A Color-Magnitude Diagram in Field #3 of the Palomar–Groningen Survey

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Field #3 of the Palomar–Groningen survey (PG3) is thought to be ideal for the study of stellar evolution in the Galactic Bulge (GB). In this field the work of Plaut (1973) and Wesselink (1987) is extended with the aim of constructing a Color Magnitude Diagram (CMD) for a great many stars. This is done by means of automated photographic photometry.

With 229 646 stars from a UKST blue (J7856) and red (R8491) plate a CMD is constructed for a $3.^{o}5 \times 3.^{o}5$ field, centered at $l = 1^{o}$ and $b = -11^{o}$. The plate limit for the blue and red plate is resp. $19.^{m}8$ and $18.^{m}7$. The estimated photometric accuracy is $\sim 0.^{m}10$.

With the theoretical isochrones including convective overshoot (Bertelli et al., 1990) synthetic CMDs (Chiosi et al., 1988) and Luminosity Functions (LFs) are composed, assuming (i) A Salpeter initial mass function (iia) A starburst from 14-10 $\times 10^9$ yrs ago for (Y,Z)=(0.28,0.02) (iib) A starburst from 14-12 $\times 10^9$ yrs ago for (Y,Z)=(0.25,0.0004).

We placed the stars in each of the synthetic CMDs at a distance of 8.0 kpc (Wesselink, 1987) and simulated a depth of 3 kpc for the GB along the line of sight. The Johnson B,R magnitudes are transformed to the UKST system (Wesselink, 1987). A gaussian spread in the photometric accuracy is assumed. For the reddening in the field we adopted E(B-R)=0.20±0.05 (Wesselink, 1987).

A comparison between the synthetic and photographic CMDs showed that the turnoff point in the photographic CMD is much more extended. This structure can be explained with a stellar population present between the GB and the Galactic Disk which has the same age and (almost) the same chemical composition as the GB stars !! We simulated the contribution from this stellar population with the same age and metallicity as the GB :

$$\int_0^1 dx = A_1 \int_{\log d_0}^{\log d_1} r dr + A_2 \int_{d_1}^{d_2} dr$$

With d_0 =1.0 kpc , d_1=6.5 kpc and d_2=9.5 kpc. A_1 and A_2 are normalisation constants. The ratio between the number of stars in- and outside the galactic bulge is a free parameter. For a ratio of approximately one the global shape of the synthetic CMDs and LFs is comparable with the photographic CMD and LF.

References

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