PHOTOGRAPHIC PHOTOMETRY WITH SCHMIDT PLATES OF STAR CLUSTERS IN THE SMC

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INTRODUCTION

The star clusters have always been the most important tools of testing the stellar evolution theories and when these stellar systems belong to other galaxies, then our knowledge on stellar evolution can be extended for different initial conditions than those of our Galaxy. The Magellanic Clouds being our nearest neighbour galaxies offer ideal conditions for such studies.

Since the powerful southern telescope came into operation deep plates of these two galaxies revealed a large number of new star clusters. The Schmidt plates are most useful since they have the advantage of large field where many objects can be investigated homogeneously on the same plate.

A survey of colour-magnitude (c-m) diagrams of star clusters in the SMC has been studied using plates taken with the 1.2 m. U.K. Schmidt Telescope. Twenty clusters at the west-north-east periphery have been studied. New SMC plates have been planned for the study of the south-west clusters.

OBSERVATIONS

Three V and three B plates were measured with an irish-photometer at the Royal Observatory of Edinburgh. The photoelectric sequences available do not always reach the very faint magnitudes that Schmidt plates can detect and in this case the electronographic sequences reaching the faint limit of the plate have been used very successfully (Walker, 1970; Hawkins and Brück, 1981). A detailed discussion of the photometric accuracy has been reported by Kontizas (1980).

DISCUSSION

The selected clusters are located in the halo or the SMC and their c-m diagrams show features that make them different from the clusters of

M. Capaccioli (ed.), Astronomy with Schmidt-Type Telescopes, 355–357.

our Galaxy. The most important points are outlined below.

1. Halo, "red", clusters.

There is a variety of old globular clusters all over the whole studied area; in the northern part, the cluster members suffer severe contamination with the bar or arm's stellar content and therefore the western clusters seem to be a suitable sample of the old SMC clusters.

One typical feature of their c-m diagrams is the horizontal branch (HB) which is from very weak to very conspicuous but with preference to the red side of the RR variable star strip. The fact that the red part of the HB is quite populous whereas the blue part is almost non existent does not necessarily mean high metallicity as it is explained in our galaxy.

Another characteristic is the existence of very red stars which in most cases have been proved to be carbon stars (Feast and Evans, 1973; Aaronson and Mould, 1982) and most likely cluster members as it was found from luminosity functions of some clusters (Kontizas and Kontizas, 1982).

Many faint blue stars seem to be an unusual feature of these clusters and give indication of being "blue stragglers" (Tifft, 1963; Gascoigne, 1980) have found the same c-m structure for the old SMC clusters NGC 121, L1 and K3.

These characteristic features found in the c-m diagrams support the argument that the old SMC clusters are younger than their galactic counterparts.

The resemblance of these c-m diagrams with some diagrams of remote globular clusters of our own galaxy and some dwarf galaxies might mean that galaxies like SMC with very little activity in their nucleus have different evolutionary history and lower metal content because of an evolutionary slower metal production in their nucleus. A composite c-m diagram of the central areas of six western old clusters is illustrated in Fig. 1a.

2. Disc, "blue" clusters.

The disc clusters which are the "blue" and intermediate in colour clusters (Brück, 1975) are mainly globular (Kontizas et al., 1982) and have various ages according to the subsystem in which they belong (spiral arm, bar).

The two clusters located on the north east spiral arm produce c-m diagrams with a vertical main sequence giving evidence of young age (5×10^7) and resemble the c-m diagram of the field studied by Brück and Marsoglu (1978).

A group of northern young clusters shows that the central region which is an extension of the bar contains objects younger than the ones of the arm. The main sequences of all young clusters compared to those of our galaxy are found to be much bluer in the SMC, that may again be an indication of their low metallicity.

A composite c-m diagram of the central areas of the young clusters is illustrated in Fig. 1b. The main sequence and some of the very bright red stars have been found to be the stellar content of the clusters whereas the lower part of the red giant branch is the stellar content of the halo superimposed in this area. The existence of some evolved stars in

the young SMC clusters shows that the populous "blue" clusters are not very young compared to the very young clusters of our Galaxy.

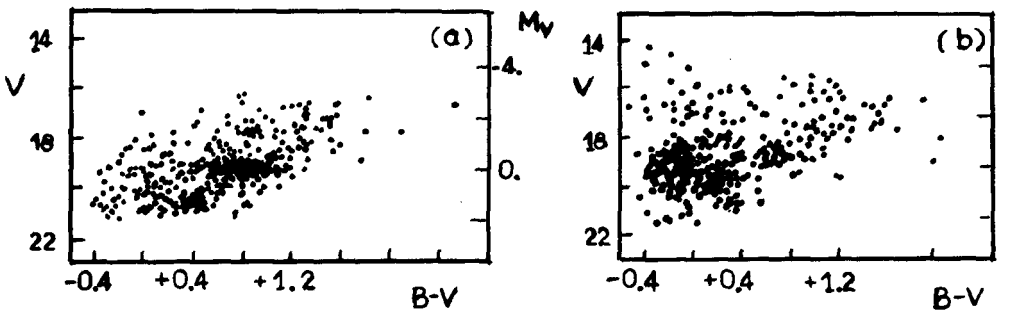

Fig. 1. Composite c-m diagrams for the central regions: a) of six SMC halo clusters b) of eight SMC disk clusters.

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