STAR COUNTS AND DYNAMICAL PARAMETERS IN THE SMC

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ABSTRACT

Tidal radii, masses and relaxation times of star clusters in the SMC have been derived by means of star counts using Schmidt plates. All 43 clusters have been found to behave like true globulars although their evolutionary ages vary from 10^6 — $9x10^9$ years.

INTRODUCTION

Star counts have always been an important method of studying the dynamical structure of star clusters. King (1962) using theoretical models has shown that the core radius (r_c), the tidal radius (r_t) and the richness factor (K) are needed to describe the structure of the clusters.

Freeman (1974) and Chun (1978) have used the above theory to derive masses of populous clusters in the LMC.

In this study 43 old and young globular clusters of the SMC have been measured in order to study their dynamical behaviour and find their masses.

OBSERVATIONS

Plates taken with the 1.2 m U.K. Schmidt Telescope were measured on IIIaJ, IIaO and IIaD emulsion. Two plates taken with the AAT 3.8 m telescope were also measured and for 5 clusters in common the agreement was found to be very satisfactory (Kontizas, Danezis, Kontizas, 1983).

The star counts were obtained either by placing a circular reseau on the screen of an irisphotometer or by

M. Capaccioli (ed.), Astronomy with Schmidt-Type Telescopes, 347–349.

placing a square reseau under a binocular microscope. Each reseau was centered on the cluster by eye.

STRUCTURAL PARAMETERS

The observational material allowed star counting far beyond the radii of the clusters and the density of the field was safely reached in all cases. The density profiles of the clusters were used for the derivation of r_t, assuming all hypotheses of the King's models for the galactic globulars. Fig 1 (a,b) shows the density profiles of the clusters L15 and L6.

The different sources of error give an accuracy of 15% to the derived r_t.

Comparing a grid of King's models with our density profiles the concentration parameters (c) and core radii were found. The solid line in Fig 1b is the adopted surface density curve from the model (King, 1962) for c = 2.0.

From the derived r_t and c for each cluster the masses and the relaxation times were calculated.

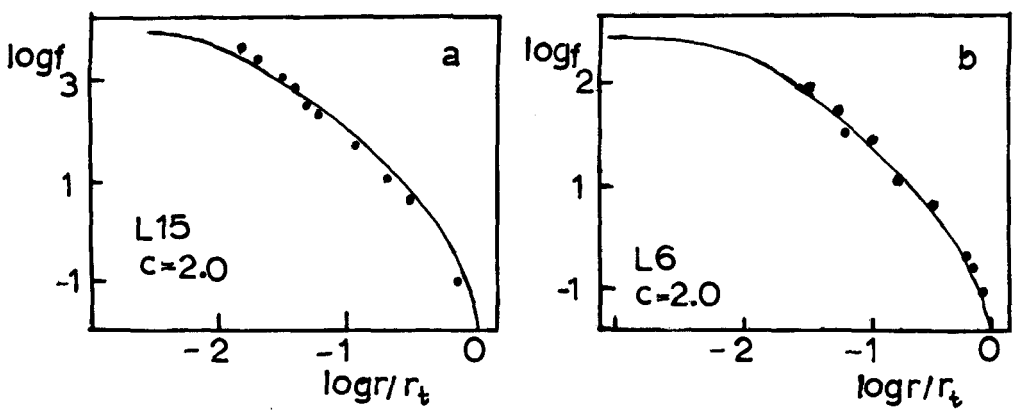

Fig. 1 Surface density profiles derived from star counts for the SMC clusters (a) L15 and (b) L6. The solid line show the adopted theoretical profile from the King model.

DISCUSSION

Previous classifications of the SMC clusters, their integrated colours, the existing c-m diagrams and the derived structural parameters found in this investigation were

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used as criteria for dividing the 43 studied clusters into two main groups : (i) the disk clusters and intermediate in colour and (ii) the halo "red", old clusters.

The disk clusters were found to have large tidal radii compared to the galactic open clusters with values accumulated at 30pc and concentration parameters higher than their galactic counterparts. Their masses are also found at least 10 times higher than those of our galaxy. Their relaxation times, much higher than their evolutionary ages mean that the clusters are not relaxed, although their density profiles favour well relaxed systems. The LMC, "blue", clusters were found to behave in the same way (Freeman, 1974; Geyer and Hopp, 1982).

The "halo" clusters are found to have tidal radii and concentration parameters similar to those of the galactic globulars. The masses are at least 10 times less massive than their galactic counterparts and the M/L ratios rather small for old clusters. Their relaxation times are smaller than their evolutionary ages (where exist) showing that the old SMC clusters are well relaxed system and being in agreement with their density profiles.

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REFERENCES

Chun, M. S. : 1978, Astron. J., 83, 1062.
Freeman, K. C. : (1974). ESO/SRC/CERN Conference on Research Programs for the New Large Telescope, Geneva, May, 1974.
Geyer, E. H., Hopp. U. : (1982). IAU Colloquium No. 68, 235.
King, I. R. : (1962), Astron. J., 67, 471.
Kontizas, M., Danezis, E., Kontizas, E. (1982). Astron. and Astrophys. Suppl. Ser. 49, 1.
Kontizas, E. and Kontizas M. (1983). Astron and Astroph. Suppl. Ser. 53, 143.