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CCD SNAPSHOTS OF FIELDS IN A STUDY OF THE VERTICAL DISTRIBUTION OF STARS

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ABSTRACT

Snapshots of eight SA and standard fields from low to high galactic latitudes were made using the KPNO 0.9m 2K×2K CCD with a limiting magnitude from 19 to 22.5. The purpose of this study is to determine the vertical distribution of stars with respect to Galactic latitude and z-distance in comparison with the model simulation between intermediate population to the 'thick disk' component of scale height of a few kpc. Comparison of the preliminary results between observed and model simulation for 3 of the 8 fields shows good agreement both in V-mag and B-V color distributions. A bimodal distribution in B-V at high galactic latitude seems to be represented by a halo and 'thick disk' dwarf in the blue and by a normal disk dwarf population in the red.

Key Words : CCD Photometry, Stars, Star Counts, Galactic Structure

I. INTRODUCTION

The luminosity profiles of spiral galaxies are usually described by a standard model suggested by Bahcall and Soneira (1980) which consists of a Galactic bulge, disk and spheroid or halo. The structure of a spiral galaxy, including the Milky Way galaxy, has been satisfactorily explained by two independent components, an exponential disk and a spheroid. Based on recent photometric surveys, several groups have suggested the existence of a 'thick disk' component (Gilmore and Reid, 1983; Robin et al. 1989, von Hippel and Bothun, 1993; Robin et al. 1996). In general, the thick disk has a scale height of more than 1 kpc, several times that of the normal disk and a density of a only few percent of the Disk. The use of star counts to model the global structure of the Galaxy has been shown to be effective for investigating metallicity, kinematics and stellar population properties. As pointed out by Robin and Obalk (1987); Ratnatunga et al. (1989), Gould et al. (1993) and Mendez and van Altena (1996), most of the proposed models have little ability to predict star counts and kinematics simultaneously.

This study is part of an on-going program to investigate the kinematics, metallicity, structure and mass density of the Galaxy toward the South Galactic Pole at Cerro Tololo Inter American Observatory (Lu, 1990, 1991, Lu et al. 1992). Photometric surveys using CCDs for Galactocentric distances beyond the solar neighborhood have been made by various groups. In this study, our observed star counts complete to a certain limiting magnitude and color are compared with a simulation. Details of this model have been described by Mendez and van Altena (1996). The basic model uses the fundamental equation of stellar statistics in Galactic astronomy (e.g. Mihalas and Binney, 1981) by calculating luminosity and density functions. The parameters used in the simulation depend largely on field of view, limiting magnitude, interstellar reddening, photometric error and positions in Galactic longitude and latitude.

magnitude is about 22 in V for our primary targets of Lp543-32/33 and SA57. The other six fields are Landolt (1992) standard fields which are generally integrated with shorter exposure time, thus, these fields reach a limiting magnitude of about 19. Distributions in V-mag error, V-mag and B-V color for the eight observed fields are shown in Fig. 1. These figures are arranged from low to high latitude fields. The distributions of magnitudes and their shapes are determined by their respective limiting magnitudes and Galactic positions, and generally show no major differences. However, the histograms of B-V color exhibit considerable difference, particularly at high latitude fields. For low latitude fields, the color distributions are generally skewed to the blue as expected, except for SA98 and 107, which both have normal distributions with similar colors.

For the high latitude fields of SA104, G12-43 and SA57, the observed distributions all show a bimodal distribution with a blue peak B-V=0.6 and red peak at about B-V =1.5. Since there are enough number of stars in the SA57 field (near the NGP), the comparison between model and observed star counts show a remarkable agreement in distribution (Fig. 2). The model simulation for other fields have not yet been analyzed. The simulation was normalized for 1 sq-deg, while the observed CCD field of 2k x 2k chips on KPNO #1 0.9 m yields a field of 0.396' x 0.396', therefore, the predicted star count of 1 sq-deg is scaled down to match with the chip size of 0.157 sq-deg.

This simulation is consistent with the best S/N scenario. In our actual CCD images, the brighter stars are likely saturated, while the faintest stars may be missed because of the low S/N. The magnitude distributions are generally in very good agreement for the intermedi-

Table 1. Positions of the Obseved Fields

Field Name	α (1994.3)	δ (1994.3)	l	b
SA98	6:51:34	-0:18:54	213.3	-0.1
LP543-32/33	7:49:58	7:14:13	213.1	16.4
PG0918+029	9:21:14	2:48:29	229.4	34.3
PG1633+099	16:35:17	9:47:03	25.9	34.6
SA107	15:39:33	-0:13:57	5.9	41.2
SA104	12:41:42	-0:31:17	297.9	62.2
G12-43	12:33:02	9:03:02	288.8	71.4
SA57	13:10:05	30:15:51	70.9	84.8

ate brightness stars but the incompleteness would still dominate for the fainter stars near the limiting magnitude.

II. OBSERVATION AND ANALYSIS

Eight fields of Selected Areas and standard fields from low to high Galactic latitudes were made in April 1994 using the KPNO 0.9m with 2k× 2k CCD (see Table 1). The limiting

III. SUMMARY

For the SA57 field, the mean blue peak color is B-V=0.8, which is typical of late F to early G stars with an absolute magnitude of about 4 and an apparent magnitude of 22. This would yield an upper limit distance modulus of about 10 kpc, consistent with halo stars near the turnoff. The red peak of B-V=1.5 likely represents typical late K and early M stars, with a distance of a few kpc for dwarf main sequence stars and about 20 kpc for the giants.

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