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Observed radii and structural parameters of clusters in the SMC

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Summary. — The structural parameters of 20 star clusters of different types in the SMC have been obtained by means of star counts. Tidal and core radii of the clusters have been found and their masses are calculated. The derived masses are found to be about 10 times smaller than those in our Galaxy. The concentration parameters of the « red » clusters are comparable to values found in globular clusters of our own Galaxy, whereas the « blue » clusters do not appear similar to open clusters, showing globular cluster dynamical behaviour.

Key words : Galaxies — Clusters (globular) — Magellanic clouds.

1. **Introduction.** — Star counts have long been a very useful tool for studying the dynamical properties of star clusters. In a series of papers (King, 1962, 1966a, 1966b; King *et al.*, 1968; Peterson and King, 1975; Peterson, 1976) star counts for many clusters of our Galaxy have been compared with theoretical models in order to derive their structural parameters, such as limiting radii and concentration classes.

King (1962, 1966a) has shown from theory and observations that three parameters are needed to describe the structure of a cluster : a core radius (r_c), a limiting radius (r_t) and a richness factor (k). The core radius is determined by the internal energy of the system while the limiting radius is set by external tidal forces. The above theory seems to fit best the globular clusters whereas for the open clusters it is satisfactory assuming that the potential field is produced by a group of stars of all types having the same distribution. In some old open clusters of our Galaxy it is tested and King's models fit quite satisfactorily.

Freeman and Munsuk (1972) have used the above theory to derive the masses and dynamical properties of globular clusters in the Large Magellanic Cloud (LMC). The blue globular clusters found in the LMC, studied by Freeman (1974), appear to be similar dynamically to old galactic clusters. This result is interesting because these clusters are not old enough to have relaxed in the usual way.

In this paper, a dynamical study by means of star counts of old and young clusters of the Small Magellanic Cloud (SMC) has been started assuming that the structure of these clusters is described by King's models (1962). The aim of this project is to derive the concentration classes and masses of the SMC clusters and compare them with the values found for clusters of our own Galaxy.

2. **The observational material.** — The photographic plates used were obtained from the 1.2 m U.K. Schmidt Telescope in Australia, scale 67″ per mm, on IIIaJ emulsion, reaching about $21^{\mathrm{m}}.5$ limiting magnitude, and from the Anglo-Australian 3.8 m telescope, scale $15''.3$ per mm, reaching about $21^{\mathrm{m}}.5$ on IIaD emulsion and $22^{\mathrm{m}}.5$ on IIaO emulsion.

The star counts were obtained either on the screen of an irisphotometer for the Schmidt plates or by placing a square reseau on the original AAT plates and examining the plates under a binocular microscope.

A very good film copy of the original Schmidt plate was measured by placing a circular concentric reseau on the screen of an irisphotometer at the Laboratory of Astrophysics of the University of Athens. The radial separation of the annuli was determined by the star density around each cluster.

The counts on the two original AAT plates were carried out on a light-table by placing a square reseau with separation of 0.32 arcmin. at the Royal Observatory, Edinburgh. The area counted was a square of side 3.23 arcmin. Each reseau was centered on the cluster by eye. Counts of the clusters were made by all three authors. Intercomparison of the counts for the clusters in common has shown very good agreement.

For each cluster a diagram (N/A *vs.* r) was produced, where N/A is the number of stars per unit area in the ring of radial distance r, from the centre. From these diagrams the background level, b, was defined for each cluster and therefore the values, f, of the ring densities. In table II, the values of f for the rings with an asterisk, considered as representing the background fluctuation, were not entered in the calculation of r_t.

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The counting errors due to crowding toward the central areas of the clusters, or due to the smallest accepted image, were unavoidable, and sometimes a correction for crowding is needed. The empirical formula given by King *et al.* (1968) is :

$$\delta(\log f) = 0.429(\log f + \log a + 1.735) + 0.15\log(s/67.1) \qquad (1)$$

where a is the area of a stellar image in square minutes (this value is 0.00042 sq. min. for the AAT plates and 0.00020 sq. min. for Schmidt plates), and, s is the plate scale in seconds of arc per millimeter (Table I).

The measured plates and the corresponding telescopes are listed in table I :

TABLE I.

Plate no.	Telescope	Aperture scale (″/mm)	Emulsion
(1) J1877	Schmidt	1.2 m 67″	IIIaJ
(2) 1536	Anglo-Australian	3.8 15″.3	IIaO
(3) 1571	Anglo-Australian	3.8 15″.3	IIaD

The resulting radial densities are derived as defined by King (1962). The results of the star counts are given in table II.

Each part of this table gives : the cluster name and plate characteristics (number and emulsion) in the first line. The second line gives the adopted background density per sq. min. and the radial unit of each reseau in arcmin. In column (1) the inner and outer radii are given in reseau units of each concentric ring. The total number of stars counted in that ring (cluster and field stars) are listed in column 2. Columns 3 and 4 give log r and log f where r is the radius in arcmin. and f the stellar density per sq. min. of each ring. Column 5 shows the statistical mean error in log f. Finally the corrections for crowding computed from equation (1) are listed in column 6.

The surface density profiles (log f *vs.* log r) are illustrated in figures 1-20.

3. **Dynamical parameters.** — Our observational material allowed star counting far beyond the radii of the clusters and the background was certainly reached, so that r_t was calculated from the star counting (Table III).

The error in the determination of r_t depends on the number of points in the innermost area, the errors in star counting, and the background errors. It is also assumed from King's models that equipartition exists. This is very likely to be true for the old clusters for which we can observe only giant and subgiant stars. So a difference in the distribution of stars could only be seen if faint main sequence stars were detectable. Taking into account the different sources of errors the uncertainty in the derived r_t is about 15 %.

Since in most cases the counts cannot reach the innermost areas of the cluster, as is seen from the profiles of figures 1-20, the r_c (Table III) were found using the grid of King's models adopting the already known value of r_t.

Two examples of the fit of the profiles with theoretical models are illustrated in figures 21 and 22. These two figures show that the fit in the upper part of the model is uncertain due to the lack of data in the innermost areas of each cluster. For the sake of comparison with clusters of our own Galaxy in each case the values of the model below the innermost points were adopted, so the derived concentration classes are rather underestimated.

The masses are calculated from the formula :

$$\frac{M_{\mathrm{cl}}}{M_\odot} = 3.5\,M_{\mathrm{SMC}}\left(\frac{r_t}{d}\right)^3 \quad \text{(King, 1962)} \qquad (2)$$

where d is the distance of the cluster from the dynamical centre. The adopted SMC dynamical centre is the rotation centre (Brück, 1980) at $a_0 = 1^{\mathrm{h}}03^{\mathrm{m}}$ and $\delta_0 = -72^{\circ}4'$ (Hindman, 1967) and the SMC mass is $3 \times 10^9\, M_\odot$ (de Vaucouleurs and Freeman, 1972).

Provided that the observed distances are the projection of the actual ones the values of d introduced in equation (2) are the minimum, and consequently the calculated masses are maximum. In any case the distances cannot be larger than the tidal radius of the SMC ($5^{\circ}.5$; Brück, 1980) that gives the maximum limit of the masses.

Table III gives the final dynamical characteristics of each cluster. Column 1 gives the name of the cluster. In brackets the indication B or R means « blue » or « red » cluster as adopted from Brück (1975) and Kontizas (1980). Column 4 gives the number of the plate (from Table I) from which the information is taken. The derived r_t in arcmin. and pc are listed in columns 5 and 6.

The distance modulus is taken to be 19.20 mag as given by Westerlund (1974) which gives a scale of $0^{\circ}.82$ per kpc (Brück and Marsoglu, 1978). Column 7 gives the best fit value of log r_t/r_c and colum 8 lists r_c in pc. The projected distances of the clusters from the dynamical centre are given in column 9 and finally column 10 lists the mass of each cluster in solar mass units as calculated from equation (2).

From table III it is shown that the masses range from $2 \times 10^3 - 2 \times 10^5\, M_\odot$; with the exception of the cluster L15. Chun (1978) has found the mass of the very populous SMC cluster NGC41.9 to be $11.4 \times 10^4\, M_\odot$, which is again a value within the same mass range. The masses of globular clusters in our Galaxy vary from $10^4\, M_\odot$ to $2 \times 10^6\, M_\odot$ (Surdin, 1978, 1979) which are about 10 times larger than the maximum masses for the SMC.

The derived concentration parameters even underestimated, as it was explained before, seem to be comparable to those found in globular clusters of our Galaxy. Therefore our results for the « red » clusters do not give evidence of systematic differences from the typical globular clusters.

The « blue » clusters give values of concentration parameters which are larger than expected, as far as we know from the open clusters of the Milky way. Their high concentration parameters and their density curves seem to resemble characteristics of globular clusters. Freeman (1974) has reached the same conclusion as it is already mentioned, for the LMC. Similarly in a dynamical study of populous « blue » clusters of the LMC, Geyer *et al.* (1977) and Geyer and Hopp (1981) reported that their results show clearly that these « blue » clusters have real globular cluster nature.

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From all this we can suggest that in the SMC as well the « blue » clusters have globular cluster dynamical behaviour, whereas their c-m diagrams show the existence of evolutionary young stellar population (Kontizas, 1980).

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Table II(1).

L3 J1877 IIIaJ

b=165 sqmin 0.116 min

radius	stars	log r	log f	M.E.	Corr.
1 - 2	63	-0.63	2.51	0.082	0.11
2 - 3	74	-0.46	2.26	0.096	
3 - 4	79	-0.33	2.00	0.128	
4 - 5	82	-0.23	1.69	0.208	
5 - 6	93	-0.16	1.53	0.263	
6 - 7*	79	-0.09	-	-	
7 - 8*	114	-0.03	1.14	0.523	
8 - 9*	135	0.02	1.30	0.318	
9 - 10*	136	0.06	0.27		
10 - 15*	950	0.27	-	-	

Table II(2).

L6 J1877 IIIaJ

b = 90 sqmin 0.116 min

radius	stars	log r	log f	M.E.	Corr.
0 - 1	25	-0.93	2.69	0.102	0.19
1 - 2	44	-0.63	2.40	0.088	0.07
2 - 3	57	-0.46	2.25	0.086	
3 - 4	56	-0.33	1.99	0.111	
4 - 5	52	-0.23	1.66	0.177	
5 - 6	58	-0.16	1.53	0.207	
6 - 7	51	-0.09	0.36	0.560	
7 - 8	67	-0.03	1.12	0.370	
8 - 9*	75	+0.02	1.13	-	
9 - 14*	450	0.21	-	-	

L4 J1877 IIIaJ

b=259 sqmin 0.116 min

radius	stars	log r	log f	M.E.	Corr.
0 - 1	62	-0.93	3.08	0.067	0.36
1 - 2	84	-0.63	2.60	0.078	0.15
2 - 3	100	-0.46	2.32	0.096	0.03
3 - 4	123	-0.33	2.19	0.105	
4 - 5	128	-0.23	1.88	0.169	
5 - 6	138	-0.16	1.56	0.300	
6 - 7	147	-0.09	0.85		
7 - 8	167	-0.03	0.49		
8 - 9*	186	0.02	-		
9 - 10*	218	0.06	1.04		
10 - 11*	213	0.11	-		

L7 J1877 IIIaJ

b = 410 0.116 min

radius	stars	log r	log f	M.E.	Corr.
1 - 2	112	-0.63	2.67	0.076	0.18
2 - 3	152	-0.46	2.48	0.082	0.10
3 - 4	174	-0.33	2.24	0.109	
4 - 5	204	-0.23	2.08	0.131	
5 - 6	224	-0.16	1.84	0.200	
6 - 7	229	-0.09	0.66	0.400	
7 - 8	256	-0.03	0.24	0.258	
8 - 9	302	0.02	0.91	-	
9 - 10*	337	0.06	0.87	-	
10 - 12*	1126	0.18	-	-	

TABLE II(3).

L8 - Kron 3 J1877 IIIaJ
b = 13 0.46 min

radius	stars	log r	log f	M.E.	Corr.
5 - 6	190	0.36	1.25	0.054	-0.42
6 - 7	144	0.44	0.79	0.111	
7 - 8	144	0.51	0.51	0.179	
8 - 9*	134	0.57	-0.88	0.430	
9 - 10*	155	0.62	-0.39	0.225	
10 - 11*	123	0.67	-0.42	0.380	
11 - 12*	210	0.71	-	-	
12 - 13*	210	0.75	-0.378	-	
13 - 14*	220	0.78	-	-	
14 - 15*	240	0.81	-1.15	-	
15 - 16*	255	0.43	-	-	
16 - 17*	272	0.87	-	-	

L8 - Kron 3 1536 IIaO
b = 55 0.32 min

radius	stars	log r	log f	M.E.	Corr.
2 - 3	381	-0.01	2.24	0.029	0.16
3 - 4	457	0.11	2.15	0.028	
4 - 5	412	0.21	1.92	0.035	
5 - 6	398	0.29	1.74	0.044	
6 - 7	356	0.36	1.44	0.068	
7 - 8	382	0.41	1.34	0.115	
8 - 9	373	0.46	1.07	0.129	
9 - 10*	410	0.55	1.02	0.134	

TABLE II(4).

L8 - Kron 3 1571 IIaD
b = 24 0.32 min

radius	stars	log r	log f	M.E.	Corr.
0 - 1	100	-0.49	2.45	0.047	0.26
1 - 2	260	-0.19	2.38	0.030	
2 - 3	290	-0.01	2.18	0.029	
3 - 4	284	0.11	2.00	0.032	
4 - 5	187	0.21	1.59	0.051	
5 - 6	155	0.29	1.27	0.079	
6 - 7	142	0.36	0.97	0.132	
7 - 8	160	0.41	0.92	0.133	
8 - 9*	131	0.46	-		
9 - 10*	151	0.55	-1.0		

L11 1536 IIaO
b = 70 0.32 min

radius	stars	log r	log f	M.E.	Corr.
0 - 1	96	-0.49	2.35	0.058	0.20
1 - 2	219	-0.19	2.18	0.043	
2 - 3	221	-0.01	1.81	0.061	
3 - 4	205	0.11	1.28	0.140	
4 - 5	236	0.21	0.98	0.232	
5 - 6	285	0.29	0.78	0.229	
6 - 7	309	0.36	0.34	0.697	
7 - 8*	369	0.41	0.67	0.358	
8 - 9*	379	0.46	0.47	-	

TABLE II(5).

L11 1571 IIaD
b = 27 0.32 min

radius	stars	log r	log f	M.E.	Corr.
0 - 1	40	-0.49	1.98	0.088	0.04
1 - 2	93	-0.19	1.82	0.063	
2 - 3	85	-0.01	1.39	0.099	
3 - 4	80	0.11	0.89	0.213	
4 - 5	86	0.21	0.32	0.661	
5 - 6	121	0.29	0.80	0.205	
6 - 7	126	0.36	0.38	0.470	
7 - 8*	132	0.41	-		
8 - 9*	151	0.46	-		
9 - 10*	147	0.55	-		

L12 J1877 IIIaJ
b = 192 0.116 min

radius	stars	log r	log f	M.E.	Corr.
1 - 2	61	-0.63	2.45	0.093	0.09
2 - 3	71	-0.46	2.15	0.121	
3 - 4	70	-0.33	1.63	0.281	
4 - 5	84	-0.23	1.44	0.375	
5 - 6	97	-0.16	1.19	0.586	
6 - 7*	105	-0.09	-	-	
7 - 8*	104	-0.03	-	-	
8 - 9*	150	0.02	1.19	0.469	
9 - 10*	155	0.06	-	-	
10 - 11*	173	0.11	0.27	-	
11 - 12*	199	0.14	0.53	-	
12 - 13*	218	0.18	-	-	
13 - 14*	233	0.21	-	-	

TABLE II(6).

L12 1536 IIaO
b = 79 0.32 min

radius	stars	log r	log f	M.E.	Corr.
0 - 1	53	-0.49	1.92	0.12	-
1 - 2	97	-0.19	1.29	0.22	
2 - 3	130	-0.01	-1.0	-	
3 - 4*	79	-	-	-	-

L12 1571 IIaD
b = 45 0.32 min

radius	stars	log r	log f	M.E.	Corr.
0 - 1	43	-0.49	1.95	0.022	0.03
1 - 2	79	-0.19	1.54	0.016	
2 - 3	90	-0.01	0.99	0.016	
3 - 4	109	0.11	0.36	0.015	
4 - 5	143	0.21	0.49	0.013	
5 - 6*	171	0.29	0.34	0.012	
6 - 7*	187	0.36	-	-	
7 - 8*	226	0.41	-0.15	0.010	
8 - 9*	245	0.46	-		

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TABLE II(7).

L13 J 1877 IIIaJ
b = 67 0.232 min

radius	stars	log r	log f	M.E.	Corr.
0 - 1	46	-0.63	2.30	0.085	0.03
1 - 2	73	-0.33	1.88	0.095	
2 - 3	94	-0.16	1.63	0.114	
3 - 4	121	-0.03	1.54	0.115	
4 - 5	130	0.06	1.25	0.180	
5 - 6	139	0.14	0.86	0.373	
6 - 7	158	0.21	0.65	0.549	
7 - 8*	175	0.27	0.24	0.800	
8 - 9*	191	0.32	-	-	

L13 1536 IIaO
b = 105 0.32 min

radius	stars	log r	log f	M.E.	Corr.
0 - 1	56	-0.49	1.80	0.153	-0.02
1 - 2	146	-0.19	1.63	0.124	
2 - 3	195	-0.01	1.10	0.275	
3 - 4	268	0.11	1.06	0.275	
4 - 5	323	0.21	0.60	0.670	
5 - 6	392	0.29	0.53	0.750	
6 - 7*	435	0.36	-	-	
7 - 8*	537	0.41	0.30	0.556	

TABLE II(8).

L13 1571 IIaD
b = 58 0.32 min

radius	stars	log r	log f	M.E.	Corr.
0 - 1	39	-0.49	1.79	0.134	
1 - 2	98	-0.19	1.61	0.106	
2 - 3	117	-0.01	1.11	0.222	
3 - 4	148	0.11	0.79	0.379	
4 - 5	173	0.21	-0.52	-	
5 - 6*	216	0.29	0.18	1.12	
6 - 7*	241	0.36	-	-	
7 - 8*	292	0.41	0	-	
8 - 9*	318	0.46	-	-	

L15 J1877 IIIaJ
b = 550 0.116 min

radius	stars	log r	log f	M.E.	Corr.
0 - 1	77	-0.93	3.10	0.071	0.36
1 - 2	110	-0.63	2.49	0.113	0.10
2 - 3	173	-0.46	2.42	0.101	
3 - 4	206	-0.33	2.15	0.146	
4 - 5	242	-0.23	1.91	0.212	
5 - 6	277	-0.16	1.62	0.361	
6 - 7*	309	-0.09	0.98	0.568	
7 - 8*	357	-0.03	0.72	-	
8 - 9*	407	+0.02	-	-	
9 - 10*	440	+0.06	-	-	

TABLE II(9).

L15 1536 IIaO
b = 95 0.32 min

radius	stars	lof r	log f	M.E.	Corr.
2 - 3	322	-0.01	2.00	0.047	0.05
3 - 4	351	0.11	1.76	0.061	
4 - 5	352	0.21	1.37	0.115	
5 - 6	391	0.29	1.13	0.183	
6 - 7	404	0.36	-	-	
7 - 8	493	0.41	0.69	0.397	
8 - 9*	513	0.46	-		
9 - 10*	559	0.55	-		

L15 1571 IIaD
b = 60 0.32 min

radius	stars	log r	log f	M.E.	Corr.
0 - 1	67	-0.49	2.16	0.075	0.12
1 - 2	172	-0.19	2.06	0.050	
2 - 3	220	-0.01	1.87	0.052	
3 - 4	231	0.11	1.60	0.071	
4 - 5	233	0.21	1.26	0.121	
5 - 6*	259	0.29	1.06	0.167	
6 - 7*	278	0.36	0.69	0.345	
7 - 8*	319	0.41	0.65	0.348	
8 - 9*	321	0.46	-		
9 - 10*	355	0.55	-		

TABLE II(10).

L16 J1877 IIIaJ
b = 410 0.116 min

radius	stars	log r	log f	M.E.	Corr.
1 - 2	105	-0.63	2.61	0.084	0.15
2 - 3	128	-0.46	2.22	0.121	
3 - 4	152	-0.33	2.00	0.179	
4 - 5	181	-0.23	1.79	0.245	
5 - 6	204	-0.16	1.40	0.517	
6 - 7	241	-0.09	1.40	0.481	
7 - 8	277	-0.03	1.37	0.478	
8 - 9*	305	+0.02	1.05	0.927	
9 - 10*	346	+0.06	1.24	0.565	
10 - 11*	370	0.11	-	-	
11 - 12*	402	0.14	-	-	
12 - 13*	448	0.18	-	-	
13 - 14*	497	0.21	-	-	

L19 J1877 IIIaJ
b = 440 0.116 min

radius	stars	log r	log f	M.E.	Corr.
0 - 1	38	-0.93	2.65	0.138	0.17
1 - 2	77	-0.63	2.21	0.182	
2 - 3	106	-0.46	1.77	0.356	
3 - 4	137	-0.33	1.31	0.821	
4 - 5	171	-0.23	0.86	-	
5 - 6*	198	-0.16	-		
6 - 7*	237	-0.09	-		
7 - 8*	276	-0.03	-		
8 - 13*	2524	0.21	-		

TABLE II(11).

L20 J1877 IIIaJ
b = 60 0.232 min

radius	stars	log r	log f	M.E.	Corr.
1 - 2	82	-0.33	1.78	0.076	-0.19
2 - 3	87	-0.16	1.62	0.112	
3 - 4	75	-0.03	0.47	0.999	
3 - 5	97	+0.06	0.47	0.730	
5 - 6	114	0.14	-0.04	0.102	
6 - 7*	128	0.21	-	-	

HW32 J1877 IIIaJ
b = 46 0.232 min

radius	stars	log r	log f	M.E.	Corr.
0 - 1	28	0.23	2.07	0.113	-0.07
1 - 2	27	0.46	0.83	0.637	
2 - 3	40	0.70	-	-	
3 - 4	57	0.93	-0.04	-	
4 - 5*	69	1.16			
5 - 6*	78	1.39			
6 - 7*	104	1.63			
7 - 8*	120	1.86			

TABLE II(13).

E107 J1877 IIIaJ
b = 50 0.232 min

radius	stars	log r	log f	M.E.	Corr.
0 - 3	62	-0.16	1.36	0.175	-
3 - 4	67	-0.03	0.799	0.473	
4 - 5	83	0.06	0.628	0.608	
5 - 6	97	0.14	0.271	1.221	
6 - 7*	111	0.21	-0.568	-	
7 - 8*	129	0.27	-0.229	-	
8 - 9*	148	0.32	0.089		
9 - 10*	167	0.37	0.235		

L89 J1877 IIIaJ
b = 250 0.116 min

radius	stars	log r	log f	M.E.	Corr.
1 - 2	92	-0.63	2.67	0.069	0.18
2 - 3	103	-0.46	2.37	0.088	
3 - 4	112	-0.33	2.10	0.122	
4 - 5	135	-0.23	2.01	0.128	
5 - 6	137	-0.16	1.63	0.252	
6 - 7	144	-0.09	1.02	0.890	
7 - 8	167	-0.03	1.08	0.728	
8 - 9*	182	0.02	0.30	-	
9 - 10*	200	0.06	-	-	
10 - 11*	213	0.11	-	-	
11 - 12*	255	0.14	1.0	0.640	
12 - 13*	283	0.18	-	-	
13 - 14*	311	0.21	0.77	0.900	

TABLE II(12).

NGC361 J1877 IIIaJ
b = 470 0.116 min

radius	stars	log r	log f	M.E.	Corr.
3 - 4	221	-0.33	2.43	0.079	0.08
4 - 5	284	-0.23	2.43	0.070	
5 - 6	299	-0.16	2.23	0.094	
6 - 7	306	-0.09	1.92	0.159	
7 - 8	332	-0.03	1.70	0.243	
8 - 9	352	0.02	1.24	0.648	
9 - 10	392	0.06	1.19	0.679	
10 - 11	423	0.11	0.63	0.800	
11 - 12*	457	0.14	-		
12 - 13*	485	0.18	-		
13 - 14*	526	0.21	-		

HW40 J1877 IIIaJ
b = 524 0.116 min

radius	stars	log r	log f	M.E.	Corr.
0 - 1	67	-0.93	3.02	0.079	+0.33
1 - 2	101	-0.63	2.42	0.127	
2 - 3	114	-0.46	1.02	0.230	
3 - 4*	151	-0.33	-	-	
4 - 5*	189	-0.23	-	-	
5 - 6*	245	-0.16	-0.40	-	
6 - 7*	275	-0.09	0.25	-	

TABLE II(14).

L90 J1877 IIIaJ
b = 228 0.116 min

radius	stars	log r	log f	M.E.	Corr.
1 - 2	79	-0.46	2.16	0.125	-
2 - 3	91	-0.33	1.89	0.178	
3 - 4	99	-0.23	1.49	0.365	
4 - 5	115	-0.15	1.26	0.549	
5 - 6	132	-0.09	1.04	0.820	
6 - 7	151	-0.03	0.95	0.933	
7 - 8*	170	0.02	0.87	-	
8 - 9*	184	0.06	-	-	
9 - 10*	205	0.11	0.25	-	
10 - 11*	223	0.14	-0.70	-	
11 - 12*	241	0.18	-	-	
12 - 13*	258	0.21	-	-	

HW64 J1877 IIIaJ
b = 262 0.116 min

radius	stars	log r	log f	M.E.	Corr.
1 - 2	68	-0.63	2.43	0.103	0.08
2 - 3	73	-0.46	1.91	0.212	
3 - 4	80	-0.33	0.85	0.770	
4 - 5	95	-0.23	-	-	
5 - 6	111	-0.16	-	-	
6 - 7*	141	-0.09	-	-	
7 - 8*	175	-0.03	-	-	
8 - 9*	206	0.02	1.00	0.708	
9 - 10*	232	0.06	1.07	0.370	
10 - 11*	248	0.11	1.09	0.321	
11 - 16*	1460	0.27	-	-	

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TABLE II(15).

NGC458				J1877 IIIaJ	
b = 310				0.116 min	
radius	stars	log r	log f	M.E.	Corr.
3 - 4	206	-0.33	2.58	0.054	0.14
4 - 5	194	-0.23	2.29	0.080	
5 - 6	191	-0.15	1.99	0.129	
6 - 7	196	-0.09	1.65	0.245	
7 - 8	236	-0.03	1.78	0.173	
8 - 9	260	+0.02	1.70	0.194	
9 - 10	268	0.06	1.34	0.399	
10 - 11	308	0.11	1.54	0.241	
11 - 12	323	0.14	1.31	0.388	
12 - 13*	336	0.18	-	-	
13 - 14*	362	0.21	-	-	

TABLE III.

cluster	α(1900)	δ(1900)	plate	r_t(arcmin)	r_t(pc)	$\log \frac{r_t}{r_c}$	r_c(pc)	d(arcmin)	$M/M_\odot \times 10^4$
	h m	° ′							
1) L3 (R)	00 13.8	-74 52.4	(1)	2.5	50.4	2.00	0.5	250.8	1.05
2) L4 (R)	00 18.2	-74 18.3	(1)	2.5	50.4	2.00	0.5	184.4	2.63
3) L6 (R)	00 18.5	-74 13.4	(1)	4.0	80.6	2.00	0.8	220.2	6.30
4) L7 (R)	00 20.1	-74 18.7	(1)	1.5	30.2	1.25	1.7	193.2	0.53
5) L8/K3 (R)	00 20.3	-73 21.1	(1)	4.3	86.7	1.50	2.8	195.0	11.50
			(2)	4.9	90.7	1.75	1.7		12.95
			(3)	4.5	98.7	1.50	2.7		16.63
6) L11 (R)	00 23.3	-73 20.7	(2)	4.1	82.6	1.70	1.6	164.4	16.27
			(3)	4.5	90.7	1.70	1.8		21.52
7) L12 (R)	00 23.7	-73 51.8	(1)	1.2	24.2	1.25	1.3	210.6	0.17
			(2)	1.1	22.2	1.25	1.2		0.17
			(3)	1.3	26.2	1.25	1.5		0.17
8) L13 (R)	00 25.8	-73 56.6	(1)	4.5	90.7	1.75	1.6	156.6	24.84
			(2)	4.6	92.7	1.75	1.6		26.60
			(3)	4.2	84.7	1.75	1.5		20.12
9) L15 (R)	00 28.8	-73 41.8	(1)	6.4	129.0	2.00	12.9	124.8	141.60
			(2)	6.6	133.0	2.00	13.3		155.20
			(3)	6.6	133.0	2.00	13.3		155.20
10) L16 (R)	00 31.8	-73 43.6	(1)	2.9	58.5	1.75	1.0	136.2	10.50
11) L19 (R)	00 33.9	-74 27.7	(1)	1.3	26.2	1.50	0.8	180.6	0.35
12) L20 (R)	00 34.2	-73 02.1	(1)	1.5	30.2	1.25	1.7	153.0	1.05
13) HW32 (B)	00 56.5	-71 18.5	(1)	0.7	14.1	1.00	0.8	55.2	2.10
14) **L67/NGC361 (B)**	00 58.9	-72 08.9	(1)	1.6	32.3	1.00	3.2	76.8	9.60
15) HW40 (R)	00 59.6	-71 25.3	(1)	0.8	16.1	1.00	0.9	41.9	7.35
16) E107 (B)	01 01.5	-72 6.5	(1)	1.9	38.3	1.00	3.8	90.1	10.10
17) L89 (B)	01 09.5	-72 16.7	(1)	1.3	26.2	1.25	1.5	99.0	2.45
18) L90 (B)	01 09.8	-71 51.2	(1)	1.6	32.3	1.25	1.8	119.3	2.60
19) HW64 (B)	01 10.5	-71 47.0	(1)	1.5	30.2	1.25	1.7	102.6	3.30
20) L96/NGC458 (B)	01 11.9	-72 04.3	(1)	2.4	48.4	1.25	2.7	123.6	7.50

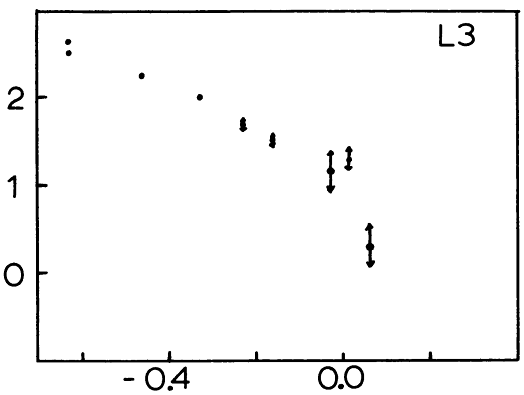

FIGURE 1.

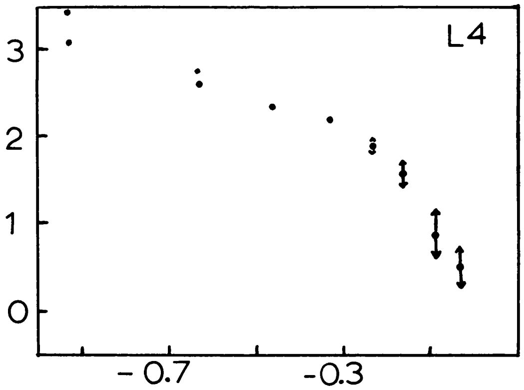

FIGURE 2.

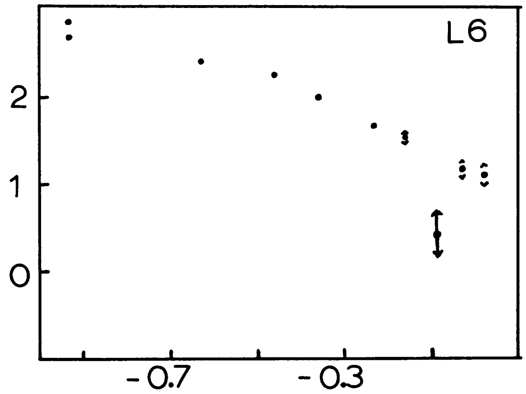

FIGURE 3.

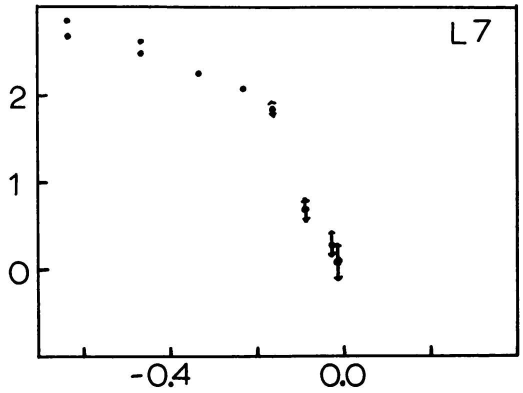

FIGURE 4.

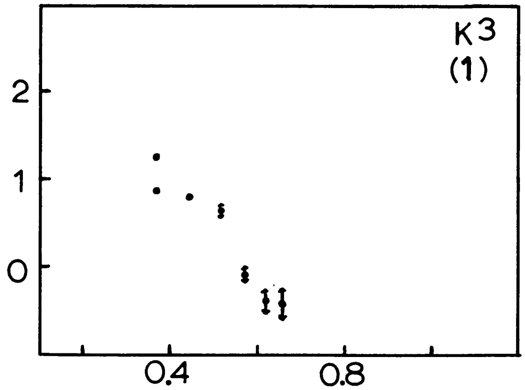

FIGURE 5*a*.

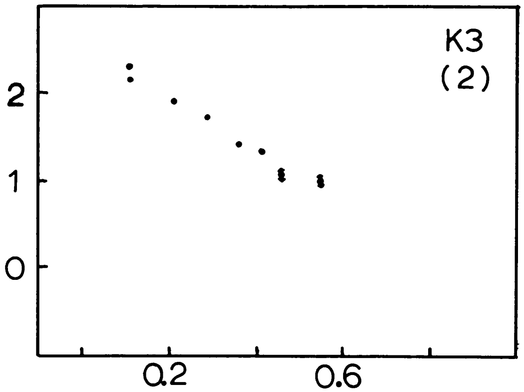

FIGURE 5*b*.

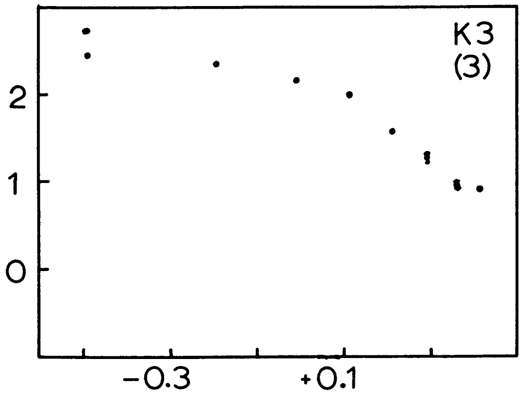

FIGURE 5*c*.

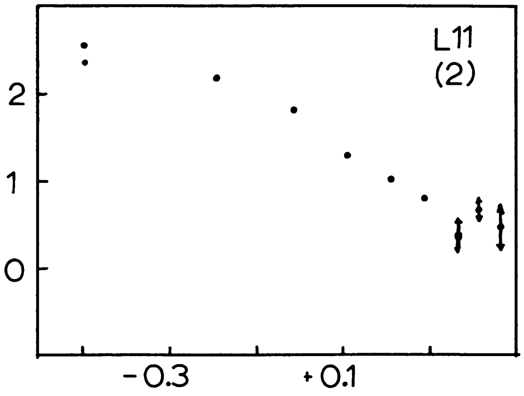

FIGURE 6*a*.

FIGURES 1-20. — Surface density profiles derived from star counts. The ordinate is the logarithmic value of stellar density per square minute of arc and the abcissa the logarithmic value of the radius in minutes. Statistical mean errors are indicated by the vertical bars. Where two data points are plotted at the same radius, the upper point is the surface density corrected for the effects of image crowding.

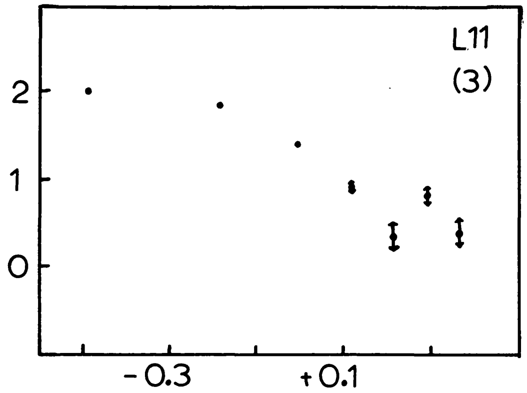

FIGURE 6*b*.

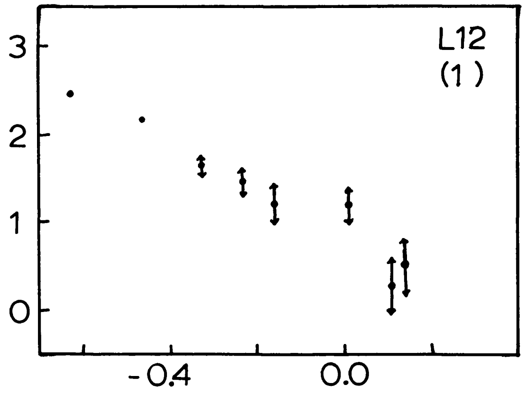

FIGURE 7*a*.

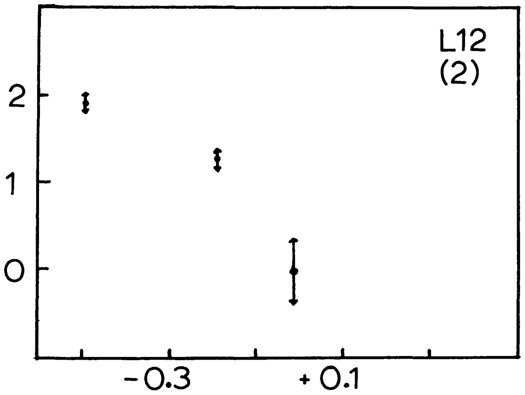

FIGURE 7*b*.

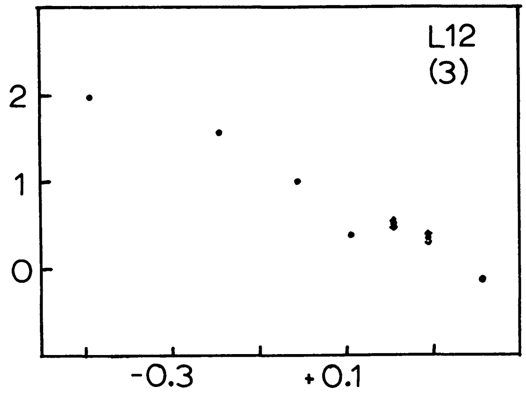

FIGURE 7*c*.

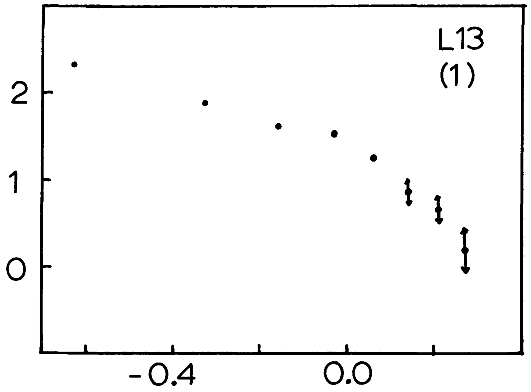

FIGURE 8*a*.

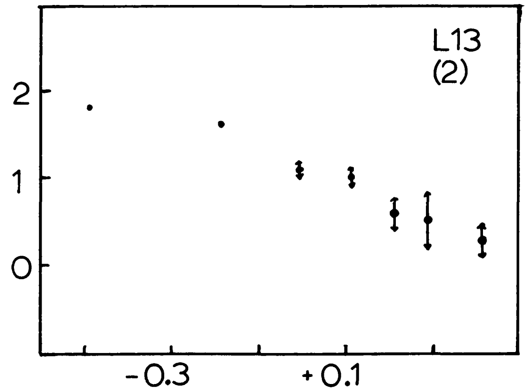

FIGURE 8*b*.

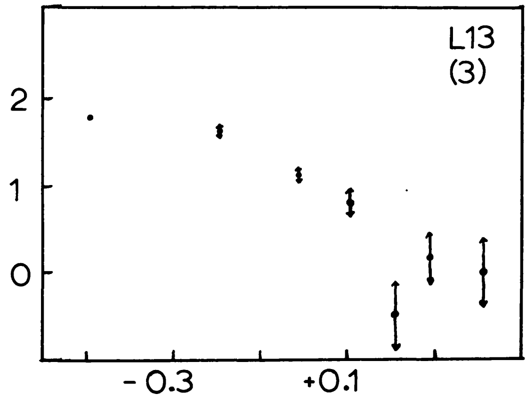

FIGURE 8*c*.

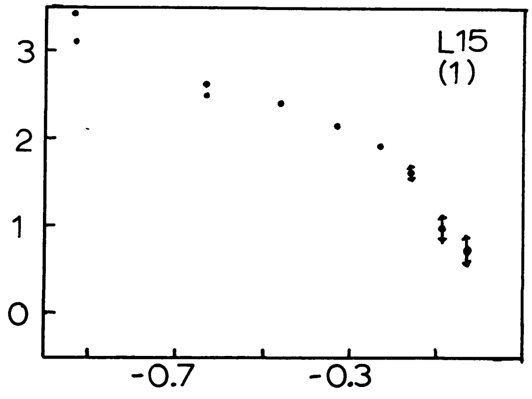

FIGURE 9*a*.

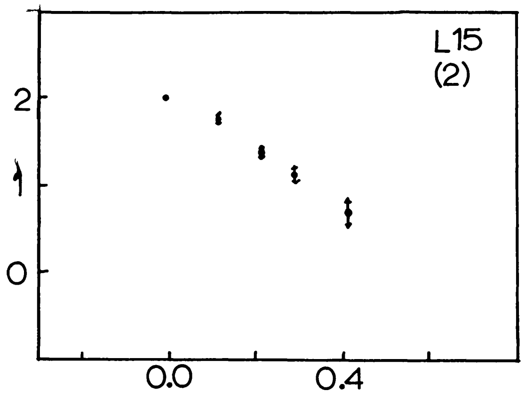

FIGURE 9*b*.

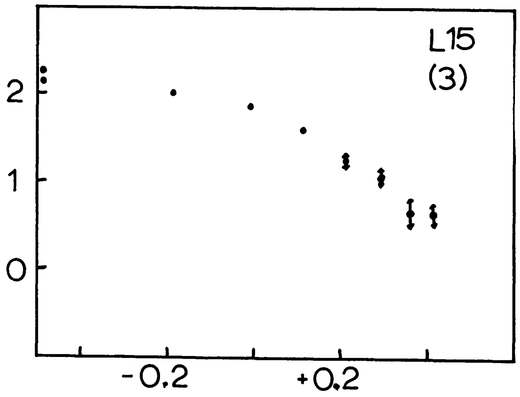

FIGURE 9*c*.

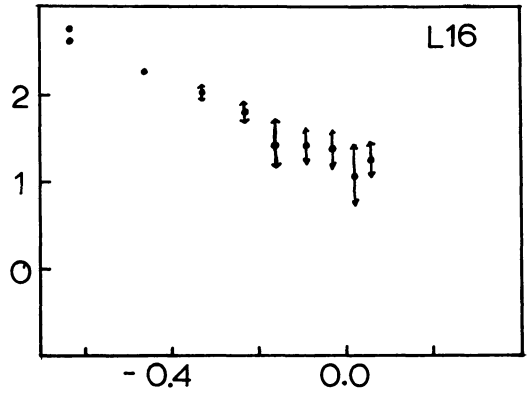

FIGURE 10.

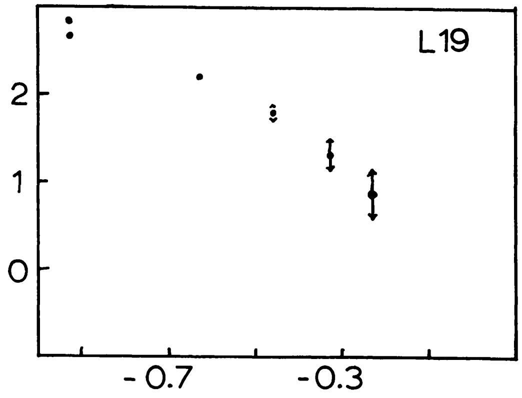

FIGURE 11.

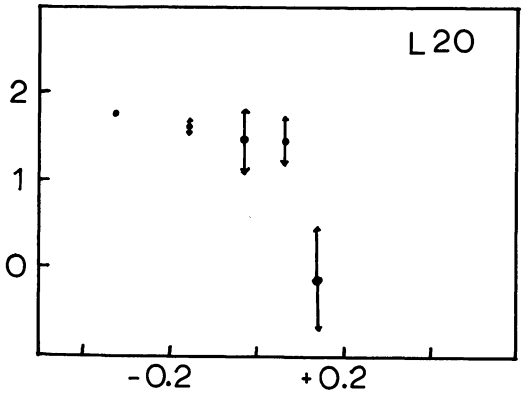

FIGURE 12.

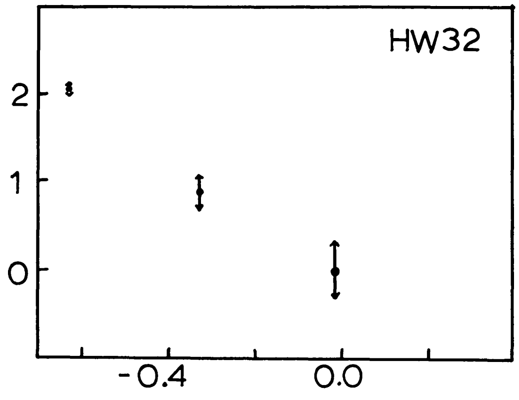

FIGURE 13.

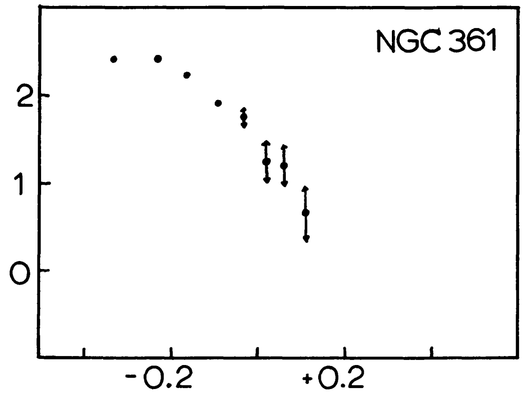

FIGURE 14.

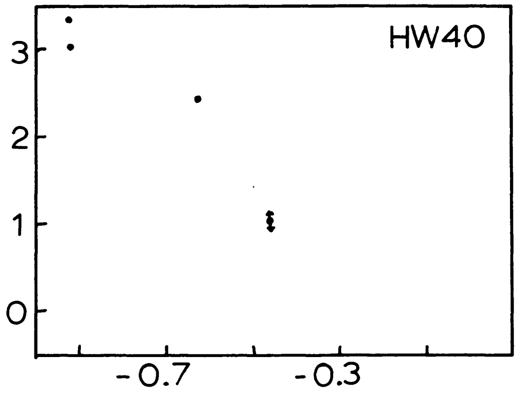

FIGURE 15.

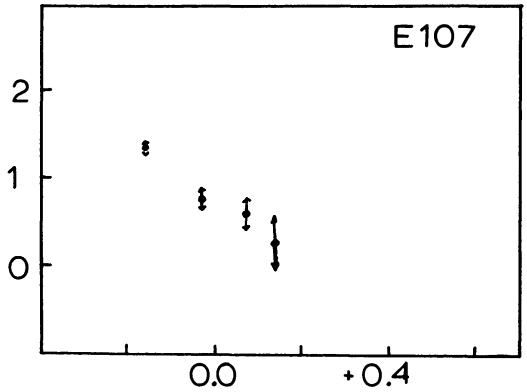

FIGURE 16.

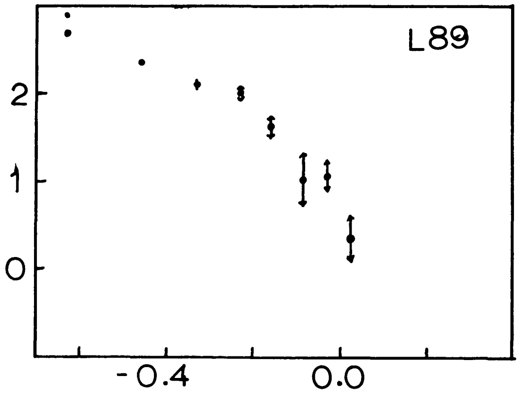

FIGURE 17.

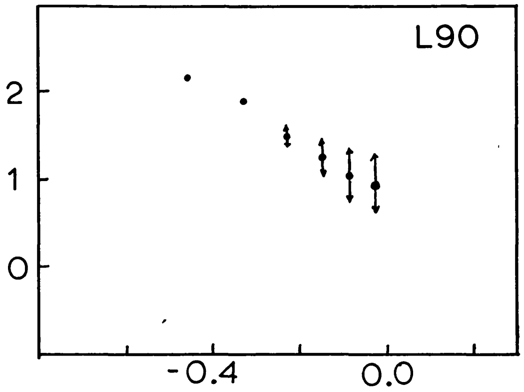

FIGURE 18.

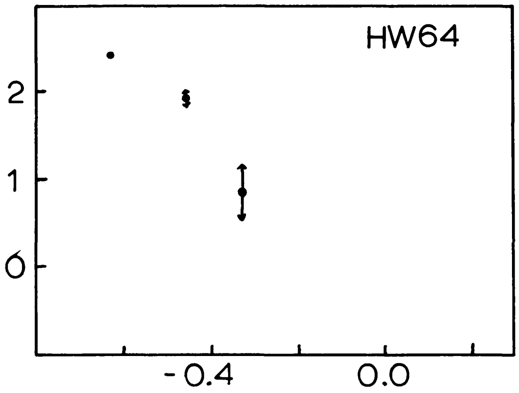

FIGURE 19.

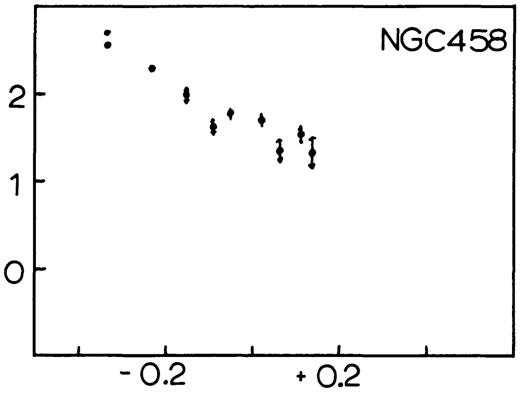

FIGURE 20.

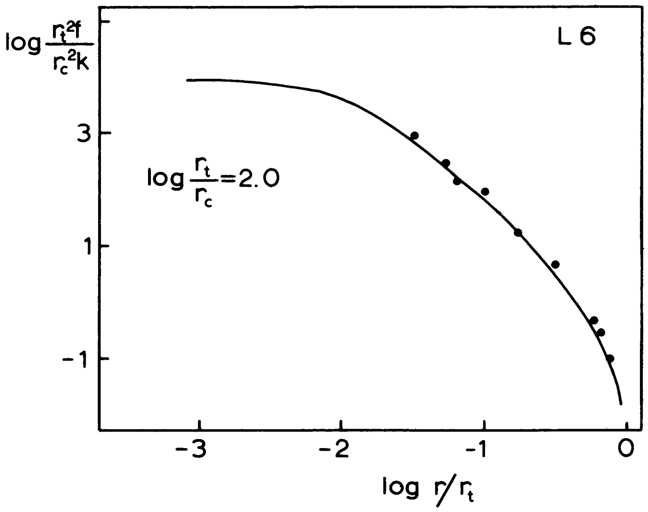

FIGURE 21.

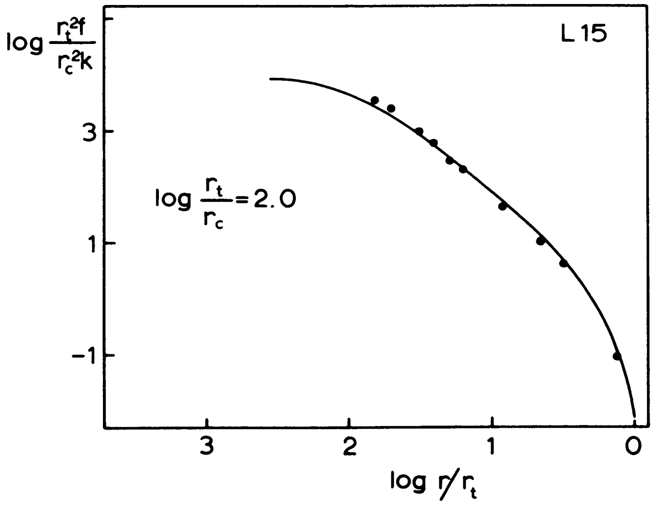

FIGURE 22.

FIGURES 21-22. — Surface density profiles derived from star counts. The solid lines are surface density curves from the models of King (1962) for the indicated concentration $c = \log r_t/r_c$.