Part 1. The Star Clusters of Local Group Galaxies

Section B. Poster Papers

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Mr. and Mrs. Star Cluster (Doug and Eugenia Geisler) and Grandma and Grandpa Star Cluster (John and Dorothy Geisler) enjoy a rare free moment.

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Near Infrared Photometry of New Galactic Globular Clusters GC 01 and GC 02.

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Abstract. We present a preliminary report on the first deep near infrared photometry of 2MASS GC 01 and 2MASS GC 02 - new Galactic globular cluster candidates, discovered by the 2MASS. The red giant branch slopes yielded [Fe/H]$=-0.42\pm0.15$ dex and [Fe/H]$=-0.66\pm0.17$ dex, respectively for GC 01 and GC 02. We estimated the reddening towards GC 01 and GC 02: $E(B-V)=5.36\pm0.20$, and $E(B-V)=4.55\pm0.17$. The calculated distance moduli to the clusters are: $(m-M)_0=13.53\pm0.27$ and $(m-M)_0=14.53\pm0.31$ for GC 01 and GC 02. Our best fit for the radial surface brightness profile of GC 02 yields: $\lg(r_c)=1.40$, $\lg(r_h)=1.54$, $\lg(r_t)=1.31$, and c=1.60. CC 01 is less concentrated: $\lg(r_c)=1.63$, $\lg(r_h)=1.7$, $\lg(r_t)=1.25$, and c=1.41.

1. Introduction

The known Galactic globular clusters (GC) - less than 150 (Harris 1996) - were discovered mostly through optical searches, that are obviously biased against highly obscured objects. Since the Galaxy is estimated to have 160 ± 20 GCs (Harris 1991), a certain number of them may still be hidden behind the Galactic disk. The Two Micron All Sky Survey (2MASS) offers an opportunity to carry a search for missing GCs, and recently Hurt et al. (2000), reported a discovery of two new GCs: 2MASS GC 01 and 2MASS GC 02 (GC 01 and GC 02).

The purpose of the present paper is to determine the basic parameters of the new clusters - metallicity, reddening, distance, core radius and concentration on the basic of near infrared J, H and K_s photometry.

2. Approach to the Problem

The clusters GC 01 and GC 02 were observed at the ESO-NTT with SOFI in different occasions during July 2000. We used the Large-Field setup with a plate scale of 0.292 arcsec/pixel, and a field of view 5×5 arcmin that allows to cover

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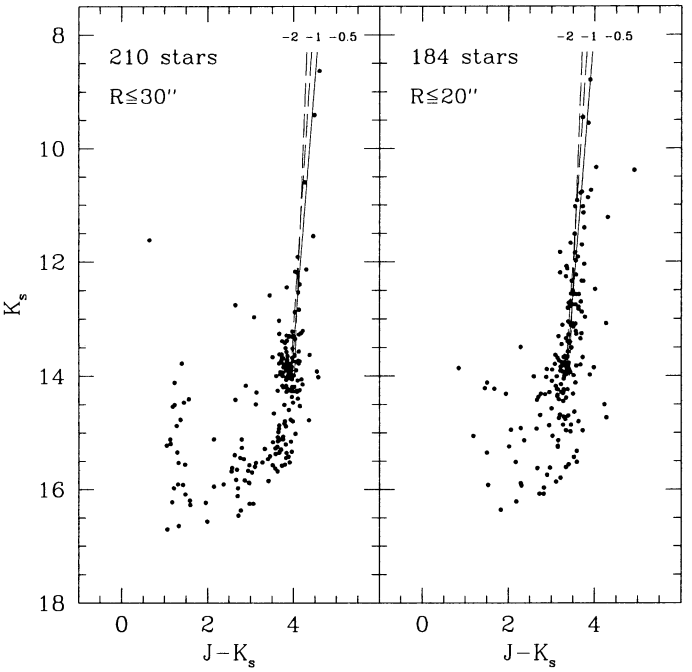

Figure 1. The color-magnitude diagrams of GC 01 and GC 02.

the entire clusters in J, H and K_s. The stellar photometry of the frames was performed with the point-spread function fitting routine ALLSTAR available in DAOPHOT (Stetson 1993). Only stars with errors less than 0.15 mag are used in the analysis.The photometric calibration was performed using 2MASS stars as photometric standards, with typical r.m.s. 0.05 – 0.07 mag.

3. Results

The J – K_s vs. K_s color-magnitude diagrams (CMDs) of the two clusters are shown in Fig. 1. To reduce the field stars contamination we constructed CMDs only for stars within 30 and 20 arcsec from the cluster centres. Although some disk stars are still present, the plots are dominated by cluster members. The RGBs are clearly separable from field stars at $J - K_s$=3-4.5 mag. The location of the brightest stars on the giant branch (K_s=8.63, $J - K_s$=4.6 for GC 01, and K_s=9.45, $J - K_s$=0.72 for GC 02) indicate the RGB tips. The RGB bumps can be located at K_s=13.86 in GC 01, and K_s=13.99 in GC 02. The red HB clump in GC 01 is at K_s=13.60-13.80.

To determine the structural parameters of GC 01 and GC 02 King's (1966) iterative star counts method was applied. The data were corrected for geomet-

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rical completeness, and the field stars were removed. The best fit for the radial surface brightness profile of GC 01, with a single-mass King's model suggests: $\lg(r_c) = 1.63$, $\lg(r_h) = 1.7$, $\lg(r_t) = 1.25$, and c=1.41. GC 02 is more concentrated: $\lg(r_c) = 1.40$, $\lg(r_h) = 1.54$, $\lg(r_t) = 1.31$, and c=1.60.

The only reddening independent method of metallicity determination uses the slope of the RGB. The calibration of Ferraro et al. (2000) yields [Fe/H]= -0.42 ± 0.15 dex for GC 01 and [Fe/H]=-0.66 ± 0.17 dex for GC 02 in Carretta & Gratton (1997) scale. The best fit of the $(J - K_s, H - K_s)$ diagrams with the theoretical sequence from Koornneef (1983) gives $E(J - K_s)$=3.00 ± 0.20 and $E(J - K_s)$=2.55 ± 0.17 for GC 01 and GC 02, respectively. Using the tip of RGB, our new metallicity and reddening estimates, and Ferraro's at al. (2000) calibration for [Fe/H] versus the RGB tip, we calculated the distance to the clusters: $(m - M)_0$=13.53 ± 0.27 for GC 01, and $(m - M)_0$=14.53 ± 0.31 for GC 02.

4. Conclusions

We carried out the first deep NIR photometry of GC 01 and GC 02 - new Galactic GCs, discovered by the 2MASS. They are located near the Galactic center, and are expected to belong to the disk system of GCs. They are metal rich GCs: ([Fe/H]=-0.42 ± 0.15 dex and [Fe/H]=-0.66 ± 0.17 dex), consistent with their location in the disk. The clusters are virtually invisible in the optical, hidden behind 17-20 magnitudes of visual extinction. Interestingly, the two clusters have different morphology. GC 02 is highly concentrated: c=1.60, while CC 01 is less concentrated: c=1.41. This result suggests that the disk shocking would affect the clusters differently.

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