Publ. Astron. Obs. Belgrade No. 73 (2002), 159 - 162 *Poster*

ESTIMATED NUMBER OF FIELD STARS TOWARDS THE LOCAL GROUP GALAXY IC10: MODELS AND OBSERVATIONS

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Abstract. It is very important to know the distribution in magnitude and color of the field stars from the Galaxy towards the different extragalactic objects. In this work are compared real photometrical data with the model predictions. The observational $B-V, V$ color-magnitude diagram for the area of 5.6×5.6 arcmin situated 30 arcmin north of the center of the galaxy IC 10 is compared with synthetic color-magnitude diagrams based on the model of the Milky Way galaxy (Robin & Creze 1986). Model with appropriated reddening $A_V = 1.2$ mag/kpc describes in the best way the observations. Despite the relatively good result there is about 20% more model stars. This is a significant difference when we talk about the luminosity function or IMF for instance. In these cases we have to get "a comparison field" near to the object of research.

1. INTRODUCTION

It is very important to know the distribution in magnitude and color of the field stars from our Galaxy towards the star clusters or the resolved Local Group Galaxies with low galactic latitudes. It is obviously necessary to check the level of field star contamination before discussing the detailed structure of the color-magnitude diagrams and the stellar content of the stellar systems. The purpose of this work is to compare real data ("CCD comparison field") on the distribution in color and in apparent magnitude with the model predictions (Robin & Creze 1986). The chosen area is near to the Local Group Galaxy IC 10 (30 arcmin north of the galaxy center) and situated very close to the galactic plane ($b = -3.34°$, $l = 118.97°$) and the foreground contamination is significant. This model can be used for simulations of the galactic stellar populations in any directions in photometric bands from U to K as well as radial velocity and proper motion distributions. It may help for preparing observations, for evaluating the galactic stellar contamination in extragalactic studies or in star cluster fields.

2. OBSERVATIONS AND DATA REDUCTION

A set of BV frames of the area around the Local Group Galaxy IC 10 was obtained with CCD Photometrics camera attached to the 2-m Ritchey-Chretien telescope of the

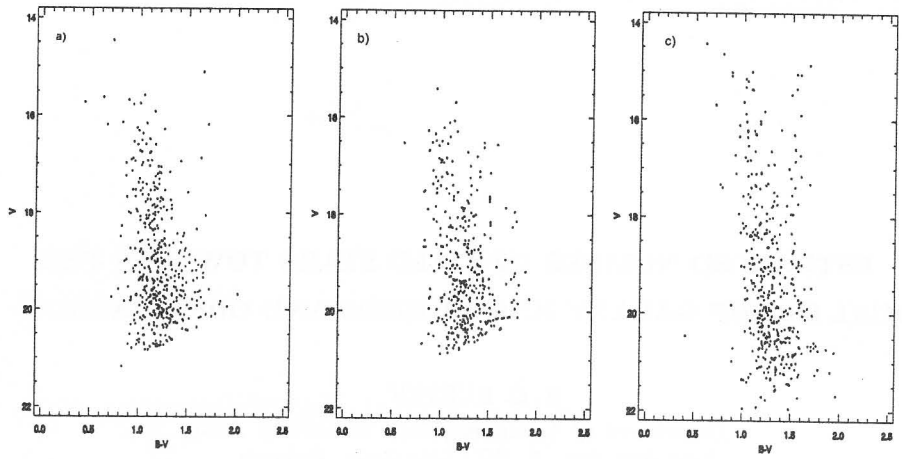

Fig. 1: a) Synthetic $(B-V, V)$ color-magnitude diagram obtained for the Model 1 ($A_V = 1.1$mag/kpc; b) for the Model 2 ($A_V = 1.2$mag/kpc.; c) Observed $(B-V, V)$ color-magnitude diagram obtained for the area around the galaxy IC 10. Only stars with photometric errors larger than 0.15 mag in both filters are plotted.

Bulgarian National Astronomical Observatory "Rozhen" on 15/16 September 1999. The exposure time of the images was 900 sec. The observing area was $5.6' \times 5.6'$. The seeing during these observations was excellent for Rozhen: $1.2''$ with stable and very good photometric conditions. The IRAF data reduction package was used to carry out the basic image reductions and the flat field correction. The Landolt (1992) standards PG0231 and PG2213 were taken before and after the observations. The transformation equations to the standard Johnson BV system are:

$$\begin{aligned} V &= 1.013v + 0.139(B-V) - 0.345X - 1.866 \\ B-V &= 1.028(b-v) - 0.203X - 0.308 \end{aligned}$$

where b, v are instrumental magnitudes, B, V are the standard ones and X is the airmass.

The stellar photometry of the frames was performed with the point-spread function fitting routine ALLSTAR available in DAOPHOT (Stetson 1993). The final photometry list contains 429 stars. The zero-point errors of the transformations to the standard BV system are 0.04 mag.

3. RESULTS

In the model predictions a mean diffuse extinction of 0.7 mag/kpc in V band is recommended for intermediate and high latitude fields. It may be modified. Because of the very low galactic latitude of the observed field this default value does not lead to a reliable result. Five different values of A_V have been used as model input parameters – $0.8, 0.9, 1.0, 1.1$ and 1.2 mag/kpc. The best coincidence of the model and the observations is at $A_V = 1.1$ mag/kpc and $A_V = 1.2$ mag/kpc. We will

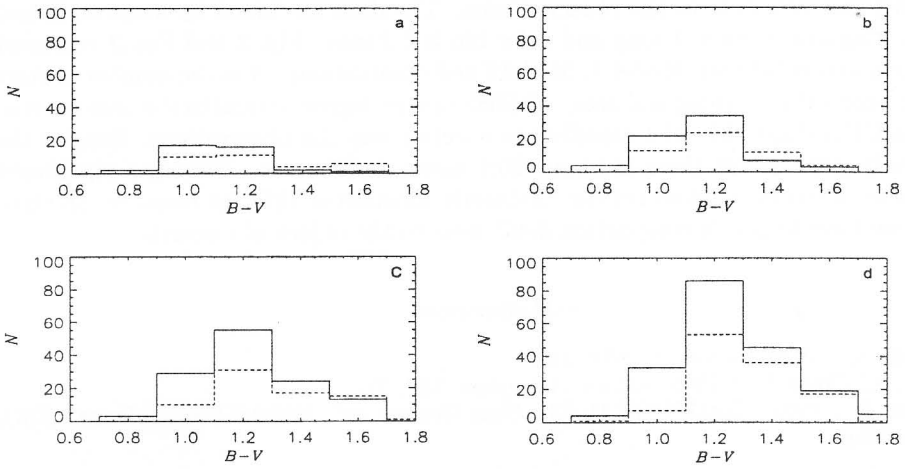

Fig. 2: Comparison between Model 1 (thick line) and observations (dashed line) within intervals by V: a) 16.5 – 17.5; b) 17.5 – 18.5; c) 18.5 – 19.5; d) 19.5 – 20.5

call the models with these extinctions Model 1 and Model 2 respectively. The output star list of Model 1 contains 480 stars within the intervals $14.0 < V < 21.5$ and $0.3 < B - V < 2.0$. In Model 2 the stars are 396 within $15.0 < V < 21.0$ and $0.5 < B - V < 2.0$.

Color-magnitude diagram (CMD) of Model 1 is given in Fig. 1a, CMD of Model 2 in Fig. 1b and observed CMD in Fig. 1c.

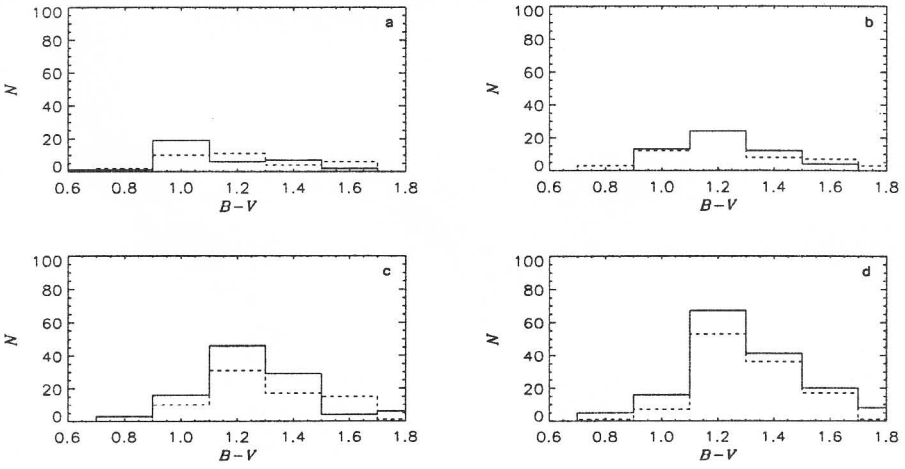

Fig. 3: Comparison between Model 2 (thick line) and observations (dashed line) within intervals by V: a) 16.5 – 17.5; b) 17.5 – 18.5; c) 18.5 – 19.5; d) 19.5 – 20.5

Star counts are made in the intervals $16.5 < V < 20.5$ and $0.6 < B - V < 1.8$ because most of the stars are there. The sample is to be complete to, at least, $V = 21.0$. Within these new boundaries there are 423 stars in Model 1, 353 stars in

Model 2 and 276 stars in the observed area. The data are bined by magnitude and color. Magnitude bin is 1 mag and color bin is 0.2 mag. Fig. 2 and Fig. 3 represent the comparison between Model 1, Model 2 and observations. N is the number of stars within interval $V = 1$mag and area of 0.0087 square degrees (equal to the area covered by the CCD chip). Model 2 describes in a better way the observations. Despite the relatively good result there is about 20% more model stars. This is a significant difference when we want to get the luminosity function or IMF for instance. In these cases we have to get "a comparison field" near to the object of research.

References

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