SIT-VIDICON SURFACE PHOTOMETRY OF GLOBULAR CLUSTERS IN THE MAGELLANIC CLOUDS

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INTRODUCTION

The globular clusters in the Large Magellanic Cloud offer an unique possibility for the study of their spatial structures. Their ages show a very wide range from $6 \cdot 10^7$ to $>5 \cdot 10^9$ years which is unknown for their galactic counterparts. The latter ones are all very old and therefore dynamically relaxed systems, whereas the young globular clusters of the Magellanic Clouds (age $<10^8$ years) have still preserved the dynamical state with which they were formed (Geyer et al.1979). Furthermore, these young globulars show in their Hertzsprung-Russell diagram morphology the massive and luminous stars still on the main sequence with only a few evolved red supergiants. As in general the luminosity of the individual stars depends on their evolutionary state, the total mass to total luminosity ratio of a stellar cluster represents also its evolutionary state.

Furthermore, if during the forming process of the cluster the spatial mass distribution is anisotropic or in the case of old systems mass segregation has occured by the dynamical evolution, this should be seen in the radial variation of the mass/luminosity ratio within the clusters.

We have started an observing program for star counts and surface photometry of a sample of young and old LMC globular clusters to study the spatial star and luminosity distribution to search for these effects. We present here first preliminary results about a red (NGC 1806) and a blue (NGC 1818) cluster. The star counts of these objects have been reported earlier by Geyer et al. (1979 and 1982).

The spatial density distribution is described with a polytrope and the constants are derived from the surface density distribution (counts and photometry) as described by Geyer et al. (l.c.).

OBSERVATIONS

The surface photometry in the UBV and RGU colour systems was carried out for 22 LMC globulars with a panoramic detector system ("OMA 2" - Optical Multichannel Analyzer, EG&G Corp.) based on a SIT vidicon at the 1m telescope of the European Southern Observatory. The whole equipment

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was described by us (1982). The field of the detector-telescope system is 2.9' x 2.9' with a pixel size of 3.45" x 3.45" (50x50 pixels for the whole frame). The SIT vidicon detector was cooled with dry ice and we used integration times of 0.9 and 5.8 minutes. The data were digitzed and stored on 8" flexible disks using a LSI 11 based microcomputer.

REDUCTIONS

All data have been corrected for dark current and flat field variations. As the microcomputer of the detector system has only limited programming facilities, we transfered the data to a HP 9835A desktop microcomputer for further reductions:

1) The center of the cluster is determined in fitting a Gaussian to the row and column sums (marginal distributions) of the array describing the image frame. This is used to center a diaphragm simulating one as used for photoelectric photometry (e.g. from literature). the intensity of the pixels is summed up in this diaphragm and with the photometric magnitude value converted to astronomical units (mag/arcsec^2/pixel). These have been used for calibrated contour plots.
2) To remove the influence of single bright stars which would considerably contaminate the strip functions, a simple filtering algorithm was applied.
3) These corrected row and column sums are fitted with the strip functions to determine the cluster center (the least square fits use the Marquardt algorithm).
4) Finally all values are made symmetric in respect to the center yielding the radial surface density distribution. These are fitted to the strip function L(r) with the results for the constants describing the spatial distribution.

PRELIMINARY RESULTS FOR NGC 1806 AND 1818

From the spatial star and luminosity distribution it can be seen that the average luminosity per cluster member has its maximum in the center and drops radially outward except for NGC 1818 in B. If this finding holds true for the other clusters it would indicate that the massive stars are already more concentrated during the clusters' formation.

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