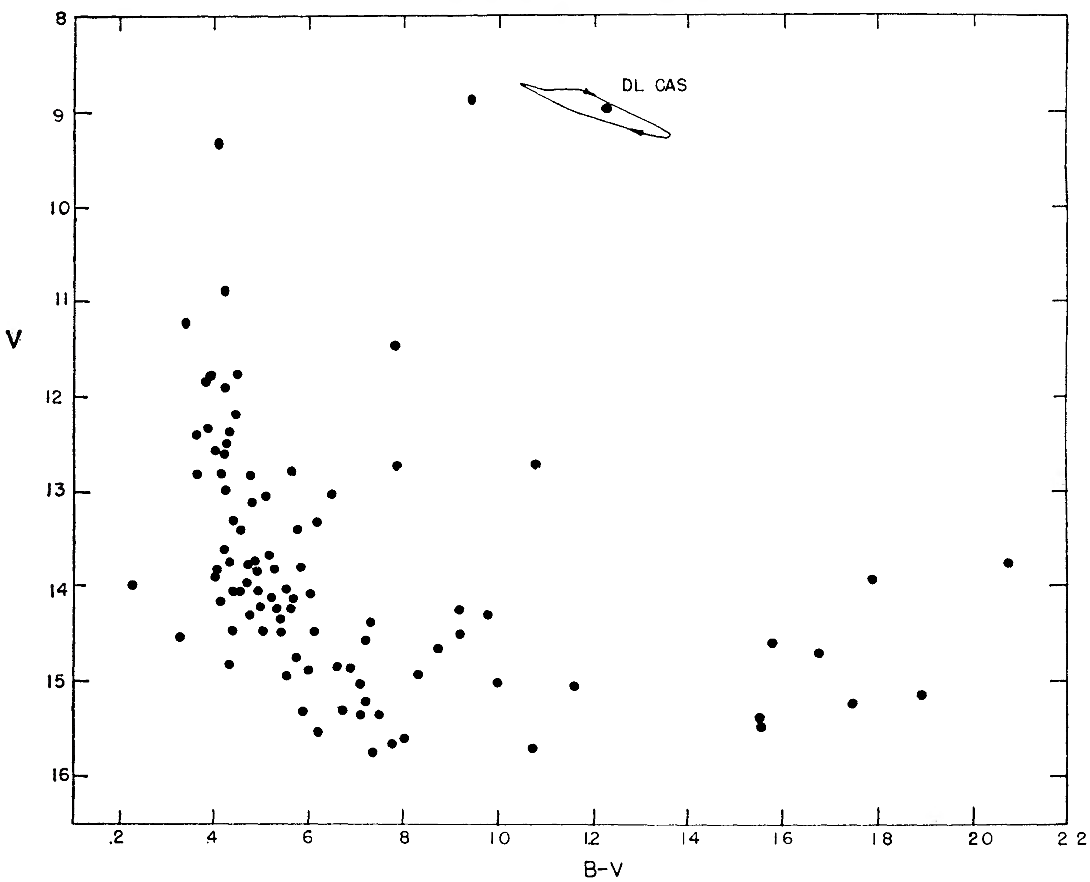

FIG. 2.—The color-magnitude diagram for all stars in the area containing DL Cas. Only stars within the rectangular region 1 in Fig. 1 are plotted. Only photographically determined values are used (except for the variable DL Cas itself, where the photoelectric measures are plotted).

that the cluster is reddened differently in different parts. Four photoelectrically measured stars near J in the southern part of the cluster give a reddening of $E_{B-V} = 0.69 \pm 0.02$ mag. As mentioned in the preceding section, these may not be cluster members, and the cluster may not occupy this region. Four stars in the northeast give $E_{B-V} = 0.50 \pm 0.02$, however, and are undoubtedly cluster members with less than average reddening. Further along in this same direction, the presumed cluster member AE is

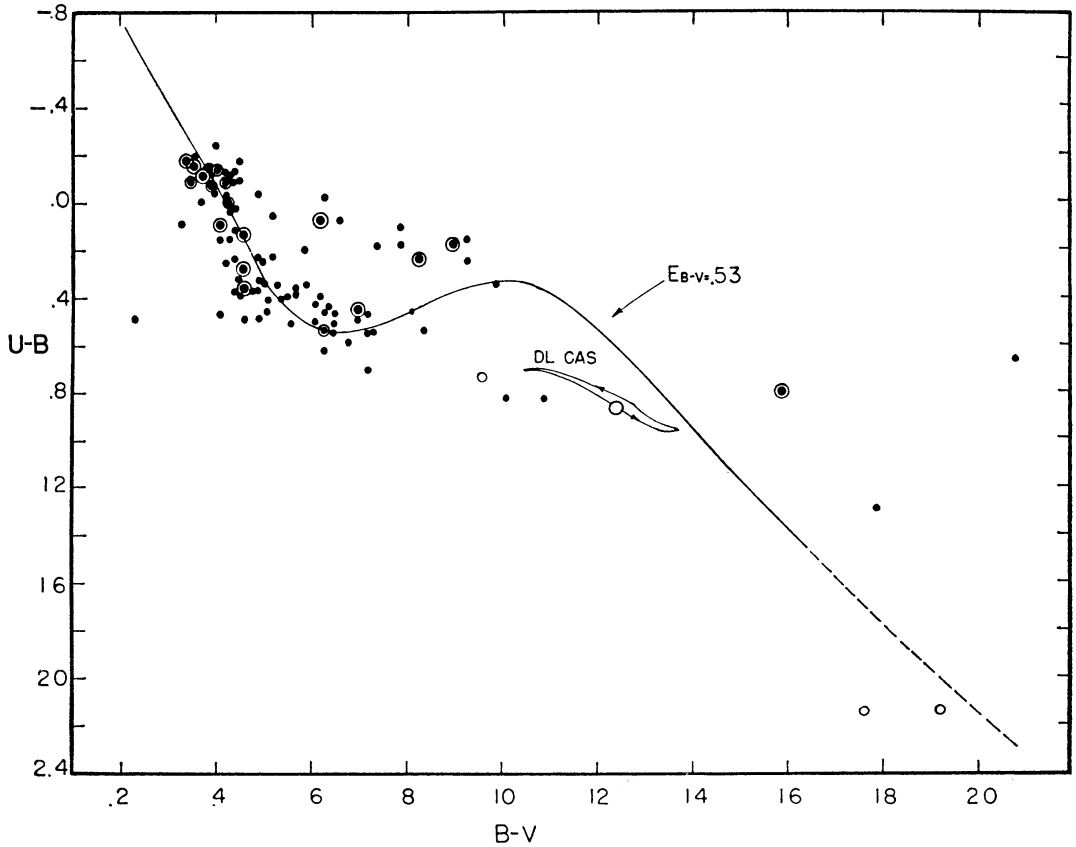

FIG. 3.—Two-color diagram for NGC 129. Only stars within region 1 are plotted, plus AA, AB, and AE. Large circles are photoelectric values, small circles are photographic values. Open circles are luminosity class I*b* stars. The full line represents the $U - B$, $B - V$ relation for main-sequence stars reddened by $E_{B-V} = 0.53$, $E_{U-B} = 0.40$. The dashed line is an extension to the red for luminosity classes I–III. The open circle and loop show the mean place and the excursion of DL Cas. The standard $U - B$, $B - V$ relation has been modified slightly to compensate for the non-standard Corning 5840 used in the $U - B$ in the 1957 data of the present investigation.

TABLE 3

REDDENING DETERMINED BY COLORS AND SPECTRA

STAR	E_{B-V} Two-Color	E_{B-V} Spectra	STAR	E_{B-V} Two-Color	E_{B-V} Spectra
24	0.53	0.53	121	0.55	0.56
61	.49	0 50	125	.54	....
63	.52	....			
105	0.50	....	C	0.56	0.56

even less reddened, with $E_{B-V} = 0.48$ mag. In any case, seven stars in the region of DL Cas itself give $E_{B-V} = 0.53 \pm 0.01$ mag. It is clear that this is the appropriate value to use for the cepheid DL Cas as well as for the majority of the NGC 129 stars.

Since three colors have been measured for all the stars here, however, it is possible to remove the reddening of each individual star. In addition, by restricting ourselves to stars in Figure 3 which are within ± 0.1 mag. in $B - V$ or ± 0.2 mag. in $U - B$ of the

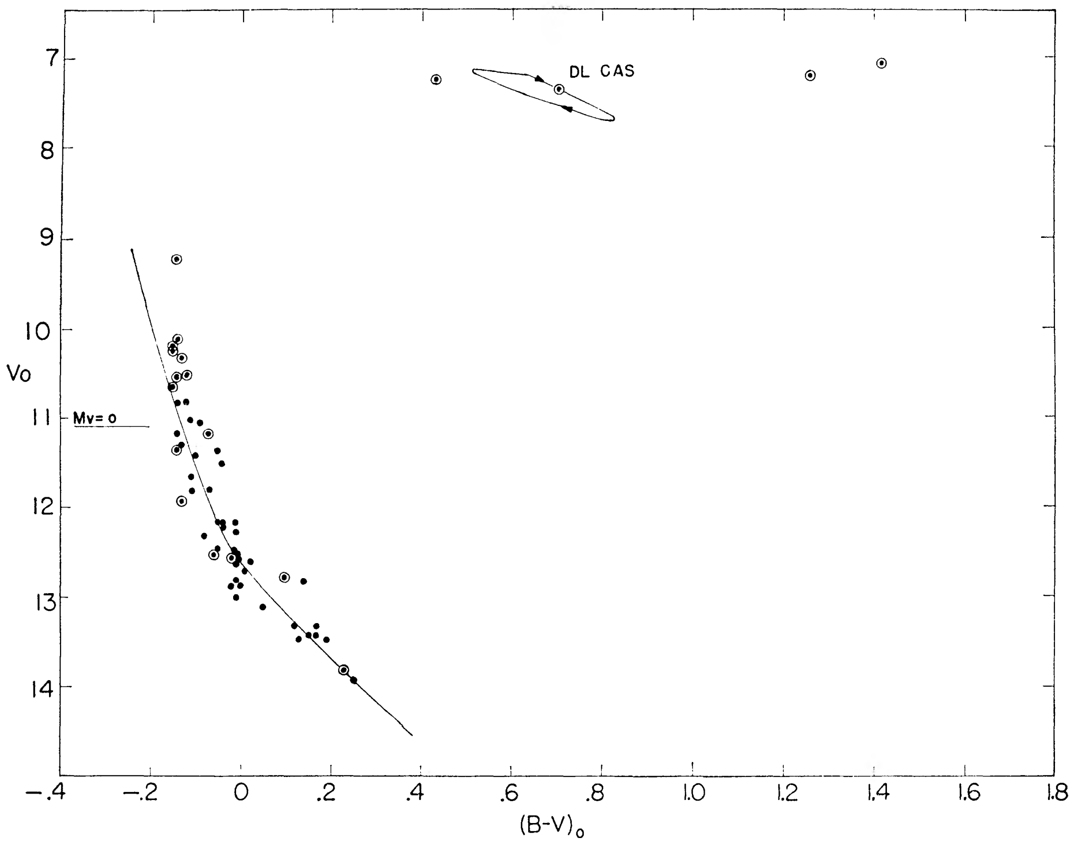

FIG. 4.—The color-magnitude diagram for NGC 129. Individual reddening and absorption corrections have been made for each star by using the measured $U - B$, $B - V$ values. Only stars from within the rectangular region are plotted, plus AA, AB, and AE. The small circles are photographically determined values; the large circles are photoelectric values. In the case of the I*b* stars (AA, AB, DL Cas, and A), reddening corrections have been taken as equal to that given by the nearest stars in their immediate vicinity.

mean line, it is possible to obtain stars which are almost exclusively cluster members. The usual reddening and absorption corrections have been used (Johnson and Hiltner 1956):

$$\frac{E_{U-B}}{E_{B-V}} = 0.72 + 0.05 E_{B-V} ,$$

$$A_V = 3.0 E_{B-V} .$$

f) The Final Intrinsic Color–Apparent Magnitude Diagram

The result of applying individual reddening and absorption corrections to each of the catalogued stars is shown in Figure 4. In that figure, star B, which is spectroscopically a non-member, has been omitted, and the two late-type supergiants, which are possible members of the cluster, have been included. The resulting color-magnitude diagram is the best representation of the cluster that can be obtained.

g) Fitting the Age-Zero Main Sequence

The color-magnitude diagram in Figure 4 enables a very accurate fit to be made to the age-zero main sequence. Using that main sequence as determined by Johnson and Hiltner (1956) and Sandage (1957) yields a fit of $(m - M)_0 = 11.1$ mag. In order to obtain as independent a check as possible on this fit, the age-zero main sequence was fitted to the raw data of Figure 2 by applying a mean reddening correction of $E_{B-V} = 0.53$ to the main sequence. The derived apparent modulus was then corrected for an absorption of $A_V = 1.59$, and a true modulus of $(m - M)_0 = 10.9$ mag. was obtained. This second method is equivalent to the first but enables a fit to be made to a different distribution of points. Therefore, an estimate can be made of the fitting accuracy, which is useful because this is the major source of inaccuracy. A simple average has been taken of these two values, and the true modulus of $(m - M)_0 = 11.0$ has been adopted. It is estimated that this modulus is accurate within ± 0.15 mag.

h) The Ib Stars

Four supergiant I*b* stars are candidates for membership in NGC 129. They are, in order of blueness, A, DL Cas, AB, and AA. Such stars are rare, and few clusters are rich enough to contribute large numbers of them in a given color-magnitude diagram. Therefore, it is of considerable interest to find as many as possible in any given cluster, check their membership, and build up a picture of the appearance of the giant-branch sequence at these luminosities.

There appears to be no question of the membership of DL Cas and A because they are near the cluster center and their velocities are almost exactly that of the average of the cluster stars (Kraft 1958). The two late-type supergiants, however, fall rather far from the cluster, and their velocities are somewhat discordant: -4 and -24 km/sec compared to an average velocity of -15 km/sec. In favor of the pair being cluster members is the fact (1) that they are both high-luminosity stars, which are rare; (2) that the rectangular area found best to define the cluster extends in their direction; (3) they have about the right amount of reddening; and (4) they fall approximately in the expected place in the color-magnitude diagram.

In all, it seems likely that at least the *K*2I*b* star is a member of the cluster. Unless they are radial-velocity variables (Abt 1957), however, their discrepant velocities would predict that in the age of the cluster, 8×10^6 years, they should have arrived about 80 parsecs from the center. This distance is large compared to their present projected distance from the center, which is about 5 parsecs.

II. THE CEPHEID DL CAS

Table 4 lists all the points observed photoelectrically on the light-curve of DL Cas. In the usual manner of measuring differentially from a local standard, star B was always measured either before or after DL Cas, and the correction needed to bring B to its adopted value was applied to the cepheid. The accurate light-curve resulting from this technique is shown in Figure 5.

The period derived from the present observations is 8.000 ± 0.004 days. This agrees with the published period of 8.0003 days (T. S. Meshkova, as quoted by Kukarkin, Parenago, *et al.* 1958). The cepheid can be classified as Eggen type B (Eggen, Gascoigne, and Burr 1957), although these classifications are probably of uncertain significance at present. To find the mean values of V, $B - V$, and $U - B$, the light-curves in each wave-length region were transformed to an intensity scale, planimetered, and the magnitude at mean intensity was obtained.

TABLE 4

PHOTOELECTRIC OBSERVATIONS OF DL CAS

Heliocentric JD 2436+	Phase*	V	$B-V$	$U-V$
051.840	0.230	8.65	....	....
108.833	7.354	8.78	1.14	0.77
121.014	8.877	9.24	1.37	.98
121.613	8.952	9.21	1.32	.93
121.954	8.994	9.15	1.28	.85
121.960	8.995	9.14	1.29	.84
128.643	9.830	9.19	1.36	.96
129.790	9.974	9.20	1.29	.89
130.624	10.078	8.96	1.17	.79
130.901	10.113	8.89	1.13	.73
135.605	10.701	9.04	1.30	.93
219.628	21.204	8.68	1.04	.72
220.631	21.329	8.78	1.11	.71
221.627	21.454	8.78	1.20	.80
221.756	21.470	8.82	1.19	.85
222.614	21.580	8.91	1.24	.84
223.623	21.703	9.05	1.29	.94
226.625	22.078	8.96	1.18	.75
227.620	22.203	8.68	1.04	0.70

* Phase computed from epoch at heliocentric JD 2436050.000

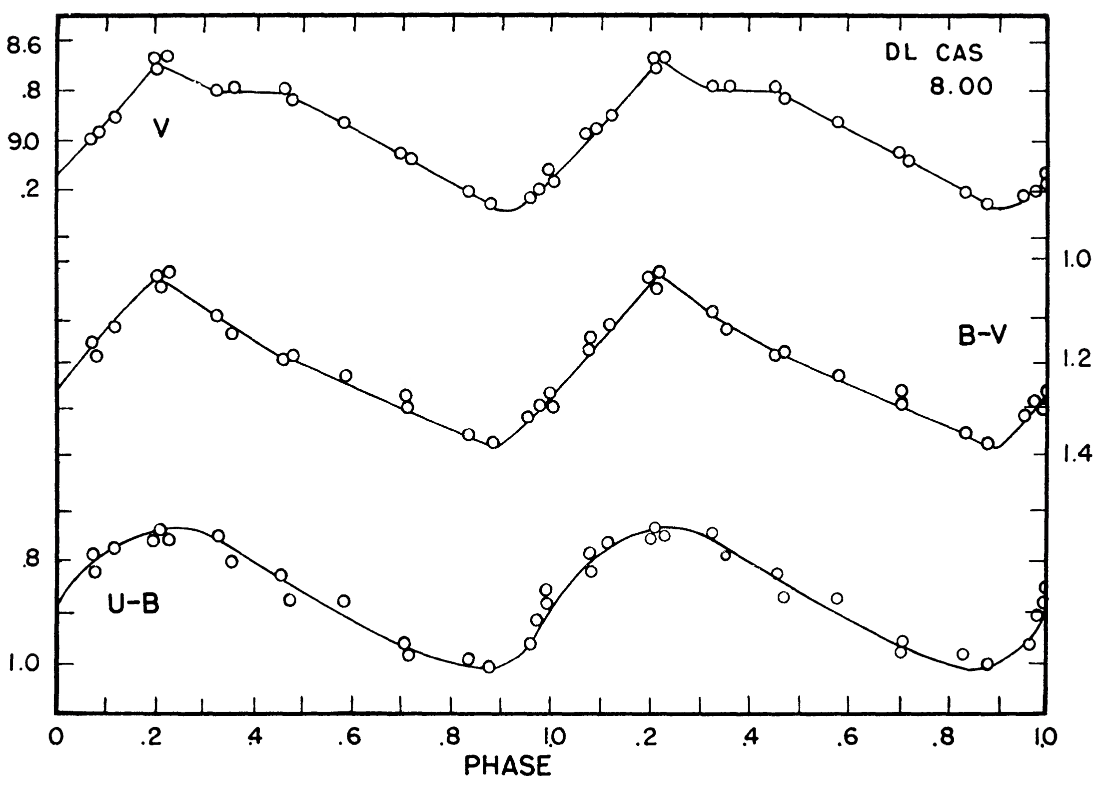

FIG. 5.—Light- and color-curves for the cepheid DL Cas

The final values for the cepheid are collected in Table 5. In the properties of absolute magnitude, intrinsic color, and amplitude of light-variation, DL Cas seems to be an intermediate or average cepheid. The final comparison, however, between DL Cas and the other cepheids in galactic clusters will be made in the final paper of this series.

TABLE 5

PHOTOELECTRIC PARAMETERS FOR DL CAS

	Max.	Min.	Mean	Amplitude
V	8.69	9.27	8.97	0.58
$B-V$	1.05	1.37	1.24	.32
$U-B$	0.70	0.98	0.87	.28
V_0*	7.10	7.68	7.38	.58
$(B-V)_0$*	0.52	0.84	0.71	.32
$(U-B)_0$*	0.30	0.58	0.47	.28
M_V†	−3.90	−3.32	−3.62	.58
M_B†	−3.38	−2.48	−2.91	0.90

* E_{B-V} = 0 53; E_{U-B}=0.40; A_V=1.59.
† $m-M_{\text{true}}$ = 11.0.

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